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MANGOSUTHU
UNIVERSITY OF TECHNOLOGY

FACULTY OF
ENGINEERING

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2025

CONTENTS **Page**

This faculty prospectus must be read in conjunction with the Mangosuthu University of Technology's General Rules contained in the current General Regulations handbook for Students.

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1. DEPARTMENT OF CHEMICAL ENGINEERING

Chemical Engineering is an area of study which prepares individuals to apply mathematical and scientific principles to the design, development and operational evaluation of systems employing chemical processes, such as chemical reactors, kinetic systems, electrochemical systems, energy conservation processes, heat and mass transfer systems, and separation processes, and the applied analysis of chemical problems such as corrosion, particle abrasion, energy loss, pollution and fluid mechanics.
Successful completion of the programmes which are offered in this Department will lead to the award of the following qualifications:

Qualification	SAQA NLRD Number
Diploma in Chemical Engineering (CHENDI) Advanced Diploma in Chemical Engineering (ADCHEN)	96854 101988
Access courses: • Chemical Engineering (ACHEMI) • Analytical Chemistry (ANACHE)	

1.1 Diploma in Chemical Engineering (CHENDI)

NQF Level: 6
SAQA Credits: 360
Duration: 3 years

Rationale for the Qualification

Professional Chemical Engineering Technicians are characterised by the ability to apply proven, commonly understood techniques, procedures, practices and codes to solve well-defined engineering problems. They manage and supervise chemical engineering operations and activities. They work independently and responsibly within an allocated area or under guidance.

Professional Engineering Technicians must, therefore, have a working understanding of the engineering sciences underlying the techniques used and financial, commercial, legal, socio-economic, health, safety, and environmental methodologies, procedures, and best practices.

The professional development process for a Professional Engineering Technician starts with attaining a qualification that meets this standard. After graduation, a training and experience programme is completed to achieve the competencies for registration in the category of Professional Engineering Technician.

Statement of Purpose

This qualification is primarily industry-oriented. The knowledge emphasises general principles and application or technology transfer. The qualification provides students with a sound knowledge base in a chemical engineering field and the ability to apply their knowledge and skills to particular career or professional contexts while equipping them to undertake more specialised and intensive learning. The programme leading to this qualification has a strong professional or career focus, and holders of this qualification are normally prepared to enter a specific niche in the labour market.

Specifically, the purpose of the Diploma in Chemical Engineering is to build the necessary knowledge, understanding, abilities, and skills required for further learning to become a competent practising Professional Engineering Technician. This qualification provides:

1. Preparation for careers in engineering and related areas, for achieving technical leadership and to contribute to the economy and national development;

2. The educational requirement towards registration as a Professional Engineering Technician with the Engineering Council of South Africa (ECSA) as well as to allow the graduate to pursue careers in engineering and related fields;
3. A thorough grounding in mathematics, natural sciences, engineering sciences, engineering modelling, and engineering design and the ability to enable applications in fields of emerging knowledge together with an appreciation for the world and society in which engineering is practised;
4. For graduates with an appropriate level of achievement in the programme, the minimum entry requirement for admission to an Advanced Diploma, as specified in E-23-P, is designed to support articulation and to satisfy an engineering technologist education benchmark qualification.

Qualification Rules
The learners will be awarded this qualification if they have successfully completed all modules (as outlined in section (c) below) and demonstrated competence (to the satisfaction of the assessors) in all Graduate Attributes as per the E-02-PN ECSA standard outlined below.

Please note that the indicated graduate attributes statements are in accordance with ECSA E-02-PN Revision 5 of September 2020. This standard will be used to assess student cohorts enrolled in the programme before 2025. The students enrolled in the programme in or after 2025, as well as repeating students, will be assessed based on the ECSA E-02-PN Revision 6 standard of August 2023 (see https://www.ecsa.co.za/ECSADocuments/Shared%20Documents/E-02-PN%20-%20Qualification%20Standard%20for%20Diploma%20in%20Engineering%20NQF%20Level%206-signed.pdf for more information).

ECSA Graduate Attributes

Graduate Attribute 1: Problem Solving
Identify, formulate, analyse and solve well-defined engineering problems.

Graduate Attribute 2: Application of scientific and engineering knowledge
Apply knowledge of mathematics, natural sciences, engineering fundamentals and an engineering speciality to solve well-defined engineering problems.

Range Statement:
Mathematics, natural science and engineering sciences are applied in analysis and modelling of engineering situations, and for reasoning about and solving well-defined engineering problems.

Graduate Attribute 3: Engineering Design
Perform procedural design and synthesis of components, systems, engineering works, products or processes.

Range Statement:
Design problems used in exit-level assessment must conform to the definition of a well-defined engineering problem. A design problem should be used to provide evidence. The design knowledge base and components, systems, engineering works, products or processes to be designed depend on the sub-discipline or practice area.

Graduate Attribute 4: Investigations, experiments and data analysis
Demonstrate competence to design and conduct investigations and experiments.

Range Statement: The balance of investigation and experiment should be appropriate to the sub-discipline. Research methodology is to be applied in research or an investigation where the student engages with selected knowledge in the research literature of the sub-discipline.

Note: An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon and a recommended course of action rather than specifying how an artefact could be produced.

Graduate Attribute 5: Engineering methods, skills and tools, including Information Technology
Demonstrate competence to use appropriate engineering methods, skills and tools, including those based on information technology.

Range Statement:
A range of methods, skills and tools appropriate to the disciplinary designation of the program including:

- Sub-discipline-specific tools, processes or procedures;
- Computer packages for computation, modelling, simulation, and information handling;
- Computers and networks and information infrastructures for accessing, processing, managing, and storing information to enhance personal productivity and teamwork.

Graduate Attribute 6: Professional and Technical Communication
Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large.

Range Statement:
Material to be communicated is in an academic or simulated professional context. Audiences range from engineering peers to academic personnel and related engineering peers, using appropriate academic or professional discourse. Written reports range from short (300 words) to long (a minimum of 2000 words excluding tables, diagrams, and appendices), covering material at the exit level. Methods of providing information include the conventional methods of the sub-discipline, for example, engineering drawings, as well as subject-specific methods.

Graduate Attribute 7: Sustainability and impact of engineering activity
Demonstrate critical awareness of the sustainability and impact of engineering activity on the social, industrial and physical environment.

Range Statement:
The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the sub-discipline or other designation of the qualification. Comprehension of the role of engineering in society and identified issues in engineering practice in the sub-discipline: health, safety and environmental protection; risk assessment and management and the impacts of engineering activity: economic, social, cultural, environmental and sustainability.

Graduate Attribute 8: Individual, team and multidisciplinary working.
Demonstrate competence to work effectively as an individual, in teams and in multidisciplinary environments.

Range Statement:
Multidisciplinary tasks require cooperation across at least one disciplinary boundary. Co-operating disciplines may be engineering disciplines with different fundamental bases other than that of the programme or may be outside engineering.

Graduate Attribute 9: Independent learning ability
Demonstrate competence to engage in independent learning through well-developed learning skills.

Range Statement:
Operate in a well-structured environment with some unfamiliar elements requiring personal responsibility and initiative, accurately self-evaluate and take responsibility for learning requirements; be aware of social and ethical implications of applying knowledge in particular contexts.

Graduate Attribute 10: Engineering professionalism
Demonstrate critical awareness of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence.

Range Statement:
Evidence includes case studies typical of engineering practice situations in which the graduate is likely to participate. Ethics and the professional responsibility of a technician and the contextual knowledge specified in the range statement of Graduate Attribute 7 is generally applicable here.

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

Range Statement:
Basic techniques from economics, business management; project management applied to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Graduate Attribute 12: Workplace practices
Demonstrate an understanding of workplace practices to solve engineering problems consistent with academic learning achieved.
Range Statement:
Tasks to demonstrate this outcome should be designed to connect academic learning with workplace practice and may be performed in one or more of the following types of work-integrated learning.

i) Work-directed theoretical learning.
ii) Problem-based learning.
iii) Project-based learning.
iv) Work-based learning, and
v) Simulated learning.

Note: While attribute 12 is specific to workplace practices, other attributes may be demonstrated simultaneously.

a. **Admission requirements**

i) National Senior Certificate with rating codes:

English Home Language	4
English First Additional Language	4
Mathematics	4
Physical Science	4

OR

ii) Senior Certificate or equivalent qualification with passes in

Mathematics	D(HG)/C(SG)
Physical Science	D(HG)/C(SG)
English	D(HG)/C(SG)

iii) Students who have successfully completed the Chemical Engineering Bridging Course are also considered.

iv) NCV level 4 with a minimum of 50% pass in English and Mathematics (Mathematical Literacy would not be considered) and a minimum of 60% pass in three compulsory vocational subjects: Physical Science, Process Technology and Process Chemistry or Process Control.

ALL ADMISSIONS ARE BASED ON A SELECTION PROCESS ONLY!!!

Applicants who satisfy the minimum requirements will be subjected to a selection process. Applicants will be ranked based on their academic results and selected for admission accordingly. Mathematical Literacy will not be considered.

b. **Duration of Study**

The minimum duration of study is three years. Two of these are spent full-time at the University, and one year is appropriate Work-Integrated Learning as a learner technician. *All instructional offerings indicated in the next section are compulsory.*

c. **Curriculum Compilation and Prerequisites**

Diploma in Chemical Engineering (CHENDI)								
Code	**Subjects**	**Credits**	**Semester of study**	**Assessment Method**	**NQF Level**	**Prerequisites**	**Co-requisites**	**GA assessed**
CHEM112	Engineering Chemistry I	12	1	Examination	5			
COMC112	English Communication Skills I	8	1	Examination	5			
MACH111	Mathematics I	12	1	Examination	5			
PHYS112	Physics I	12	1	Examination	5			
COSC111	Computer Skills I	12	1	Continuous Assessment	5			
CHTE112	Introduction to Chem Eng Tech 1	8	1	Examination	5		CHEM112 PHYS112 & MACH111	
CHTE212	Chem Eng. Tech II	12	2	Examination	6	CHEM112, CHTE112, MACH111, PHYS112		
MACH211	Mathematics II	12	2	Examination	6	MACH111		
DRAC212	Chemical Engineering Drawing	8	2	Continuous Assessment	5			
CPIN221	Chemical Process Industries II	12	2	Examination	5			
ORCH222	Engineering Chemistry II (Module 1)	12	2	Examination	5	CHEM112		
CHYC222	Engineering Chemistry II (Module 2)	12	2	Examination	5	CHEM112, MACH111		
CHPL332	Chemical Plant III	12	3	Examination	6	CHTE212, MACH211, ORCH222, CHYC222		
CHTE311	Chem Eng Tech III (Module 1)	12	3	Examination	6	CHTE212, CHYC222		GA 9
CHTE312	Chem Eng Tech III (Module 2)	12	3	Examination	6	CHTE212, CHYC222		
CEEP032	Chem Eng Laboratory Practicals III	8	3	Continuous Assessment	6		CHPL332	

THCE301	Thermodynamics: Chem Eng III	12	3	Examination	6	MACH211, CHTE212, CHYC222		
CPDP311	Chem Eng Design and Professional Practice (Principles)	14	3	Continuous Assessment	6	MACH211, CHTE212, CHYC222	CHTE311, ENPC031	GA 7 & GA 10
ENPC031	Engineering Practice and Communications	8	3	Continuous Assessment	5	COMC112, CHTE212, DRAC212, CPIN221, ORCH222, CHYC222, MACH211, COSC111	CPDP311	
CPDP321	Chem Eng Design and Professional Practice III	14	4	Continuous Assessment	6	CHTE311, CHTE312, CPDP311		GA 3, GA 5, GA 6, GA 11
CEEP042	Chem Eng Laboratory Practicals IV	8	4	Continuous Assessment	6	CHTE311, CHTE312		GA 4
PRCO331	Process Instrumentation and Control	12	4	Examination	6	MACH211, CHPL332		GA 1 & GA 2
THAP331	Thermodynamics (Applied) III	12	4	Examination	6	All S1 & S2 subjects		
ENST301	Engineering Statistics	12	4	Examination	6	All S1 & S2 subjects		
MASK212	Management Skills	8	4	Examination	5	All S1 & S2 subjects		
CEIS012	Chem Eng Practice I (P1)	40	5	Continuous assessment	6	ENPC031, CHPL332, CEEP032, THCE301, CHTE311, CHTE312, CPDP311		
CEIS022	Chem Eng Practice II (P2)	44	6	Continuous assessment	6	CEIS012		GA 8 & GA 12

d. **Teaching, Learning and Assessment**

- All subjects offered are semester-long.
- Students are expected to attend all practicals, lectures and tutorials offered in the course (as per the timetable).
- All subjects are evaluated through a combination of compulsory tests, assignments, project/practical reports, oral presentations and the end-of-semester examination as outlined in the learner guides. If a student misses a test or practical due to illness, they may apply for an aegrotat test on the prescribed form and attach a doctor's certificate. If this is not done, a "0" mark will be awarded for a missed assessment.
- A pass in the practical component of some courses is a prerequisite for achieving a semester mark or examination admission (specified in the subjects' learner guides).
- Demonstration of competency in graduate attributes may be required for examination admission and successful completion of the course in some subjects (specified in subjects' learner guides).
- Students who achieved competency in all graduate attributes assessed in a particular subject but failed to pass the course as per general rule G.22.3(f) will need to repeat the subject. However, upon students' request, with the support of a subject lecturer and approval of the HOD, they may retain the mark for the GA assessment component of the course for one year after the GA assessment, provided that the assessment contributes no more than 40% of the final course mark.
- All other rules are per General Rules and Regulations in the Students Handbook.

e. **Work Integrated Learning**

It is the student's responsibility to register for training, which must be done before or on the commencement of the training. Students who experience problems with registration must contact their WIL coordinators or the Head of Department for advice.

Students who do not register their work-integrated learning cannot be monitored or evaluated, and their training will not be recognised.

Students registering for work-integrated learning must collect a WIL manual from the Department of Chemical Engineering. The manual outlines the details of the training procedures. Students are only eligible for graduation after all the necessary reports are completed, submitted and evaluated.

f. **Curriculum Content**

- **Engineering Chemistry I (CHEM112)**
  The syllabus includes matter and energy, chemical equations and stoichiometry, solutions, acids, bases, and salts, chemical reactions, chemical equilibrium, electrochemistry and redox reactions, an introduction to inorganic and organic chemistry, and appropriate laboratory practicals.

- **English Communication Skills I (COMC112)**
  The syllabus includes academic writing skills, communication theory, meetings, public speaking and presentation skills, and report writing skills.

- **Mathematics I (MACH111)**
  The syllabus includes basic algebra and trigonometry, differential and integral calculus with applications, statistics, complex numbers and hyperbolic functions.

- **Physics I (PHYS112)**
  The syllabus includes mechanics, heat, electricity and magnetism, fluids, and corresponding laboratory work.

- **Computer Skills I (COSC111)**
  The syllabus includes hardware, software, data communications, computer applications, Windows, the theory of computers, and an introduction to Excel, word processing, and spreadsheets.

- **Introduction to Chemical Engineering Technology 1 (CHTE112)**
  The syllabus includes what chemical engineering technicians do, chemical processes, and fundamentals of material and energy balances**.**

- **Chemical Engineering Technology II (CHTE212)**
  The syllabus includes the fundamentals of material balances, single-phase systems, multi-phase systems, energy balances, and balances on reactive and non-reactive systems.

- **Mathematics II (MACH211)**
  The syllabus includes further differential and integral calculus with applications, matrix algebra, linear programming, and differential equations.

- **Chemical Engineering Drawing (DRAC212)**
  The syllabus includes isometric projection, conics, and engineering curves, including ellipses; development and intersection of surfaces; and application of CHEMCAD and CADWorx plant professional tools for drawing flow diagrams, piping systems, and chemical plant layout.

- **Chemical Process Industries II (CPIN221)**
  The syllabus includes coal processing, petroleum refining, synthetic rubber, plastics, paper and pulp, sugar refining, agrochemicals, iron and steel, and heavy chemicals.

- **Engineering Chemistry II - Module 1 (ORCH222)**
  The syllabus includes aliphatic hydrocarbons; alkyl halides, alkenes; aromatic compounds; alcohols and ethers; aldehydes and ketones; polymers; carboxylic acids and derivatives; chemical bonding and group elements of the periodic table and corresponding laboratory work.

- **Engineering Chemistry II – Module 2 (CHYC222)**
  The syllabus includes gases, liquids, chemical kinetics, chemical equilibrium, colloids, colligative properties of solutions, electrochemistry and corresponding laboratory work.

- **Chemical Plant III (CHPL332)**
  The syllabus includes separation processes, size reduction, water treatment, cooling towers, conveying gases, and mixing liquids.

- **Chemical Engineering Technology III - Module 1 (CHTE311)**
  Modules cover fundamental principles of incompressible fluid flow, compressible fluid flow, heat transfer, mass transfer, and their applications.

- **Chemical Engineering Technology III - Module 2 (CHTE312)**
  The syllabus covers basic principles and concepts underpinning operations of units encountered in the chemical and allied industries and their sizing. It includes drying, distillation, absorption, leaching, and single-stage evaporation.

- **Chemical Engineering Laboratory Practicals III (CEEP032)**
  It relates theory to practice and equips students with the necessary skills to handle projects in industry. The following practical sessions are undertaken: solid-liquid extraction, reciprocating pump test, centrifugal pump test, sedimentation, solids handling, flow meters and cooling towers.

- **Thermodynamics: Chemical Engineering III (THCE301)**
  The syllabus includes an introduction, the first law of thermodynamics, heat capacity, the second and third laws of thermodynamics, real gases, thermodynamic relationships, and properties of mixtures.

- **Chemical Engineering Design and Professional Practice (Principles) (CPDP311)**
  The syllabus includes the design process, chemical process selection, environmental protection, chemical process safety, fluid pumping, pumps and piping design procedures, process flow-sheeting, an introduction to the HAZOP study, and the design project.

- **Engineering Practice and Communications (ENPC031)**
  The syllabus includes professional and technical writing skills, oral presentation skills, CV writing, interview skills, a professional outlook, and work readiness.

- **Chemical Engineering Design and Professional Practice III (CPDP321)**
  The syllabus includes optimum design and design strategy, chemical process safety, process equipment design, including distillation, heat exchange, agitation, and mixing of fluids, process equipment cost estimation, a HAZOP study, engineering ethics, and the use of engineering software for material and energy balancing.

- **Chemical Engineering Laboratory Practicals IV (CEEP042)**
  It relates theory to practice and equips students with the necessary skills to handle projects in the industry. The following practical sessions are undertaken: distillation, heat exchanger, absorption, heat convection, fluidised bed reactor, convective dryer, and study of pressure drop due to friction.

- **Process Instrumentation and Control (PRCO331)**
  The syllabus includes piping and instrumentation diagrams, various instrumentation, controller tuning and stability, control valve sizing, simple and advanced control systems, alarms, safety trips, and interlocks.

- **Thermodynamics: Applied III (THAP331)**
  The syllabus includes reversible non-flow processes, working fluids; application of the first law of thermodynamics in the heat engine cycle, steam plants, compressors, refrigeration, gas turbines, and nozzles.

- **Management Skills (MASK212)**
  The syllabus includes human relations in organisations, principles and practice of management, project management, work study and accuracy, industrial legislation, basic principles of the law contract, type of business, financial management, marketing, and business decisions.

- **Engineering Statistics (ENST301)**
  The syllabus includes descriptive statistics, basic probability concepts, statistical distributions, regression analysis, and computer-aided statistical data analysis (using Excel).

- **Chem Eng Practice I (CEIS012)**
  The industry practice develops the skills through physically following process streams/lines to produce a process description and diagram, performing process material balances, laboratory analysis, and basic plant problem-solving whilst enhancing the understanding of the environmental, health, and safety management systems.

- **Chem Eng Practice II (CEIS022)**
  The industry practice strengthens the development of some level of competency in performing technical investigations, safety and hazard audits, participating in HAZOP studies and producing process and instrumentation diagrams, applying financial principles to the process, and evaluating a heat/mass transfer equipment design (or performing a heat/mass transfer equipment efficiency study).

1.2 Advanced Diploma in Chemical Engineering (ADCHEN)

NQF Level: 7
SAQA Credits: 142
Duration: 1 year full-time or 2 years part-time.

Rationale for the Qualification
This qualification is primarily industry-oriented and aimed at process or chemical engineering technologists working in process-related industries.
The professional development process in engineering has three principal phases: education, training, and experience, which lead to registration and continual development during practice.

Statement of purpose
This qualification's knowledge component emphasises general principles and application or technology transfer. It provides students with sound knowledge and skills for their professional lives while equipping them to undertake more specialised and intensive learning.

The purpose of the qualification is to build the necessary knowledge, understanding, abilities, and skills required for further learning towards becoming a competent practising Engineering Technologist.

Professional Engineering Technologists are characterised by the ability to apply established and newly developed engineering technology to solve broadly-defined problems and develop components, systems, services and processes. They provide leadership in applying technology in safety, health, engineering and commercially effective operations and have well-developed interpersonal skills. They work independently and responsibly, applying judgment to decisions arising in the application of technology and health and safety considerations to problems and associated risks. Professional Engineering Technologists have a specialised understanding of engineering sciences underlying a deep knowledge of specific technologies together with financial, commercial, legal, social and economic, health, safety and environmental matters.

Specifically, the purpose of this Advanced Diploma in Chemical Engineering qualification is to provide graduates with:

1. Preparation for careers in engineering and related areas, for achieving technical leadership and to make a contribution to the economy and national development;
2. The educational requirement towards registration as a Professional Engineering Technologist with the Engineering Council of South Africa as well as allows the graduate to pursue careers in engineering and related fields;
3. A thorough grounding in mathematics, natural sciences, engineering sciences, engineering modelling, engineering design and the ability to enable applications in fields of emerging knowledge together with an appreciation for the world and society in which engineering is practised;
4. For graduates with an appropriate level of achievement in the programme, the ability to proceed to study in Level 8 programmes, e.g. Bachelor's Degree, Honours Degree or Postgraduate Diploma in Engineering or other fields and then proceed to master degree studies.\.

Qualification Rules
The learners will be awarded this qualification if they have successfully completed all modules (as outlined in section (c) below) and demonstrated competence (to the satisfaction of the assessors) in all Graduate Attributes as per E-05-PT ECSA standard outlined below.

Please note that the indicated graduate attributes statements are in accordance with ECSA E-05-PT Revision 5 of September 2020. This standard will be used to assess student cohorts enrolled in the programme before 2025. The students enrolled in the programme in or after 2025, as well as repeating students, will be assessed based on the ECSA E-05-PT Revision 6 standard of August 2023 (see https://www.ecsa.co.za/ECSADocuments/Shared%20Documents/E-05-PT%20%20-%20Qualification%20Standard%20for%20Advanced%20Diploma%20in%20Engineering%20NQF%20Level%207-signed.pdf for more information).

ECSA Graduate Attributes (GAs):

Graduate Attribute 1: Problem solving
Identify, formulate, analyse and solve broadly-defined engineering problems

Graduate Attribute 2: Application of scientific and engineering knowledge
Apply knowledge of mathematics, natural sciences, engineering fundamentals and an engineering speciality to solve broadly-defined engineering problems.

Range Statement: Mathematics, natural science, and engineering sciences are applied in formal analysis and modelling of engineering situations and in reasoning about and conceptualising engineering problems.

Graduate Attribute 3: Engineering design
Perform creative, procedural and non-procedural design and synthesis of components, systems, engineering works, products or processes.

Range Statement: Design problems used in exit-level assessment must conform to the definition of a broadly-defined engineering problem.
i) A major design problem should be used to provide evidence.
ii) The selection of components, systems, engineering works, products or processes to be designed depends on the discipline or practice area.

Graduate Attribute 4: Investigations, experiments and data analysis
Demonstrate competence to design and conduct investigations and experiments

Range Statement: The balance of investigation and experiment should be appropriate to the discipline. Research methodology is to be applied in research or an investigation where the student engages with selected knowledge in the research literature of the discipline.

***Note*:** An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon and a recommended course of action rather than specifying how an artefact could be produced.

Graduate Attribute 5: Engineering methods, skills and tools, including information technology.
Demonstrate competence to use appropriate engineering methods, skills and tools, including those based on information technology.

Range Statement: A range of methods, skills and tools appropriate to the disciplinary designation of the program including:

- Discipline-specific tools, processes or procedures;
- Computer packages for computation, modelling, simulation, and information handling;
- Computers and networks and information infrastructures for accessing, processing, managing, and storing information to enhance personal productivity and teamwork.

Graduate Attribute 6: Professional and technical communication.
Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large.

Range Statement*:* The material to be communicated is in an academic or simulated professional context.
i) Audiences range from engineering peers to management and lay persons, using appropriate academic or professional discourse.
ii) Written reports range from short (300-1000 words plus tables and diagrams) to long (10 000 to 15 000 words plus tables, diagrams and appendices), covering material at the exit level.
iii) Methods of providing information include the conventional methods of the discipline, for example, engineering drawings, as well as subject-specific methods.

Graduate Attribute 7: Sustainability and impact of engineering activity.
Demonstrate critical awareness of the sustainability and impact of engineering activity on the social, industrial and physical environment.

Range Statement: The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the discipline or other designation of the qualification. Comprehension of the role of engineering in

society and identified issues in engineering practice in the discipline: health, safety and environmental protection; risk assessment and management and the impacts of engineering activity: economic, social, cultural, environmental and sustainability.

Graduate Attribute 8: Individual, team and multidisciplinary working.
Demonstrate competence to work effectively as an individual, in teams and in multidisciplinary environments.

Range Statement: Multidisciplinary tasks require cooperation across at least one disciplinary boundary. Co-operating disciplines may be engineering disciplines with different fundamental bases other than that of the programme or may be outside engineering.

Graduate Attribute 9: Independent learning ability.
Demonstrate competence to engage in independent learning through well-developed learning skills.
Range Statement: Operate independently in complex, ill-defined contexts requiring personal responsibility and initiative; accurately self-evaluate and take responsibility for learning requirements; be aware of social and ethical implications of applying knowledge in particular contexts.

Graduate Attribute 10: Engineering professionalism.
Demonstrate critical awareness of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence.

Range Statement: The evidence includes case studies typical of engineering practice situations in which the graduate is likely to participate. Ethics, the professional responsibility of an engineer, and the contextual knowledge specified in the range statement of Graduate Attribute 7 are generally applicable here.

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

Range Statement: Basic techniques from economics and business management; project management applied to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

a. **Entry Requirements**
The minimum requirement for admission into the qualification is either an appropriate Diploma, NQF level 6, or a Bachelor's Degree in Chemical Engineering or a related field. Preference will be given to candidates with higher academic achievements in the qualifications presented for admission.

b. **Duration of Programme**
The minimum formal study time is one year full-time or two years part-time. *All instructional offerings are compulsory.*

c. **Curriculum Compilation and Prerequisites**

ADVANCED DIPLOMA IN CHEMICAL ENGINEERING (ADCHEN)								
Code	**Subjects**	**Credits**	**Semester offered**	**Assessment Method**	**NQF Level**	**Prerequisites**	**Co-requisites**	**GA assessment**
MATH471	Engineering Mathematics III	14	1 & 2	Examination	7			
CHTE471	Fluid Flow IV	14	1	Examination	7			
CHTE472	Heat & Mass Transfer IV	14	1	Examination	7			
CHTE473	Unit Operations IV	14	1	Examination	7			GA 1; GA 2
INST471	Instrumental Analysis	8	1	Continuous Assessment	7			
CPDE471	Chemical Engineering Design IV	28	Annual	Continuous Assessment	7		CHTE472 & CHTE473	GA 3; GA 7; GA 10; GA 11
PECI471	Production Management	14	2	Examination	7			
PRCO471	Chemical Process Control IV	14	2	Examination	7		MATH471	GA 5
RTEC471	Reactor Technology IV	14	2	Examination	7			GA 4; GA 8
RMCE471	Research Methodology	8	2	Continuous assessment	7			GA 6; GA 9

Please note that the intake of new students only takes place in the first semester.

d. **Teaching, Learning and Assessment**

- All subjects in the programme, except for the Chemical Engineering Design IV, are semester-long courses.
- Students are expected to attend all practicals, lectures and tutorials offered in the course (as per the timetable)
- All subjects are evaluated through a combination of compulsory tests, assignments, project/practical reports, oral presentations, and the end-of-semester examination, as outlined in the learner guides.
- If a student misses an assessment due to illness, he/she may apply for an aegrotat test on the prescribed form and attach a doctor's certificate. If this is not done, a "0" mark will be awarded for missed assessment.
- Demonstration of competency in graduate attributes may be required for examination admission and successful completion of the course in some subjects (specified in subjects' learner guides).
- Students who achieved competency in all graduate attributes assessed in a particular subject but failed to pass the course as per general rule G.22.3(f) will need to repeat the subject. However, upon students' request, with the support of a subject lecturer and approval of the HOD, they may retain the mark for the GA assessment component of the course for one year after the GA assessment, provided that the assessment contributes no more than 40% of the final course mark.
- All other rules are per the General Rules and Regulations for Students Handbook.

e. **Course Content**

- **Engineering Mathematics III (MATH471)**
  The syllabus includes integration, first- and second-order ordinary differential equations, linear differential equations with constant coefficients, Laplace transforms, and numerical methods.

- **Fluid Flow IV (CHTE471)**
  The syllabus includes macroscopic mass, energy and momentum balances and elements of boundary layer theory; fluid flow through pipes, ducts, fittings and open channels; pumping of fluids, pumps in series and parallel; flow through porous media; compressible fluids flow; particle dynamics in settling; non-Newtonian fluids flow and mixing of fluids.

- **Heat and Mass Transfer IV (CHTE472)**
  The syllabus includes boundary layer fundamentals, forced convection in laminar, turbulent, and transitional flow, forced convection over an exterior surface, heat transfer with a change in phase, molecular diffusion in fluids and solids, prediction of diffusivities in fluids, diffusion through a solid barrier, molecular diffusion in laminar flow, mass transfer in turbulent flow, and diffusion between phases.
- **Unit Operations IV (CHTE473)**
  The syllabus includes multiple-effect evaporation, crystallisation, distillation, absorption, liquid-liquid extraction, and computer-aided simulation of separation processes.

- **Instrumental Analysis (INST471)**
  The syllabus includes Spectroscopic Techniques, Chromatographic Techniques, Electro-analytical Techniques, and Hyphenated Techniques.

- **Chemical Engineering Design IV (CPDE471)**
  The syllabus includes general design considerations, process design development, process and instrumentation diagrams development, equipment design, cost estimation, and simulation (Aspen) software use for process design, optimisation, cost estimation, and pinch technology.

- **Production Management (PECI471)**
  The syllabus includes organisational goals and society, planning, control, process and project management, financial management, people management, and innovation management.

- **Chemical Process Control IV (PRCO471)**
  The syllabus includes a process control overview, mathematical modelling principles, linearisation of non-linear equations, the Laplace transformation of important functions, analysis of dynamic behaviour of chemical engineering processes using inverse Laplace transform, the feedback controllers and analytical expression for closed loop response and stability analysis of control systems.

- **Reactor Technology (RTEC471)**
  The syllabus includes mole balances, the rate of reaction, the general mole balance equation; batch reactors (BR); continuous-flow reactors (CSTR, PFR, PBR), conversion and reactor sizing; rate law and stoichiometry; isothermal reactor design, collection and analysis of rate data;

- **Research Methodology (RMCE471)**
  The syllabus includes an overview of research and its methodologies, literature search, review, citation practices, problem identification, design of experiments, analysis and interpretation of data, presentation of research findings, and writing of research proposals.

1.3 Access Courses:

- **Chemical Engineering (ACHEMI)**
- **Analytical Chemistry (ANACHE)**

Statement of Purpose

The purpose of this course is to enhance and bridge the candidates' existing skills, knowledge and attitude with the skills, knowledge and attitude required for admission to the Diploma in Chemical Engineering or Diploma in Analytical Chemistry programmes.

b. **Duration of the course**

The duration of the course is six months.

PLEASE NOTE: This course may not be repeated.

c. **Admission Requirements**

i) National Senior Certificate (NSC) with rating codes:

English Home Language	3
English First Additional Language	3
Mathematics	3
Physical Science	3
Satisfactory achievement in their Home Language	4

A minimum of 130 total credits, with a maximum of 60 credits with "Partial Achievement", at NQF Level 4

ii) Senior Certificate or equivalent qualification with a pass in

Mathematics	E(SG)/F(HG)
Physical Science	E(SG)/F(HG)
English	E(SG)/F(HG)

iv) An N3 qualification with a minimum of 50% passes in English, Mathematics and Physical Science.

v) An appropriate GCE Certificate with five subjects, including Mathematics, Science, and English, with symbols A, B, or C. Three of the five subjects must have been passed at the same examination sitting.

vi) NCV level 4 with a minimum of 40% pass in English and Mathematics (Mathematical Literacy would not be considered) and a minimum of 50% pass in Physical Science.

ALL ADMISSIONS ARE BASED ON A SELECTION PROCESS ONLY!!!

Applicants who satisfy the minimum requirements will be subjected to a selection process. Applicants will be ranked based on their academic results and selected for admission accordingly. Mathematical Literacy will not be considered.

d. **Curriculum Compilation**

All the instructional offerings are compulsory.

ACCESS COURSE: CHEMICAL ENGINEERING/ANALYTICAL CHEMISTRY			
Code	**Subjects**	**Semester offered**	**Assessment Method**
ACHEM11	Chemistry	1&2	Examination
APHYC11	Physics	1&2	Examination
AMACH11	Mathematics	1&2	Examination
ADRAW11	Drawing	1&2	Continuous assessment
ACOCH11	Communications	1&2	Examination
ALABC11	Lab Practice	1&2	Continuous assessment

e. **Learning, Teaching and Assessment**

- Students are expected to attend all practicals, lectures, and tutorials offered in the course (as per the timetable).
- All subjects are evaluated by means of compulsory tests, practicals and/or assignments, and the end-of-semester examination. If a student misses a test or a practical due to illness, he/she may apply for an aegrotat test on the prescribed form and attach a doctor's certificate. If this is not done, a "0" mark will be entered for the missed assessment.
- All students will be admitted to the end-of-semester examination.
- The final mark for a subject is calculated based on the performance in ALL compulsory assessments. To pass a subject, the student should obtain a final mark of at least 50%.

- **PLEASE NOTE THAT THIS COURSE MAY NOT BE REPEATED**.

All other examination rules apply, as in the General Rules and Regulations for Students handbook—Rule G22.

f. **Promotion to Higher Level**

To qualify for admission to S1 Chemical Engineering or S1 Analytical Chemistry, students should pass (obtain 50%) in all six subjects offered in this course.

g. **Course Content**

- **Chemistry (ACHEM11)**
  The syllabus includes units of measurement, matter, atomic theory, nomenclature, chemical reactions, stoichiometry, acids and bases and chemical energies.

- **Physics (APHYC11)**
  The syllabus includes units and dimensions, motion in a straight line, motion in free fall, projectile motion, momentum and elastic collision, Newton's laws of motion, work, energy and power**.**

- **Mathematics (AMACH11)**
  The syllabus includes algebra, plane analytic geometry, equations, functions, perimeter, area and volume and trigonometry.

- **Drawing (ADRAW11)**
  The course content starts with the use of a pencil to print letters and figures and draw freehand sketches. It then proceeds to the use of drawing instruments to draw geometrical constructions, orthographic projections, isometric drawings, and sectional drawings.

- **Communications (ACOCH11)**
  The syllabus includes oral communication, vocabulary-building skills, language usage skills, basic reading skills, and business correspondence.

- **Lab Practice (ALABC11)**
  The practicals include using mass and electronic top-loading balances, a gas burner, instruments for measuring volume and temperature, filtration and evaporation equipment, etc.

2 DEPARTMENT OF CIVIL ENGINEERING & SURVEYING

Note: The National Diploma programmes were phased out from January 2018 and replaced by the new Diploma programmes. In future, returning and pipeline students will have to migrate to the Diploma programmes.

2.3 Qualification Name: Diploma in Civil Engineering

SAQA ID Number	:	96855
NQF Level	:	6
SAQA Credits	:	360
Duration	:	3 years

Mission

The mission of the department of Civil Engineering and Surveying is to provide superior quality, technologically advanced instructional programmes and services in the field of civil engineering and surveying, which respond to local, regional and national industry for which we produce competent graduates.

Statement of Purpose

The purpose of the Diploma: Engineering: Civil is to prepare a civil engineering technician, who will satisfy the criteria for registration as a professional technician (by the Engineering Council of South Africa (ECSA), for articulated advanced study in civil engineering and/or to gain employment by function as a competent member of an engineering team in the execution of technical tasks, under supervision, by applying his/her knowledge, skills and techniques necessary for civil engineering practice.

Qualification Rules:

The qualification will be awarded to a learner who has provided evidence to the satisfaction of the assessors that the stated competence of the qualification, as detailed in the outcomes, has been achieved, either through education and training in a single provider's learning programme, or through experience that complies with the stated outcomes.

Exit Level Outcomes:

A person in possession of this qualification will be able to do the following:

- Identify, analyse and produce solutions to problems related to the civil engineering/ surveying environments as presented in classroom and laboratory examples and practicals; and as encountered in the real-life work context as part of experiential learning.
- Apply analytical and practical techniques and knowledge related to the specific disciplines of civil engineering/ surveying.
- Conduct civil engineering/ surveying operations and apply practical skills related to the specific real-life working environment as addressed through laboratory practicals, and specific skills training and projects done in industry during experiential training.
- Communicate in a professional manner using the language, concepts, models, techniques and equipment encountered in the engineering/ surveying working environment.
- Apply mathematical techniques and interpret results of mathematical calculations to assist in the solving of engineering/ surveying problems.

- Use basic scientific and technological principles in an engineering / surveying applied context.
- Analyse the overall functioning and purpose of a particular organisation.
- Organise and give directions to the work of self and others.
- Work as part of a team or independently as required by the work environment.
- Work ethically, safely and responsibly with due consideration for the environment and fellow human beings.

ECSA Graduate Attributes

Graduate Attribute 1: Problem solving

Identify, formulate, analyse and solve well-defined engineering problems.

Graduate Attribute 2: Application of scientific and engineering knowledge
Apply knowledge of mathematics, natural sciences, engineering fundamentals and an engineering speciality to solve well-defined engineering problems**.**

Range Statement: Mathematics, natural science and engineering sciences are applied in analysis and modelling of engineering situations, and for reasoning about and solving well-defined engineering problems.

Graduate Attribute 3: Engineering design
Perform procedural design and synthesis of components, systems, engineering works, products or processes.

Range Statement: Design problems used in exit-level assessment must conform to the definition of a well-defined engineering problem. A design problem should be used to provide evidence. The design knowledge base and components, systems, engineering works, products or processes to be designed are dependent on the sub-discipline or practice area.

Graduate Attribute 4: Investigations, experiments and data analysis
Demonstrate competence to design and conduct investigations and experiments.

Range Statement: The balance of investigation and experiment should be appropriate to the sub-discipline. Research methodology is to be applied in research or an investigation where the student engages with selected knowledge in the research literature of the sub-discipline. Note: An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon and a recommended course of action rather than specifying how an artifact could be produced.

Graduate Attribute 5: Engineering methods, skills and tools, including information technology
Demonstrate competence to use appropriate engineering methods, skills and tools, including those based on information technology.

Range Statement: A range of methods, skills and tools appropriate to the disciplinary designation of the program including:
 Sub-discipline-specific tools, processes or procedures;
 Computer packages for computation, modelling, simulation, and information handling; Computers and networks and information infrastructures for accessing,
processing, managing, and storing information to enhance personal productivity and teamwork.

Graduate Attribute 6: Professional and technical communication
Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large.

Range Statement: Material to be communicated is in an academic or simulated professional context. Audiences range from engineering peers, academic personnel and related engineering peers, using appropriate academic or professional discourse. Written reports range from short (300 words) to long (a minimum of 2000 words excluding tables, diagrams and appendices), covering material at exit-level. Methods of providing information include the conventional methods of the sub-discipline, for example engineering drawings, as well as subject-specific methods.

Graduate Attribute 7: Sustainability and impact of engineering activity
Demonstrate critical awareness of the sustainability and impact of engineering activity on the social, industrial and physical environment.

Range Statement: The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the sub-discipline or other designation of the qualification. Comprehension of the role of engineering in society and identified issues in engineering practice in the sub-discipline: health, safety and environmental protection; risk assessment and management and the impacts of engineering activity: economic, social, cultural, environmental and sustainability.

Graduate Attribute 8: Individual, team and multidisciplinary working Demonstrate competence to work effectively as an individual, in teams and in multidisciplinary environments.

Range Statement: Multidisciplinary tasks require co-operation across at least one disciplinary boundary. Co-operating disciplines may be engineering disciplines with different fundamental bases other than that of the programme or may be outside engineering.

Graduate Attribute 9: Independent learning ability
Demonstrate competence to engage in independent learning through well-developed learning skills.

Range Statement: Operate in well-structured environment with some unfamiliar elements requiring personal responsibility and initiative, accurately self-evaluate and take responsibility for learning requirements; be aware of social and ethical implications of applying knowledge in particular contexts.

Graduate Attribute 10: Engineering professionalism
Demonstrate critical awareness of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence.

Range Statement: Evidence includes case studies typical of engineering practice situations in which the graduate is likely to participate. Ethics and the professional responsibility of a technician and the contextual knowledge specified in the range statement of Graduate.
Attribute 7 is generally applicable here.

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

Range Statement: Basic techniques from economics, business management; project management applied to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Graduate Attribute 12: Workplace practices

Demonstrate an understanding of workplace practices to solve engineering problems consistent with academic learning achieved.

Range Statement: Tasks to demonstrate this outcome should be designed to connect with workplace practice and may be performed in one or more of the following types of work-integrated learning

I. Work-directed theoretical learning.
II. Problem-based learning.
III. Project-based learning.
IV. Work-based learning, and
V. Simulated learning.

Note: While attribute 12 is specific to workplace practices, other attributes may be demonstrated simultaneously.

2.3.1 **Minimum Admission Requirements**

2.3.1.1 National Senior Certificate with rating codes:

English Home Language	(4)
English First Additional Language	(4)
Mathematics	(4)
Physical Science	(4)

2.3.1.2 A minimum of 130 total credits, with a maximum of 60 credits with "Partial Achievement", at NQF Level 4

2.3.1.3 Adequate achievement rating code 3: 40%-49% in the relevant subject in the Manufacturing, Engineering and Technology learning field will be an advantage.

2.3.1.4 Pass all the Pre-Tech subjects with a minimum of 50%

2.3.1.5 National Senior Certificate / Standard 10 / Matric Certificate with a minimum:

Maths	D (HG)
Physical Science	D (HG)
English	E (SG)

2.3.1.6 An appropriate N4 Certificate with minimum 50% pass in all subjects and a minimum of 50% for Maths at the N4 level and an E (SG) Symbol for English

2.3.1.7 An appropriate GCE, GCSE, IGSCE or Cambridge School Certificate with at least five subjects (including Mathematics, Science and English) passed with an A, B or C symbol. Three of the five subjects must have been passed at the same examination sitting.

2.3.2 **Duration of Study**

Four semesters of attendance at the University together with two semesters of appropriate work integrated learning.

2.3.3 **Diploma**: **Subjects, Curriculum Compilation, Course Codes**

DIPLOMA IN CIVIL ENGINEERING. SAQA CODE 96855						
Diploma CIVDIP	**Subjects**	**Assessment Method**	**NQF Level**	**Pre- requisites**	**Co-requisites**	**Saqa Credits**
Semester 1						
APME101	Applied Mechanics for Civil Engineers	Exam	5			12
CPIL101	Computer Skills I	Exam	5			12
COME101	Construction Methods I	Exam	5			8
DING101	Civil Engineering Drawing 1	Continuous	5			8
MATA101	Mathematics I	Exam	5			12
SUTP101	Surveying: Theory and Practical	Exam	5			12
Semester 2						
COSL102	Communication Skills IA	Exam	5			8
COMA102	Construction Materials I	Exam	5	Construction Methods I		12
DING 102	Civil Engineering Drawing II	Continuous	5	Civil Engineering Drawing 1		8
CEMA102	Civil Engineering Management	Exam	5			8
MATA102	Mathematics II	Exam	5	Mathematics I		12
THOS102	Theory of Structures II	Exam	5	Applied Mechanics I and Mathematics I		12
EPAC 102	Engineer practice and communication (Engineer in Society and Professional Ethics)	Exam	5			8
Semester 3						
GEEN 201	Geology and Soil Mechanics	Exam	6	Mathematics II, Theory of Structures II, Construction Materials I and Construction Methods I		12

CMD201	Reinforced Concrete & Masonry Design III	Continuous	6	Theory of Structures II, Drawing II, Mathematics II and Construction Materials I		12
TREN 201	Transportation Eng.	Exam	6	Civil Engineering Drawing II, Surveying T/P, Mathematics II and Construction Materials I		8
WENG 201	Water Engineering I	Exam	6	Theory of Structures II and Mathematics II		12
ENVE201	Introduction to Environmental Engineering	Exam	6	Mathematics II and Civil Engineering Management		8
CENS 201	Engineering Statistics	Exam	6	Mathematics II		12
DOCU202	Documentation for Civil Engineers	Continuous	6			8
Semester 4						
CIVD 202	Civil engineering design	Continuous	6	Completion of S3		16
GEOT 202	Geotechnical Eng.	Exam	6	Geology and Soil Mechanics		12
STUA 202	Structural Analysis	Exam	6	Theory of Structures II and Mathematics II		12
SSTM 202	Structural Steel & Timber Design III	Continuous	6	Theory of Structures II & Civil Eng., Drawing II		12
EWPD 202	Earthworks and Pavement Design	Exam	6	Transportation Eng.		12
WENG 202	Water Engineering II	Exam	6	Water Engineering I Introduction to Environmental Engineering		12
In-service Training						
CVEP301	Civil Engineering Pract. I		5	Engineer practice and communication (Engineer in Society and Professional Ethics)		40
CVEP302	Civil Engineering Pract. II		6	Civil Engineering Pract. I		40
						Total Credits 360

Note: The revised diploma above has been phased-in gradually and it was fully phased-in by the 1st semester of 2023. Also, the S3 and S4 old diploma modules will be phased-out by the end 2024 and similar modules will be credited.

2.3.4 **Work Integrated Learning**

Two (2) semesters of appropriate Civil Engineering work integrated learning to be completed after S2.

It is the student's responsibility to register his/her training. This must be done before or on commencement of the training. Students who experience any problem when trying to register must contact their Head of Department for advice.
Students who do not register their work integrated learning cannot be monitored and evaluated resulting in the training NOT being recognised.

2.3.5 **Restriction on Subjects**

A student can only continue with a subject of the same name at the next level if the same subject at the preceding level has been passed.

2.3.6 **Examination Regulations**

Refer to General Handbook Rule: 22

2.3.7 **Pass Requirements**

A candidate passes a subject if a final mark of at least 50% is obtained. The final mark consists of 40% of the year mark and 60% of the examination mark for examination subjects.

A candidate must obtain a sub-minimum of 40% in the examination to pass a course. Where the examination in a course consists of two or more papers, a sub-minimum of 40% must be obtained in each paper.

The student's performance in certain subjects is assessed by Continuous Evaluation, and no examinations are written. Details of this assessment method are included in the relevant subject Study Guides.

2.3.8 **Practicals/Laboratory**

Practical work is done in the following subjects and forms part of the assessment: Surveying I & Surveying (Civil) II
Details of the assessment of the practicals are given in the relevant Study Guides.

Laboratory work is done in the following subjects:

Applied Mechanics for Civil Engineers	Geotechnical Engineering
Construction Materials I	Earthworks and Pavement Design
Civil Engineering Drawing II	Water Engineering II
Theory of Structures II	Reinforced Concrete and Masonry Design III
Structural Analysis	Structural Steel and Timber Design III
Water Engineering I	
Geology and Soil Mechanics	

Details of the assessment of laboratory work are given in the relevant Study Guides.
Note: Students have to report to the relevant subject lecturer for all their practical classes within the first week of lectures. This also applies to students who register late.

2.4 Qualification Name: Diploma in Surveying

SAQA ID Number: 96867
NQF Level: 6
SAQA Credits: 360

Rationale for Qualification:

To be able to survey, collect and present spatial data in different forms, and set out and control positions of structures on the ground of basic engineering works.

Statement of Purpose:

The Diploma in Surveying qualifies the technician for employment with contractors, consultants, government departments and municipalities where he/ she could form part of the team headed usually by a professional engineer or professional surveyor. He/ She would be involved in the measurement for the production of maps, the setting out and monitoring of civil engineering structures and the relocation of property boundaries**.**

Qualification Rules:

The qualification will be awarded to a learner who has provided evidence to the satisfaction of the assessors that the stated competence of the qualification, as detailed in the outcomes, has been achieved, either through education and training in a single provider's learning programme, or through experience that complies with the stated outcomes.

Exit Level Outcomes:

A person in possession of this qualification will be able to do the following:

- Identify, analyse and produce solutions to problems related to the civil engineering/ surveying environments as presented in classroom and laboratory examples and practicals; and as encountered in the real-life work context as part of experiential learning.
- Apply analytical and practical techniques and knowledge related to the specific disciplines of civil engineering/ surveying.
- Conduct civil engineering/ surveying operations and apply practical skills related to the specific real-life working environment as addressed through laboratory practicals, and specific skills training and projects done in industry during experiential training.
- Communicate in a professional manner using the language, concepts, models, techniques and equipment encountered in the engineering/ surveying working environment.
- Apply mathematical techniques and interpret results of mathematical calculations to assist in the solving of engineering/ surveying problems.
- Use basic scientific and technological principles in an engineering/surveying applied context.
- Analyse the overall functioning and purpose of a particular organisation.
- Organise and give directions to the work of self and others.
- Work as part of a team or independently as required by the work environment.

- Work ethically, safely and responsibly with due consideration for the environment and fellow human beings.

2.4.1 **Admission Requirements:**

2.4.1.1 National Senior Certificate with rating codes:

English Home Language	(4)
English First Additional Language	(4)
Mathematics	(4)
Physical Science	(4)

2.4.1.2 A minimum of 130 total credits; with a maximum of 60 credits with "Partial Achievement", at NQF Level 4

2.4.1.3 Pass all Pre-Tech subjects with a minimum of 50%

2.4.1.4 National Senior Certificate/Standard 10 / Matric Certificate with a minimum

Maths	D (HG)
Physical Science	D (HG)
English	E (SG)

2.4.1.5 An appropriate N4 Certificate with minimum 50% passes in all subjects and a minimum of 50% for Maths at the N4 level and an E (SG) symbol for English

2.4.1.6 An appropriate GCE, GCSE, IGCSE or Cambridge School Certificate with at least five subjects (including Mathematics, Science and English) passed at the same examination sitting.

2.4.2 **Duration of Study:**

Four semesters of attendance at the University together with two semesters of appropriate work integrated learning.

2.4.3 **Subjects, Curriculum Compilation, Course Codes**

Diploma CISEND	Subjects	NQF Level	Pre-requisites	Co-requisites	SAQA Credits
Semester 1					
COML101	Computer Skills I	5			12
CMET101	Construction Methods I	5			10
DRNG101	Drawing I	5			10
MATE101	Mathematics I	5			12
SURY101	Surveying I	5			12
PHSC101	Physics I	5			10
				Sub-Total	*66*
Semester 2					
COLL102	Communication Skills IA	5			5

GEOG102	Geography I	5			10
MATE102	Mathematics II	5	Mathematics I		12

Diploma CISEND	Subjects	NQF Level	Pre-requisites	Co- requisites	SAQA Credits
PHOT102	Photogrammetry II	5	Surveying I, Mathematics I		12
SURY102	Surveying II	5	Drawing I		12
SURD102	Survey Drawing II	5	Surveying I		10
				Sub-Total	*61*
Semester 3					
COLL201	Communication Skills IB	6	Communication Skills IA		2,5
COSU201	Control Surveying III	6	Surveying II		15
LEGP201	Legal Principles I	6			10
STTT201	Statistics I	6	Mathematics II		12
PHOT201	Photogrammetry III	6	Photogrammetry II		12
MCIV201	Management (Civil) I	6			10
				Sub-Total	*61,5*
Semester 4					
ADER202	Adjustment of Errors III	6	Statistics I, Mathematics II, Surveying II		12
CASU202	Cadastral Surveying III	6	Survey Drawing II, Surveying II, Legal Principles I		12
COLL202	Communication Skills IC	6	Communication Skills IB		2,5
COAP202	Computer Applications III	6	Computer Skills I, Surveying II		12
SURY202	Surveying III	6	Surveying II		15
GEIS202	Geographic Information Systems III	6		Computer Applications III	12
SUPR000	Work Readiness Program	-	-	-	-
				Sub-Total	*65,5*
In-Service Training					
SUPR301	Survey Practice I	5	Work Readiness Program Surveying II		120
SUPR302	Survey Practice II	5	Survey Practice I		120
				Sub-Total	*120*
			Total Credits		***374***

Curriculum Compilation: A student can only continue with a subject of the same name at the next level if the same subject at the preceding level has been passed.

2.2.7 **Practicals**

Practical work is done in the following subjects and forms part of the assessment: Surveying I, Surveying II, Control Surveying III, Surveying III, Cadastral Surveying III, Geographic Information Systems III & Photogrammetry III

Details of the assessment of the practicals are given in the relevant Study Guides.

All practicals are compulsory.

Note: Students have to report to the relevant subject lecturer for all their practical classes within the first week of lectures. **This also applies to students who register late.**

2.2.8 **Work Integrated Learning**

Work integrated learning consists of two semesters where the student is placed with an employer which will provide training of survey related work as specified in the Work Integrated Log Book. This experiential learning will be evaluated by Mangosuthu University, in consultation with the Employer, and the Diploma can only be awarded once the experiential learning has been completed satisfactorily.

The Department will set up periodical meetings with representatives of training providers and academic staff will visit students in training and their mentors at least once to discuss the progress students are making with experiential training. The emphasis during these visits will be on co-operation with the employers so that the student will gain maximum benefit from the experiential training component of the course.

Experiential training has to be verified by the training provider before the Diploma can be awarded. This means that the mentor must sign each page of the student's log book.

The University requires that verification of experiential training be carried out by a senior person within the organisation who is registered with PLATO in one of the following categories; Surveyor; Professional Surveyor (Engineering) or Professional Land Surveyor.

2.5 Access Courses: (Pre Tech) – Civil Engineering
(Pre-Tech) – Surveying

2.5.1 **Admission Requirements**

2.5.1.1 National Senior Certificate with rating codes: English Home Language (3)

English First Additional Language	(3)
Mathematics	(3)
Physical Science	(3)
Satisfactory achievement in Home Language	(4)

2.5.1.2 A minimum of 130 total credits, with a maximum of 60 credits with "Partial Achievement" at NQF Level 4

2.5.1.3 Senior Certificate or equivalent qualification with a pass in

Mathematics	SG (D)
Physical Science	SG (D)

iii) N3 certificate and a minimum E (SG) symbol in English

2.5.2 **Duration of Study**

Study will be for a period of six months.

2.5.3 **Subjects, Curriculum Compilation, Course Codes**

Code	Subjects	*C/ O	Assessment Method
Access Course: Civil Engineering			
ACOMC11	Communication	C	Exam
AMATC11	Mathematics	C	Exam
ADRAC11	Drawing	C	Continuous
APHYS11	Physics	C	Exam
ASURV11	Surveying	C	Continuous
AINC011	Introduction to Construction	C	Exam
Access Course: Surveying			
ACOMC11	Communication	C	Exam
AMATC11	Mathematics	C	Exam
ADRAS11	Survey Drawing	C	Continuous
APHYB11	Survey Physics	C	Exam
AGEOM11	Introduction to Geomatics	C	Continuous
ASCOMP1	Computation in Surveying	C	Continuous
C=Compulsory; O=Optional			

2.5.4 **Examination Regulations**

Refer to General Handbook Rule 22

2.5.5 **Pass Requirements**

Students should pass ALL subjects at 50%.

2.5.6 **Practicals**

Students are expected to attend all practicals offered in the course. This course may not be repeated.

2.6 Diploma in Civil Engineering: (4-Year Programme - ECP)

NQF Level : 6
SAQA Credits : 360
Duration : 4 years

The minimum study period for the Diploma: Engineering Civil is usually three years. However, students are usually under-prepared and some complete the programme in 4, 5 or 6 years. A 4- year programme (also known as the Extended Curriculum programme) has been designed to provide structured support to students over a period of four years. A range of additional interventions are offered to students who are accepted to this programme. This programme has been a response to the well-known inequalities in the South African society and to cater for varying levels of student preparedness. It ensures that sufficient support is provided during the initial years of study while guaranteeing the same exit standards as the 3-year programme.

The 4-year programme addresses gaps and disparities in students' educational and life experience so that they can be better equipped to manage the diploma programme. It also provides students with broad educational and life skills, including Mathematics, language literacy and subject knowledge. While students are mostly tutored separately in small classes in the first year, they undertake their studies and lectures as integral members of the Diploma student group.

This programme in Civil Engineering is further unique and designed in such a way that after the first semester, students may transfer to similar programmes in Mechanical Engineering or Electrical Engineering without sacrificing time or quality of training.

Statement of Purpose

The purpose of the Diploma: Engineering: Civil is to prepare a civil engineering technician, who will satisfy the criteria for registration as a professional technician (by the Engineering Council of South Africa (ECSA), for advanced study in civil engineering and/or to gain employment by function as a competent member of an engineering team in the execution of technical tasks, under supervision, by applying his/her knowledge, skills and techniques necessary for civil engineering practice.

2.4.1 Exit Level Outcomes

A person in possession of this qualification will be able to do the following:

- Identify, analyse and produce solutions to problems related to the civil engineering/ surveying environments as presented in classroom and laboratory examples and practicals; and as encountered in the real-life work context as part of experiential learning.
- Apply analytical and practical techniques and knowledge related to the specific disciplines of civil engineering/ surveying.
- Conduct civil engineering/ surveying operations and apply practical skills related to the specific real-life working environment as addressed through laboratory practicals, and specific skills training and projects done in industry during experiential training.
- Communicate in a professional manner using the language, concepts, models, techniques and equipment encountered in the engineering/ surveying working environment.
- Apply mathematical techniques and interpret results of mathematical calculations to assist in the solving of engineering/ surveying problems.
- Use basic scientific and technological principles in an engineering/surveying applied context.
- Analyse the overall functioning and purpose of a particular organisation.
- Organise and give directions to the work of self and others.
- Work as part of a team or independently as required by the work environment.
- Work ethically, safely and responsibly with due consideration for the environment and fellow human beings.

2.4.2 Minimum Admission Requirements

Admission for selection to the 4-year programme is granted to those applicants who meet the minimum admission requirements for the corresponding regular programme. Candidates shall have obtained a valid National Senior Certificate or Senior Certificate or NQF Level 4 with the following minimum rating codes:

- **Table 1:** Minimum admission requirements for applicants with a National Senior Certificate

Programme	English Home Language or English Additional Language	Mathematics	Physical Science	Home Language
ECP	4 or 5	4	4	-
RP	4 or 5	4	4	-

In addition the minimum total points must be 20.

- **Table 2:** Minimum admission requirements for applicants with a Senior Certificate

Programme	English	Mathematics	Physical Science	Technical Drawing
ECP	D(HG) or C(SG)	D(HG) or C(SG)	D(HG) or C(SG)	D(HG) or C(SG)
RP	D(HG) or C(SG)	D(HG) or C(SG)	D(HG) or C(SG)	D(HG) or C(SG)

In addition the minimum total points must be 20.

- **Table 3:** Minimum admission requirements for applicants with NQF Level 4

Programme	Credits required
ECP	A minimum of 130 total credits, with a maximum of 60 credits with "Partial Achievement", at NQF Level 4
RP	A minimum of 130 total credits, with a maximum of 60 credits with "Partial Achievement", at NQF Level 4

ECP: Extended Curriculum Programme; RP: Regular Programme; HG: Higher Grade; SG: Standard Grade; NQF: National Qualifications Framework

2.4.3 **Subjects, Curriculum Compilation, Course Codes**

Diploma (ECP) CIVECP	Subjects	*C/O	Semester /Year	NQF Level	Pre-requisites	Co-requisites	
BASC000	Basic Science I	C		4			
CLIT000	Computer Literacy I	C		4			
LSSS000	Life Skills and Study Skills	C		4			
DWIN000	Drawing	C		4			
MATH000	Mathematics	C		4			
CKIL000	Communication Skills I	C		4			
ENGC000	Engineering Calculations	C		4	Mathematics		

ESCI000	Engineering Science I	C		4	Basic Science I		
CAPL000	Computer Applications I	C		4	Computer Literacy I		
DRIG000	Drawing002	C		4	Drawing001 and Basic Science I		
APPM101	Applied Mechanics for Civil Engineers	C	S1	5	Engineering Science I		**12**
COIL101	Computer Skills I	C	S1	5	Computer Applications I		**12**
COSM101	Construction Methods I	C	S1	5			**8**
DRWN101	Civil Engineering Drawing 1	C	S1	5	Drawing 001/002 and Basic Science I		**8**
MATC101	Mathematics I	C	S1	5	Mathematics		**12**
STPR101	Surveying: Theory and Practical	C	S1	5			**12**
ECON102	Communication Skills IA	C	S2	5	Communication Skills		8
CONM102	Construction Materials I	C	S2	5	Construction Methods		12
CENM102	Civil Engineering Management	C	S2	5			8
MATC102	Mathematics II	C	S2	5	Mathematics I		12
THST102	Theory of Structures II	C	S2	5	Applied Mechanics I and Mathematics I		12
ENPC102	Engineer practice and communication (Engineer in Society and Professional Ethics)	C	S2	5			8
GEOE201	Geology and Soil Mechanics	C	S3	6	Mathematics II, Construction Materials I, Construction Methods I and Theory of Structures II		12
RECM201	Reinforced Concrete & Masonry Design III	C	S3	6	Theory of Structures II, Drawing II, Mathematics II and Construction Materials	Structural Analysis II	12

TRAN201	Transportation Eng.	C	S3	6	Drawing II, Surveying T/P, Mathematics II and Construction Materials I		8
WANG201	Water Engineering I	C	S3	6	Theory of Structures II and Mathematics II		12
ENVE1O2	Introduction to Environmental Engineering	C	S3	6	Mathematics II and Civil Engineering Management	-	8
CEST201	Engineering Statistics	C	S3	6	Mathematics II		12
DOCM202	Documentation for Civil Engineers	C	3	6			8
CEDE 202	Civil engineering design	C	S4	6	Completion of S3		16
GEOE202	Geotechnical Eng.	C	S4	6	Geology and Soil Mechanics		12
SANL202	Structural Analysis	C	S4	6	Theory of Structures II and Mathematics II		12
STST202	Structural Steel & Timber Design III	C	S4	6	Theory of Structures II & , C E Drawing II		12
TRAN202	Earthworks and Pavement Design	C	S4	6	Transportation Eng.		12
WANG202	Water Engineering II	C	S4	6	Water Engineering I		12
CVCP301	Civil Engineering Pract. I	C		5	Engineer practice and communication (Engineer in Society and Professional Ethics)		40
CVCP302	Civil Engineering Pract. II	C		6	Civil Engineering Practice I		40
O=Optional; C=Compulsory							

Note: The revised diploma above has been phased-in gradually and it was fully phased-in by the 1st semester of 2023. Also, the following S3 and S4 old diploma modules below will be phased-out by the end 2024 and similar modules will be credited.

2.4.4 Two (2) semesters of appropriate Civil Engineering work integrated learning to be completed. See Par. 2.1.4 above.

It is the student's responsibility to register his/her training. This must be done before or on commencement of the training. Students who experience any problem when trying to register must contact the Head of Department for advice.

Students who do not register their work integrated learning cannot be monitored and evaluated resulting the training NOT being recognised..

2.4.5 **Course Content**

Diploma (ECP)	Diploma	Subjects	Contents
APPM101	APME101	Applied Mechanics for Civil Engineers	Unit 1: Numbers and conversions, Unit2 : Forces, Equilibrium concept and first condition of equilibrium , unit 4: Moment of forces and second condition of equilibrium, beams, frames, support reactions , shear force , bending moment, Unit 4 : Internal forces in structures and frames , Unit5 : centre of gravity and centroids , Unit 6: Moment of inertia , Unit 7 : Friction and wedges ,unit 8 : Work ,power and energy , Unit 9 : Conservation of momentum , unit 10 : simple machines , Unit 11 : applied Kinematics Practicals : Forces , Moment of forces , centroids
COIL101	CPIL101	Computer Skills I	The syllabus includes: hardware; software; data communications; computer applications; Windows; theory of computer and introduction to excel, word processing and spreadsheets.
COSM101	COME101	Construction Methods I	This course covers the very basics of the following topics: earthworks, structures, road engineering, dams, bridges, tunnels, harbours, railways, airports, safety, drainage, and labour-enhanced construction.
DRWN101	DING101	Civil Engineering Drawing 1	The syllabus includes: Reinforced Concrete, Structural Steelwork, and Surveying.
MATC101	MATA101	Mathematics I	The syllabus includes: basic algebra and trigonometry; differential calculus with applications; integral calculus with applications; statistics, complex numbers and hyperbolic functions.

STPR101	SUTP101	Surveying: Theory and Practical	Surveying ,Geomatics, Types of Surveying ,Branches of Surveying ,Spatial Data,Co-ordinate systems and map projection systems used in South Africa Coordinate calculations Joins and Polars ,Levelling ,Introduction to Spirit Levelling, Principles of Spirit Levelling ,Angle and distance measurement Introduction to Electromagnetic Distance Measurement (EDM),Traversing, Site Surveying, Coordinates of intersecting lines Traversing, Coordinate calculations Joins and Polars, Circular curves, Transition curves, Vertical Curves, Angle and distance measurement, Construction surveying, GIS.
ECOM102	COSL102	Communicatio n Skills IA	The syllabus includes: hardware; software; data communications; computer applications; Dos; Windows; theory of computer and introduction to Office XP, word processing and spreadsheets.
CONM102	COMA102	Construction Materials I	The syllabus includes: The study of soil, concrete, bitumen, other common materials found on construction site, environment issues and internal building materials and finishes; introduction to Soil and concrete practicals.
DRWN102	DING102	Civil Engineering Drawing II	The syllabus includes: Introduction to AutoCAD, Geometric Construction, First Angle Orthographic, Isometric, and Beams & Slabs.
CENM 102	CEMA102	Civil Engineering Management	The syllabus includes: Management of construction project, Management of construction company, Management of engineering design, Economic analysis, Contract management, Management of industrialized building and Management information systems.
MATC102	MATA102	Mathematics II	The syllabus includes: further differential and integral calculus with applications; matrix algebra; linear programming; statistics and differential equations.
THST102	THOS102	Theory of Structures II	The syllabus includes: The study of sectional properties of structural members, stresses and strains, simply supported beams and cantilevers with point loads, uniformly distributed and uniformly varying loads and analysis of statically determinate pin-jointed frames.
ENPC102	EPAC102	Engineer practice and communication (Engineer in	The syllabus includes: The world of work, developing employability skills, developing employability skills, skills inventory, professional writing, interviews, industry presentations, discipline-specific topics.

		Society and Professional Ethics)	
GEOE201	GEEN201	Geology and Soil Mechanics	The syllabus includes: The study of soil in terms of densities, moisture contents, liquid limits, soli classification, identifying the type of material to be used during construction
RECM201	RCMD201	Reinforced Concrete & Masonry Design III	The syllabus includes: Loading & resistance (partials factors), limit states design & Analysis (Ultimate and serviceability limit state), design of structural members (Beam, slabs, columns and foundations) and concrete practicals (flexural strength test, workability of concrete and cubes test)
TRAN201	TREN201	Transportation Eng.	The syllabus includes: Transportation planning, traffic engineering, route location, design criteria, horizontal alignment, vertical alignment, cross- sectional elements, safety barriers, intersection and interchange design.
WANG201	WENG 201	Water Engineering I	The syllabus includes: The study of pressures in fluids, calculating hydrostatic forces on various shapes of sluice gates, fluid flow by means of gravitational acceleration , fluid flow by means of centrifugal pumps, losses in pipes. It involves also general aspects of water treatment, general methods of water treatment, overview of conventional water treatment processes, stabilization of water for domestic use, processes for desalination of water, treatment problems
			related to the operation of treatment plants, safety issues in treatment plant, wastewater treatment processes and sludge disposal.
ENVE102	ENVE201	Introduction to Environmental Engineering	The syllabus includes: General aspects of Water treatment, Conventional Water treatment processes, Point of use treatment processes, Treatment of sewage, The complete treatment, Wastewater flows and characteristics, Operations of water works, Wastewater collection systems, and Urban Planning
CEST201	CENS 201	Engineering Statistics	The syllabus includes: Descriptive Statistics**,** Basic Probability concepts**,** Random variables and Probability distributions**,** Statistical intervals of a single sample**,** Estimation of parameters and testing of Hypotheses**,** Regression analysis**,** Computer-aided statistical analysis of data (e.g.: Excel®, R Statistics and Design Expert®). And Applications on engineering problems

DOCM202	DOCU202	Documentation for Civil Engineers	The syllabus includes: The study of Quantities, Estimating, Specifications and General Conditions of Contract.
CEDE 202	CIVD 202	Civil engineering design	This module involve the provision of solution to basic civil engineering problems through design projects and its presentation.
GEOE202	GEOT202	Geotechnical Eng.	The syllabus includes: Total, pore-water and effective stresses, shear strength of soils, permeability of water through soils, consolidation, slope stability, foundations, and site investigations.
SANL202	STUA 202	Structural Analysis	Structural analysis is the determination of the effects of loads on physical structures and their components. The syllabus includes the analysis for the following; Moment area theorem, Moment distribution, Plastic theory, Strain energy for frames.
STST202	SSTM 202	Structural Steel & Timber Design III	The syllabus includes: Loading and resistance (partial factors), limit states design and Analysis, connection design (bolted and welded connections), columns base plate connection, elements design (grade of structural steel, axial tension, axial compression, bending and defection); practical (timber test).
TRAN202	EWPD 202	Earthworks and Pavement Design	The syllabus includes: The study of Bitumen, coal tar, Pavement materials, Surfacing materials, Modified Bitumen, Bitumen surfacing and seal design and pavement rehabilitation and design. It also includes; introduction to Bitumen Practical and model maker software.
WANG202	WENG 202	Water Engineering II	The syllabus includes: The study of hydrology, stormwater design, Patching of records for rainfall, Open channel uniform flows and open channel non uniform flows, Water demand and distribution, Dam design, Borehole construction and water resources management. It includes abstraction from a single well in an unconfined aquifer piratical and ARCGIS software.

2.4.6 **Restriction on Subjects**

A student can only continue with a subject in the 4-year programme of the same name at the next level if the same subject at the preceding level has been passed. In addition, the following pre-requisites apply with respect to the subjects and associated credits in the 4-year programme:

2.4.7 **Examination Regulations**

Refer to General Handbook Rule: 22

2.4.8 **Pass Requirements**

A candidate passes a subject if a final mark of at least 50% is obtained. The final mark consists of 40% of the year mark and 60% of the examination mark for examination subjects. A candidate must obtain a sub-minimum of 40% in the examination to pass a course. Where the examination in a course consists of two or more papers, a sub-minimum of 40% must be obtained in each paper.

The student's performance in certain subjects is assessed by Continuous Evaluation, and no examinations are written. Details of this assessment method are included in the relevant subject Study Guides.

2.4.9 **Practicals / Laboratory**

Practical work is done in the following subjects and forms part of the assessment:
Surveying I & Surveying (Civil) II
Details of the assessment of the practicals are given in the relevant Study Guides.

Laboratory work is done in the following subjects:

Applied Mechanics I	Structural Analysis
Construction Materials I	Water Engineering II
Theory of Structures II	Geotechnical Engineering
Structural Analysis II	Reinforced Concrete and Masonry Design III
Drawing II	Structural Steel and Timber Design III
Water Engineering I	Earthworks and Pavement Design
Geotechnical Engineering II	

Details of these assessments of laboratory work are given in the relevant Study Guides.

Note: Students have to report to the relevant subject lecturer for all their practical classes within the first week of lectures. **This also applies to students who register late.**

2.7 Diploma in Surveying: (4-Year Programme - ECP) NQF

Level : **6**
SAQA Credits : 360
Duration : 4 years

The Extended Curriculum Programme (ECP) for Surveying is a four year course. The first year of study is foundational and is split into two semesters. From the second year the courses are identical to the diploma programme.
The admission requirements for the ECP Programme are as below:

2.7.1 **Minimum Admission Requirements**

Admission for selection to the 4-year programme is granted to those applicants who meet the minimum admission requirements for the corresponding regular programme. Candidates shall have obtained a valid National Senior Certificate or Senior Certificate or NQF Level 4 with the following minimum rating codes:

- **Table 1:** Minimum admission requirements for applicants with a National Senior Certificate

Programme	English Home Language or English Additional Language	Mathematics	Physical Science	Home Language
ECP	4 or 5	4	4	-
RP	4 or 5	4	4	-

In addition the minimum total points must be 20.

- **Table 2:** Minimum admission requirements for applicants with a Senior Certificate

Programme	English	Mathematics	Physical Science	Technical Drawing
ECP	D(HG) or C(SG)	D(HG) or C(SG)	D(HG) or C(SG)	D(HG) or C(SG)
RP	D(HG) or C(SG)	D(HG) or C(SG)	D(HG) or C(SG)	D(HG) or C(SG)

In addition the minimum total points must be 20.

- **Table 3:** Minimum admission requirements for applicants with NQF Level 4

Programme	Credits required
ECP	A minimum of 130 total credits, with a maximum of 60 credits with "Partial Achievement", at NQF Level 4
RP	A minimum of 130 total credits, with a maximum of 60 credits with "Partial Achievement", at NQF Level 4

ECP: Extended Curriculum Programme; RP: Regular Programme; HG: Higher Grade; SG: Standard Grade; NQF: National Qualifications Framework

2.7.2 **Subjects, Curriculum Compilation, Course Codes**

SUBJECTS	Diploma (ECP) CISENE	**PREREQUISITES**
YEAR 1		
First Semester		
Basic Science	BCIE001	-
Computer Literacy	COLI001	-
Introduction to English Communication Skills	IECS001	-
Basic Drawing	BADR001	-
Basic Mathematics	BAMA001	-
Second Semester		
Mathematics	MATH002	Basic Mathematics

Survey Drawing	SURD002	Basic Drawing
Survey Physics	SUPH002	Basic Science
Introduction to Geomatics	INGE002	- -
Computation in Surveying	COSU002	Computer Literacy
YEAR 2		
First Semester		
Computer Skills I	CMPK101	Computation in Surveying
Construction Methods I	CONM101	- -
Drawing I	DANG101	Survey Drawing
Mathematics I	MAMT101	Mathematics
Surveying I	SRVY101	Introduction to Geomatics
Physics I	PSCS101	Survey Physics
Second Semester		
English Communication Skills I	ECMK102	Introduction to English Communication Skills
Geography I	GEGR102	- -
Mathematics II	MAMT102	Mathematics I
Photogrammetry II	PHTO102	Surveying I & Mathematics I
Surveying II	SRVY102	Surveying I
Survey Drawing II	SDRW102	Drawing I
YEAR 3		
First Semester		
English Communication Skills II	ECMK201	English Communication Skills I
Control Surveying III	CSRV201	Surveying II
Legal Principles I	LGLP201	- -
Statistics I	STSS201	Mathematics II
Photogrammetry III	PHTO201	Photogrammetry II
Management (Civil) I	MCVL201	-
Second Semester		
Adjustment of Errors III	ADJE202	Statistics I, Mathematics II, Surveying II
Cadastral Surveying III	CADS202	Survey Drawing II, Surveying II, Legal Principles I
Computer Applications III	CMAP202	Computer Skills I, Surveying II
Geographic Information Systems III	GINS202	CO-REQUISITE: Computer Applications III
Surveying III	SRVY202	Surveying II
English Communication Skills III	EMCK301	English Communication Skills II
Work Readiness Program	SUPR000	-
YEAR 4		
First Semester		

Survey Practice I (WIL)	SPRA301	Work Readiness Program Surveying II
Second Semester		
Survey Practice II (WIL)	SPRA302	Survey Practice I

2.7.3 **Course Content Diploma / ECP**

- **Computer Skills I (COML101 / CMPK101)**
  The syllabus includes: Computers and Information Processing, Windows 10, Word processing, Spreadsheets, Internet and e-mail, Online collaboration

- **Construction Methods I (CMET101 / CONM101)**
  The syllabus includes: earthworks & construction plants, structures (steel, concrete & bricks), dams, transportation: (road; bridge; tunnel; railway; harbour; airport), drainage & water supply, policy matters, safety, labour-enhanced construction.

- **Drawing I (DRNG101 / DANG101)**
  the syllabus includes: introduction to CAD, introduction to google earth, use CAD to draw longitudinal profiles, a topographical plan, a cadastral diagram, traverse data.

- **Mathematics I (MATE101 / MAMT101)**
  The syllabus includes: Find equations of ellipse and to sketch them, solve exponential and logarithmic equations, sketch trigonometric graphs and solve trigonometric equations in radians, find derivatives of functions and to apply differentiation for maximisation and minimization, integrate and use integration to find area under a curve, work with complex numbers, use matrix in solving system of equations.

- **Surveying I (SURY101 / SRVY101)**
  The syllabus includes: spirit levelling, angular observations, distance measurement, the South African coordinate system, join and polar calculations, traversing, tacheometry, area and volume calculations.

- **Physics I (PHSC101 / PSCS101)**
  The syllabus includes: graphing & vectors, density, kinematics, dynamics, energy, electrostatics, magnetic fields.

- **Communication Skills IA (COLL102) / English Communication Skills I (ECMK102)**
  The syllabus includes: academic writing skills, communication theory; meetings; public speaking & presentation skills; report writing skills.

- **Geography I (GEOG102 / GEGR102)**
  The syllabus includes: the solar system, climatology, oceanography, geomorphology, map, projections, GIS.

- **Mathematics II (MATE102 / MAMT102)**
  The syllabus includes: further differential and integral calculus with applications; matrix algebra; statistics and differential equations, hyperbolic functions.

- **Photogrammetry II (PHOT102 / PHTO102)**
  The syllabus includes: digital images, determination of heights of images, parallax measurements, planimetric positions, use of digital photogrammetric software, flight planning.

- **Surveying II (SURY102 / SRVY102)**
  The syllabus includes: electromagnetic distance measurement, intersection, resection, trilateration, setting out of curves, topographic surveys, GPS.

- **Survey Drawing II (SURD102 / SDRW102)**
  The syllabus includes: advanced CAD functions, complex topographical plan, cadastral working plan, cadastral diagram from working plan, using CAD to present horizontal curve data.

- **Communication Skills IB (COLL201) / English Communication Skills II (ECMK201)**
  The syllabus includes: the process of writing, business writing, visual literacy, surveying terms, progress report writing, status reports, business correspondence, meetings.

- **Control Surveying III (COSU201 / CSRV201)**
  The syllabus includes: triangulation networks, resection with graphical adjustment, calibration of total stations and EDMs, traverse with external orientation, trilateration with graphical adjustment, trigonometric levelling networks, advanced GPS surveys.

- **Legal Principles I (LEGP201 / LGLP201)**
  The syllabus includes: classification of South African law, the South African judiciary, contract law, business enterprises, personal and real rights, ownership, leases and servitudes, registration of surveyors, Geomatics Act, Land Survey Act, Expropriation Act.

- **Statistics I (STTT201 / STSS201)**
  The syllabus includes: probability density functions, Binomial distribution, normal distribution, mean and variance of random variable, normal approximation to the Poisson distribution, hypothesis testing, regression, chi-squared table, confidence intervals.

- **Photogrammetry III (PHOT201 / PHTO201)**
  The syllabus includes: stereo photogrammetry, absolute orientation, photogrammetric control, aerial triangulation, ortho rectification, DEM generation, mosaicing, terrestrial photogrammetry, digital photogrammetry, LIDAR

- **Management (Civil) I (MCIV201 / MCVL201)**
  The syllabus includes: economic analysis, contract management, management of – a construction project; a construction company; engineering design; an industrialised building; information systems.

- **Adjustment of Errors III (ADER202 / ADJE202)**
  The syllabus includes: theory of errors, statistical analysis, matrix algebra. least squares adjustment, network adjustment

- **Cadastral Surveying III (CASU202 / CADS202)**
  The syllabus includes: Surveying of boundaries, Land Rights, Forms of Land Title, Surveys conducted by Land Surveyors, Survey Records, Diagrams and General Plans.

- **Communication Skills IC (COLL202) / English Communication Skills III (EMCK301)**
  The syllabus includes: corporate CV, interviews, negotiation, small group communication, cross-cultural communication.

- **Computer Applications III (COAP202 / CMAP202)**
  The syllabus includes: Apply problem solving techniques and programming skills to solve commercial/scientific problems, apply basic business principles and effectively analyse **Business, to** be able to provide solutions for specific problems, Implement software solutions in one or more development environments

- **Surveying III (SURY202 / SRVY202)**
  The syllabus includes: circular curves, transition curves, vertical curves, deformation surveys, precise levelling, and construction survey

- **Geographic Information Systems III (GEIS202 / GINS202)**
  The syllabus includes: Introduction to Geographic Information Systems, Spatial Data Concepts, Spatial Referencing in GIS, GIS Data Acquisition and Structuring, Spatial Data Quality and Data Sharing, Management of Data in a GIS, Data Analysis in a GIS, Presentation & Dissemination of Spatial Data

- **Work Readiness Program (SUPR000)**
  The syllabus includes: Prepares the student for the world of work.

- **Survey Practice I (SUPR301 / SPRA301)**
  To promote integration of theoretical concepts learned in the academic environment with industrial practice. To develop other skills, that cannot be fully developed in a classroom, practicals or laboratory environment.

- **Survey Practice II (SUPR302 / SPRA302)**
  To promote integration of theoretical concepts learned in the academic environment with industrial practice. To develop other skills, that cannot be fully developed in a classroom, practicals or laboratory environment.

2.7.4 **For Work Integrated learning, see Par 2.2.8 above.**

It is the student's responsibility to register his/her training. This must be done before or on commencement of the training. Students who experience any problem when trying to register must contact the Head of Department for advice.

Students who do not register their work integrated learning cannot be monitored and evaluated resulting the training NOT being recognised.

2.7.5 **Restriction on Subjects**

A student can only continue with a subject in the 4-year programme of the same name at the next level if the same subject at the preceding level has been passed. In addition, the following pre-requisites apply with respect to the subjects and associated credits in the 4-year programme:

2.7.6 **Examination Regulations**

Refer to General Handbook Rule: 22

2.7.7 **Pass Requirements**

A candidate passes a subject if a final mark of at least 50% is obtained. The final mark consists of 40% of the year mark and 60% of the examination mark for examination subjects. A candidate must obtain a sub-minimum of 40% in the examination to pass a course. Where the examination in a course consists of two or more papers, a sub-minimum of 40% must be obtained in each paper.

The student's performance in certain subjects is assessed by Continuous Evaluation, and no examinations are written. Details of this assessment method are included in the relevant subject Study Guides.

2.7.8 **Practicals**

Practical work is done in the following subjects and forms part of the assessment: Surveying I, Surveying II, Control Surveying III, Surveying III, Cadastral Surveying III, Geographic Information Systems III & Photogrammetry III

Details of the assessment of the practicals are given in the relevant Study Guides. All practicals are compulsory.

Note: Students have to report to the relevant subject lecturer for all their practical classes within the first week of lectures. **This also applies to students who register late.**

3. DEPARTMENT OF ELECTRICAL ENGINEERING

3.1 Diploma in Electrical Engineering

SAQA ID	:	96856
NQF Level	:	6
SAQA Credits	:	360
Duration	:	3 years
Qualification Code	:	**ELENDI**

Purpose and Rationale of the Qualification

A qualifying learner will be competent to apply technical knowledge, engineering principles and problem-solving techniques in the field of Electrical Engineering by operating within the relevant standards and codes in collaboration with other members of an engineering team.

The qualified person will be able to register with the Engineering Council of South Africa (ECSA) as a Technician-in-Training in the field of Electrical Engineering.

Qualification Rules

The qualification will be awarded to a learner who has provided evidence to the satisfaction of the assessors that the stated competence of the qualification, as detailed in the specified outcomes, has been achieved, either through education and training in a single provider`s learning programme or through experience that complies with the stated specified outcomes.

Exit Level Outcomes

A learner who successfully completes this qualification will be able to:

- Practice Electrical Engineering activities and applications at the level expected of a Professional Technician (Engineering)
- Manage Electrical Engineering activities and applications at the level expected of a Professional Technician (Engineering)

3.1.1. **Minimum Admission Requirements (3-year Diploma)**

- National Senior Certificate with rating codes:
  English Home Language (4)
  or
  English First Additional Language (4)
  Mathematics (4)
  Physical Science (4)

- A pass in all subjects in the bridging programme offered by the Department of Electrical Engineering at Mangosuthu University of Technology (MUT).

- Senior Certificate or equivalent with a minimum subject-related symbol as follows:
  Physical Science C (SG) / D (HG)
  Mathematics C (SG) / D (HG)
  English C (SG) / D (HG)

- A minimum of 50% pass in N4 Engineering Science, Mathematics and two other electrical subjects, plus a Matric Certificate or equivalent with English (50% pass).

- NCV Level 4 with a minimum of 50% pass in the following subjects: 3 Fundamentals: English, Mathematics (not Maths Literacy) and Life Orientation. A minimum of 60% in Physical Science and any two Electrical-related subjects, preferably Electrical Principles & Practice and Electronic Control & Digital Electronics.

- An appropriate GCE, GCSE, IGCSE or Cambridge School Certificate with at least five subjects at GCE 'O' level including Mathematics, Science and English that has been passed with an A, B or C symbol. Three of the five subjects must have been passed at the same examination sitting. This applies to learners from SADC countries.

- N5/N6 – Not considered for registration purposes or for credit/exemption purposes.

Please take note of the following:

- **Selection will be based on merit and availability of space.**
- **Meeting the minimum requirements does not, in any way, guarantee admission.**

Students with technical College qualifications can apply to be considered for the granting of exemptions according to the Recognition of Prior Learning (RPL) as listed below if they have passed with a minimum of **50%** in every subject.

Technical/FET College Subjects	University Exempted Subjects
Communication N4 and N5	Communication Skills I
Computer Principles N4 and N5	Computer Skills I
Mathematics N4 and N5	Mathematics I
Industrial Electronics N4 and N5	Electronics I
Digital Electronics N4 and N5	Digital Systems I
Electrotechnics N4 and N5	Electrical Engineering I
Engineering Science N4 and N5	Physics I
Strength of Materials and Structures N4 and N5	Strength of Materials II

3.1.2. Duration of Study

Three years, consisting of Four Semesters (S1, S2, S3 & S4) of formal time (full-time study at the University) over a minimum of **two years**, and two semesters (P1 & P2) of experiential time (in-service training) undertaken at an accredited training provider/employer over **one year**, in accordance with a prescribed syllabus, and subject to the University's evaluation and approval.

- **Electrical Engineering Practice I (P1) may be done after successful completion of ALL S1, S2, S3 and S4 subjects.**
- Electrical Engineering Practice II (P2) must be done after successful completion of **P1**.
- Electrical Engineering Practice (P1 or P2) must be registered on the date the training commences.

3.1.3. Curriculum Compilation and Pre-Requisites

i) The Diploma will be issued on completion of 268 credits of formal time taken from the offerings below, and 92 credits of experiential time, for a total of 360 credits.

ii) Attendance of P0 (a work readiness program) is compulsory and is used as eligibility criterion for placement for Work Intergraded Learning.

iii) A learner doing P1 registers for Electrical Engineering Practice I, and one doing P2 registers for Electrical Engineering Practice II. **Registration must be done on or before the date of commencement**. Completion of two semesters of experiential training, in accordance with the guidelines laid down in the logbook, will generate a credit of 92.

iv) There are four specialisation streams i.e., Power Systems Engineering **(ELDIPS)**, Electronics and Telecommunication Engineering **(ELDIET)**, Process Automation and Control Engineering**(ELDIPA)** and Mechatronics Engineering **(ELDIME)**.

v) Students select their area of specialization during the S2 level enrollment. After registration for S2 no further changes of streams are allowed. For curriculum compilation, the department will consider the electives as compulsory subjects for the chosen stream. All specialization subjects are compulsory for graduation.

vi) The offering of specialization subjects in each stream may alternate between semesters.

vii) The effective commencement date of this curriculum was the First Semester of 2021.

viii) The twelve (12) ECSA GAs are assessed in exit levels subjects, Table 1.

ix) If a student fails a Graduate Attribute (GA) assessment in any exit-level subject, he/she automatically fails the subject.

x) Note that the indicated graduate attributes statements are in accordance with ECSA E-02-PN Revision 5 of September 2020. This standard will be used to assess student cohorts enrolled in the programme before 2025. The students enrolled in the programme in or after 2025, as well as repeating students, will be assessed based on the ECSA E-02-PN Revision 6 standard of August 2023,(See https://www.ecsa.co.za/ECSADocuments/Shared%20Documents/E-02-PN%20%20Qualification%20Standard%20for%20Diploma%20in%20Engineering%20NQF%20Level%206-signed.pdf for more information).

xi) Students need to achieve a sub-minimum mark of 50% in the Practical to be granted DP. Otherwise, they automatically fail the subject.

Table 1. ECSA Graduate Attributes Table at the Expose, Develop and Assessment Stages

Subjects	NQF Level	Credits	Core/ Elective	Exposure	Development	Assessment
SEMESTER I						
Mathematics I	5	12	C	**GA1, GA9**		
Physics I	5	12	C		**GA2, GA4**	
Communication Skills I	5	5	C	**GA6, GA8**		
Computer Skills I	5	5	C	**GA5, GA9**		
Electrical Engineering I	5	10	C	**GA1, GA5**		
Electronics I	5	10	C	**GA1, GA5**		
Digital Systems I	5	10	C	**GA3, GA5**		

Subjects	NQF Level	Credits	Core/ Elective	Exposure	Development	Assessment
SEMESTER II						
Mathematics II	5	12	C		**GA1, GA9**	
Electrical Engineering II	5	10	C		**GA1, GA9**	
Electronics II	5	10	C		**GA1, GA5**	
Digital Systems II	5	10	C		**GA3, GA5**	
Projects I	5	10	C	**GA3, GA7**		
Electrical Machines II	5	10	E		**GA5,**	
Electronic Communication II	5	10	E		**GA2**	
Process Instrumentation II	5	10	E		**GA4**	
Strengths of Materials II	5	10	E		**GA5,**	
SEMESTER III						
Digital Systems III	6	12	C		**GA3, GA5**	
Mathematics III	6	12	C		**GA1, GA9**	
Projects II	5	10	C		**GA3, GA7**	
Software Design II	6	12	C		**GA5,**	
Control Systems II	6	12	C		**GA4, GA5**	
Electrical Engineering III	6	12	E		**GA1, GA5**	
Digital Communications II	6	12	E		**GA2**	
Process Instrumentation III	6	12	E			**GA4**
Mechatronics III	6	12	E		**GA5,**	
SEMESTER IV						
Design Projects III	6	12	C			**GA3, GA6, GA7,GA8**
Software Design III	6	12	C			**GA11**
Power Electronics III	6	12	E			**GA1**
Electrical Machines III	6	12	E			**GA5**
Electrical Distribution III	6	12	E			**GA4**
Electrical Protections III	6	12	E			**GA2**
Radio Engineering III	6	12	E			**GA2**
Signal Processing III	6	12	E			**GA5**
Electronics III	6	12	E			**GA1**
Microwave Communications III	6	12	E			**GA4**
Control Systems III	6	12	E			**GA2**
Automation III	6	12	E			**GA5**
Robotics III	6	12	E			**GA4**
WIL (P1)	6	44		**GA9, GA10, GA12**	**GA9, GA10, GA12**	
WIL (P2)	6	48				**GA9, GA10,GA12**

GA1-Problem-solving
GA2-Application of scientific and engineering knowledge.
GA3-Engineering Design.
GA4-Investigation.
GA5-Engineering methods, tools, including information technology.
GA6-Professional and Technical communication.
GA7-Impact of Engineering activity.
GA8-Individual and teamwork.
GA9-Independent learning.
GA10-Engineering professionalism.
GA11-Engineering management.
GA12-Workplace practice.

3.1.4 Diploma in Electrical Engineering course summary (ELENDI)

Diploma in Electrical Engineering (3 Years)			
S1 Subjects			
Communication Skills I			
Computer Skills I			
Mathematics I			
Electrical Engineering I			
Electronics I			
Digital Systems I			
Physics I			
S2 Subjects			
Power Systems Engineering (ELDIPS)	**Electronics and Telecommunication Engineering (ELDIET)**	**Process Automation and Control Engineering (ELDIPA)**	**Mechatronics Engineering (ELDIME)**
Digital Systems II	Digital Systems II	Digital Systems II	Digital Systems II
Electronics II	Electronics II	Electronics II	Electronics II
Electrical Engineering II	Electrical Engineering II	Electrical Engineering II	Electrical Engineering II
Mathematics II	Mathematics II	Mathematics II	Mathematics II
Projects I	Projects I	Projects I	Projects I
Electrical Machines II	Electronic Communication II	Process Instrumentation II	Strengths of Materials II
Note: Programming I is Optional and only be offered in the second semester of the year			
S3 Subjects			
Digital Systems III	Digital Systems III	Digital Systems III	Digital Systems III
Mathematics III	Mathematics III	Mathematics III	Mathematics III
Projects II	Projects II	Projects II	Projects II
Software Design II	Software Design II	Software Design II	Software Design II
Control Systems II	Control Systems II	Control Systems II	Control Systems II
Electrical Engineering III	Digital Communications II	Process Instrumentation III	Mechatronics III
S4 Subjects			
Design Projects III	Design Projects III	Design Projects III	Design Projects III
Software Design III	Software Design III	Software Design III	Software Design III
Power Electronics III	Electronics III	Electronics III	Power Electronics III
Electrical Machines III	Microwave Communications III	Automation III	Automation III
Electrical Distributions III	Radio Engineering III	Control Systems III	Control Systems III
Electrical Protections III	Signal Processing III	Signal Processing III	Robotics III
Work Readiness Program	Work Readiness Program	Work Readiness Program	Work Readiness Program

3.1.5 Subjects, Curriculum Compilation, Course Codes and Pre-requisites

Diploma in Electrical Engineering (3 Years)								
Code	**Subjects**	**C/O/E**	**Semester /Year**	**Assessment Method**	**NQF Level**	**SAQA Credit**	**Pre-requisites**	**Co-requisites**
CSKI101	Communication Skills I	C	S1	CA	5	5		
COMS101	Computer Skills I	C	S1	CA	5	5		
MATM101	Mathematics I	C	S1	EX	5	12		
ELEN101	Electrical Engineering, I	C	S1	EX	5	10		
ECTR101	Electronics I	C	S1	EX	5	10		
DISY101	Digital Systems I	C	S1	EX	5	10		
PHYC101	Physics I	C	S1	EX	5	12		
	TOTAL S1 Weighting					**64**		
MTMT102	Mathematics II	C	S2	EX	5	12	Mathematics I	
ELEN102	Electrical Engineering II	C	S2	EX	5	10	Electrical Eng. I Mathematics I	
DISY102	Digital Systems II	C	S2	EX	5	10	Digital Systems I	
PROJ102	Projects I	C	S2	CA	5	10	Electrical Eng. I Electronics I Communication Skills I	
ECTR102	Electronics II	C	S2	EX	5	10	Electronics I Electrical Eng I	
ELMA102	Electrical Machines II	E	S2	EX	5	10	Electrical Eng. I Physics I	Mathematics II
ELCO102	Electronic Communication II	E	S2	EX	5	10	Electronics I Digital Systems I Physics I	
PINS201	Process Instrumentation II	E	S2	EX	5	10	Electrical Eng. I Physics I	
STRE102	Strength of Materials II	E	S2	EX	5	10	Physics I Mathematics I	
	TOTAL S2 Weighting					**62**		
MTMT201	Mathematics III	C	S3	EX	6	12	Mathematics II	
DISY201	Digital Systems III	C	S3	EX	6	12	Digital Systems II	
SFDE201	Software Design II	C	S3	EX	6	12	Digital Systems II	
PRJC201	Projects II	C	S3	CA	5	10	Projects I Electronics II Electrical Engineering II	
COSY201	Control Systems II	C	S3	EX	6	12	Mathematics II	Mathematics III
ELEN202	Electrical Engineering III	E	S3	EX	6	12	Electrical Eng. II Mathematics II	
DIGC202	Digital Communications II	E	S3	EX	6	12	Electronic Comm. II	Mathematics III
PINS202	Process Instrumentation III	E	S3	EX	6	12	Process Instr. II	Mathematics III
MECH201	Mechatronics III	E	S3	EX	6	12	Strength of Materials II	

							Electronics II Digital Systems II	
TOTAL S3 Weighting						**70**		
DPRO202	Design Project III	C	S4	CA	6	12	Projects II Digital Systems III Maths III	
ELDI202	Electrical Distribution III	E	S4	EX	6	12	Electrical Eng. III	
SFDE202	Software Design III	C	S4	EX	6	12	Software Design II	
PWRE202	Power Electronics III	E	S4	EX	6	12	Electronics II Electrical Eng. II Mathematics III	
ELMA201	Electrical Machines III	E	S4	EX	6	12	Electrical Mach. II Electrical Eng. III	
EPRO202	Electrical Protection III	E	S4	EX	6	12	Electrical Eng. III Mathematics II	Electrical Distribution III
RADE201	Radio Engineering III	E	S4	EX	6	12	Digital Communication II	
ECTR202	Electronics III	E	S4	EX	6	12	Electronics II Mathematics III	
SIPR202	Signal Processing III	E	S4	EX	6	12	Mathematics III	
MCRC202	Microwave Communication III	E	S4	EX	6	12	Mathematics III Digital Communication II	
COSY202	Control Systems III	E	S4	EX	6	12	Control Systems II Mathematics III	
ROBO202	Robotics III	E	S4	EX	6	12	Control Systems II Mechatronics III Mathematics III Digital Systems III	
AUTM202	Automation III	E	S4	EX	6	12	Control Systems II Mathematics III Digital Systems III	
ELDI00	Work Readiness Program	C	S4	CA	NA	NA		
TOTAL S4 Weighting						**72**		

3.1.6 Examination Regulations

Refer to the General Handbook Rule: G22

3.1.7 Work Integrated Learning (In-Service Training- 92 Credits)

Electrical Engineering Practice I (P1) 44

Learners who acquired any form of work experience and wish for this experience to be considered for P1/P2 training will need to comply with the institution's RPL Policy. Such applicants may be admitted to diploma qualifications through one of the purposes of RPL namely, access, exemption, accreditation and advancement;

3.1.8 Course Content

CSKI101	**Communication Skills I**
	Offered by the Service Department Communication theory, non-verbal communication (body language), oral presentations, interviews, developing leadership and participation skills. Technical reports and correspondence.
COMS101	**Computer Skills I**
	Offered by the Service Department Learners must acquire theory and practical skills and knowledge. Theory knowledge to be learned is Personal Computer Basics, Computer Filing, Display Devices, Internet Privacy and Security, Connectors and Adapters, Network Basics, Multimedia Devices, Processors and Memory, Data Storage Devices, Network Security Overview and Safety. Practical skills to be acquired are Operating System XP and Application Software Microsoft Office 365 which include Microsoft Word, Microsoft Excel and MS PowerPoint and MS Teams. Introduction to MATLAB and Simulink
MATM101	**Mathematics I**
	Formative assessment • Tutorials. **Summative assessment** • Three class tests and Examination. Major Test 1 40% Major Test 2 40% Minor Test 20% **Overview of Syllabus:** Basic mathematics. Differentiation. Integration. Matrices and determinants. Vectors. Data handling. Complex numbers or mensuration.
ELEN101	**Electrical Engineering I**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 35% Test 2 35% Tutorials 10% Practicals 20% **Overview of Syllabus:** Electrical and Mechanical Quantities, Basic Electrical Components, DC theory and Network Analysis, Electromagnetism and Magnetic circuits, Inductance and Capacitance, Basic AC theory.
ECTR101	**Electronics I**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Practical Assignments, Examination Test 1 25% Test 2 25% Tutorials 25% Practicals 25% **Overview of Syllabus:** Oscilloscopes, Semiconductor theory and atomic structure, PN Diodes and their applications, Bipolar junction transistors and Operational Amplifiers

DISY101	**Digital Systems I**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical) and Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Introduction to Digital Systems, Logic gates, Boolean Algebra and Logic Simplification, Combination Logic Analysis, Functions of Combinational Logic, Number Systems:- operation and Codes.
PHYC101	**Physics I**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical and mini-project), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Remedial mathematics, basic units, vectors and scalars, kinetics, mechanics, momentum, moments, work, energy and power, pressure, density, heat, optics, waves and sound, electric current, magnetism, radio-activity. Practical physics.
MTMT102	**Mathematics II**
	Formative assessment • Tutorials. **Summative assessment** • Three class tests and Examination Major Test 1 40% Major Test 2 40% Minor Test 20% **Overview of Syllabus:** Revision of differentiation (Mathematics I). Differentiation of functions with more than one variable. Further integration. Numerical methods. First-order ordinary differential equations. Matrices (Gauss elimination).
ELEN102	**Electrical Engineering II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Alternating Current and Voltage generation, AC RLC circuit components and Phasors, AC Circuit Theorems, Power in AC Circuits, Series and parallel RLC resonant circuits, Introduction to Three Phase systems.
DISY102	**Digital Systems II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practical's 25% **Overview of Syllabus:** Latches, Flip flops and Timers, Counters, Shift Registers, Memory and Storage, Digital Signal Interfacing and Processing, Introduction to Microcontrollers.
PROJ102	**Projects I**
	The course is assessed through continuous assessment.

	Final Mark (FM) = 25%x Simulation +25% x Constructed project + 30% measurement and presentation + 20% final Document **Overview of Syllabus:** PCB Design using Proteus, Simulation using Proteus, Assembling the project, Testing and Debugging, Report.
ECTR102	**Electronics II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** DC Power supplies, BJT DC biasing, BJT AC analysis, FET Biasing, Operational Amplifiers
ELMA102	**Electrical Machines II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** D.C. Generators, D.C. Motors, Single Phase Transformers, Single Phase induction machines.
ELCO102	**Electronic Communication II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Fundamental Concepts of Transmission and Reception, Frequency and Amplitude Modulation Systems, Communication Techniques, Transmitter and Receiver Measurements
STRE102	**Strength of Materials II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Introduction (Review of statics), axial loading, torsion, pure bending, beams, shearing, stress, transformations, principal stresses and columns.
MATTM201	**Mathematics III**
	Formative assessment • Tutorials. **Summative assessment** • Three class tests and Examination Major Test 1 40% Major Test 2 40% Minor Test 20%

	Overview of Syllabus: First-order ordinary differential equations. Higher-order differential equations. Laplace transforms. Infinite series. Fourier series. Matrix analysis. Probability and statistics. Elements of analytic geometry in 2D and 2D space.
DISY201	**Digital Systems III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation Summative assessment • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 20% Practicals 30% **Overview of Syllabus:** Introduction to Embedded C Programming, Introduction to MPLAB-X, PIC architecture, PIC Programming in C Language, PIC I/O Port Programming, Serial Port Programming in C Language, LCD and Keyboard interfacing, Introduction to ADC and DAC.
SFDE201	**Software Design II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Tutorials 25% Practicals 25% **Overview of Syllabus:** C++ programming structure, I/O streams and Classes, Control Structures, Arrays and strings, User Defined functions, Data abstraction and inheritance, Exception handling, Recursions
PRJT201	**Projects II**
	The course is assessed through continuous assessment. The weightings of the assessment are as follows: Final Mark (FM) = 33%x Simulation + 33% x breadboard prototype +34% x Constructed project. **Overview of Syllabus: S**imulation, Prototype development, PCB design, Report writing, Preparatory design proposal document.
COSY021	**Control Systems II**
	Formative assessment • Tutorials, Classroom small-group work, WhatsApp group discussion forum, Student self-assessment through an e-learning platform. **Summative assessment** • Two class tests, Project assignment, Practical Evaluation, Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Introduction to Control Systems; Modelling of Control Systems in Frequency Domain using Laplace Transforms; Time Response of First and Second-order Control Systems; Reduction of Multiple Subsystems; Steady-State Errors; State-Space Representation of dynamic systems.
ELMA201	**Electrical Machines III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Three-phase transformers, Three phase induction machines, Synchronous machines Alternators), Synchronous machines (Motors)
DIGC202	**Digital Communications II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment**

	• Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Probability and Random Processes: Probability distributions, Random variables, Random processes, Statistical averages, Correlation, Digital Modulation Techniques: Signal space analysis, BPSK, QPSK, QAM, Digital Demodulation & Detection Techniques: Correlator-demodulator, Maximum likelihood detection (MLD) in additive white Gaussian noise (AWGN), bit error rate (BER) performance, Channel Encoder/Decoder: Linear block codes, Cyclic codes, Convolutional codes, Viterbi algorithm, Information Theory: Source Entropy, Huffman Coding, Channel Capacity.
PINS201	**Process Instrumentation II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Control valves & pumps, Control instruments, Continuous control, Sequential control, Instrumentation documentation.
MECH201	**Mechatronics III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Introduction to Mechatronics, Transducers, Analogue Signal Conditioning, Actuating Systems, System Interfacing and Data Acquisition, Programmable Logic Controller
DPRO201	**Design Projects III**
	This subject is assessed through continuous assessment. The course components' mark weightings will be determined as follows: • Proposal Document (GA7) = 20% • Project Presentation (GA6) = 20% • Final Document (GA8) = 30% • Project Artefact (GA3) = 30% **Overview of Syllabus:** Introduction to the Engineering Design Process, Problem definition, Literature review, and Generation of multiple solutions. Analysis and selection of the most appropriate solution, Testing and implementation, Feasibility study, Project implementation – design, simulation, construction, testing and documentation, Project oral presentation.
ELEN202	**Electrical Engineering III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Applications of Complex Numbers in Phasor notations, 3-Phase AC Systems Analysis, Electrical Power Measurement and analysis in 3-Phase AC Systems, Per-unit System, Introduction to AC Power Flow Analysis, Electric Lighting Systems.

ELDI202	**Electrical Distribution III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Introduction to generation, Variable loads on power stations, Economics of power generation and Tariffs, Power factor improvement, Supply systems, Mechanical and Electrical design of overhead lines, Performance of transmission lines, Underground cables.
SFDE202	**Software Design III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Practical's 50% **Overview of Syllabus:** Installing a Local Web Server, Installing PHP, MySQL and Apache, PHP Syntax and Functions, Working with PHP in Websites, Creating Databases and working With MySQL, Security in PHP
PWRE202	**Power Electronics III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Introduction to power electronics, Power electronics switches, AC to DC converters, DC to DC converters, DC to AC converters, AC to AC converters, Introduction to drives.
EPRO202	**Electrical Protection III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Three phase Theory Revision, Introduction to Electrical protection, Symmetrical fault calculations, Instrument transformers, Unsymmetrical fault calculations, Switchgears; circuit breakers, protective relays, fuses, switches, Protection of alternator and transformers, Protection of bus-bars, Overvoltage protection
RADE201	**Radio Engineering III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Electromagnetic waves, Radio propagation techniques and Antennas, Introduction to Radar Systems, Introduction to Cellular networks and Frequencies management, Introduction to Mobile Networks
ECTR202	**Electronics III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment**

	• Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignment/Project 10% Practicals 50% **Overview of Syllabus:** Feedback and Oscillator Circuits, Voltage Regulators –SMPS, Two-Terminal Devices, PNPN Devices, Linear-Digital ICs, Op-Amp Applications – Amplifiers, Filters, Multi-stage amplifiers
SIPR202	**Signal Processing III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Signals and signal processing systems, Discrete-time systems in the time domain, Discrete-time signals in the frequency domain, The z-transform.
MCR202	**Microwave Communication III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** A Review of Electromagnetic Theories and Frequencies Management, Transmission Line Theory, Transmission Lines and Waveguides, Microwave Network Analysis, Impedance Matching and Tuning, Power Dividers, Mixers and Directional Couplers, Microwave Filters, Digital Line-of-Sight Microwave Radio Links.
PINS202	**Process Instrumentation III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Automatic Process Control, Control Systems & Instrumentation, Analytical & Renewable Energy Sensors, Boilers, Heat Exchangers & Distillation Columns, Safety & Environmental Control, Industry 4.0
COSY202	**Control Systems III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Modelling 1st, 2nd Order systems, Stability, Laplace-Domain Analysis, Frequency-Domain techniques, Feedback compensation, PID Controller Tuning, Case study: SISO system Compensation Simulation.
ROBO202	**Robotics III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50%

	Overview of Syllabus: Robotics overview, Basic mechanics, Robot locomotion principles, Robot environmental interaction (Sensor and actuators), Power sources for robots, Robot Brains, Embedded robotics - systems design process.
AUTM202	**Automation III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 10% Practicals 50% **Overview of Syllabus:** Automation Fundamentals, Automation Justification and Productivity Concepts, Computer Numerical Control (CNC), Introduction to Industrial Robots, Programmable Logic Controllers (PLCs), Programming PLCs, Manufacturing Systems, Industrial Networks and SCADA Systems.
ELDI00	Work Readiness Program
	Overview of Syllabus: Integrate an understanding of the experiential learning process, Identify their skills Conduct Job Searches, Compile a CV and Cover Letter, Prepare adequately for interviews, Understand his/her role in the workplace: Increase efficiency (Productivity), Identify waste in the workplace, Understand the impact of waste on company productivity, Understand the importance of planning in the workplace, Understand problem identification and solving, Understand concepts of Quality, Cost and Delivery, Understand Plan Do, Check, Action (PDCA) cycle.

3.1.9 Additional Regulation and Rules

- A learner is not allowed to register for an offering unless the pre-requisite subject(s) have been passed.
- If, for any reason, a learner is found to be registered for any subject without the pre-requisite, the learner will automatically be de-registered in that subject.
- Learners may not register for any S4 level subject unless all subjects have been passed at the S1 and S2 level.
- A learner is only allowed to register across two consecutive levels, e.g. S1 & S2 or S2 & S3 or S3 & S4. It is not allowed to register across S1 & S3 or S2 & S4. If, for any reason, a learner is found to be registered for any subject without the pre-requisite, the learner will be de-registered immediately.

3.2 Diploma in Electrical Engineering (4-Year Programme)

NQF Level : 6
SAQA Credit : 390
Duration : 4 years
Qualification Code : **ELENEC**

(4-year Diploma) (Extended Curriculum Program)

A 4-year Extended Curriculum Programme (ECP) is designed to provide structured support for underprepared learners. It ensures that sufficient support is provided during the initial year of study while guaranteeing the same exit standards as the 3-year programme.

The first year is generic to Electrical, Civil and Mechanical Engineering. In the second year, the first semester of study, the learner joins the S1 level of the chosen field, i.e., Electrical, Civil or Mechanical Engineering. After acquiring the required skills and knowledge from year 1, the learner follows the same programme as the 3-year Diploma Programme.

Purpose and Rationale of the Qualification

A qualifying learner will be competent to apply technical knowledge, engineering principles and problem-solving techniques in the field of Electrical Engineering by operating within the relevant standards and codes in collaboration with other members of an engineering team.

The qualified person will be able to register with the Engineering Council of South Africa (ECSA) as a Technician-in-Training in the field of Electrical Engineering.

Qualification Rules

The qualification will be awarded to a learner who has provided evidence to the satisfaction of the assessors that the stated competence of the qualification, as detailed in the specified outcomes, has been achieved, either through education and training in a single provider`s learning programme, or through experience that complies with the stated specified outcomes.

Exit Level Outcomes

A learner who successfully completes this qualification will be able to:

- Practice Electrical Engineering activities and applications at the level expected of a Professional Technician (Engineering)
- Manage Electrical Engineering activities and applications at the level expected of a Professional Technician (Engineering)

3.2.1. **Minimum Admission Requirements (4-year Diploma)**

- National Senior Certificate with rating codes:
  English Home Language (4)
  (or)
  English First Additional Language (4)
  Mathematics (4)
  Physical Science (4)

- Senior Certificate or equivalent with a minimum subject-related symbol as follows:
  Physical Science C (SG) / D (HG)
  Mathematics C (SG) / D (HG)
  English C (SG) / D (HG)

- A minimum of 50% pass in N4 Engineering Science, Mathematics and two other electrical subjects, plus a Matric Certificate or equivalent with English (50% pass).

- NCV Level 4 with a minimum of 50% pass in the following subjects: 3 Fundamentals: English, Mathematics (not Maths Literacy) and Life Orientation. A minimum of 60% in Physical Science and any two Electrical-related subjects, preferably Electrical Principles & Practice and Electronic Control & Digital Electronics.

- An appropriate GCE, GCSE, IGCSE or Cambridge School Certificate with at least five subjects at GCE 'O' level including Mathematics, Science and English that has been passed with an A, B or C symbol. Three of the five subjects must have been passed at the same examination sitting. This applies to learners from SADC countries.
- N5 and/or N6 – Not considered for registration purposes or for credit/exemption purposes.

Please take note of the following:

- **Selection will be based on merit and availability of space.**
- **Meeting the minimum requirements does not, in any way, guarantee admission.**

Students with technical College qualifications can apply to be considered for the granting of exemptions according to the Recognition of Prior Learning (RPL) as listed below if they have passed with a minimum of 50% in every subject.

Technical/FET College Subjects	University Exempted Subjects
Communication N4 and N5	Communication Skills I
Computer Principles N4 and N5	Computer Skills I
Mathematics N4 and N5	Mathematics I
Industrial Electronics N4 and N5	Electronics I
Digital Electronics N4 and N5	Digital Systems I
Electrotechnics N4 and N5	Electrical Engineering I
Engineering Science N4 and N5	Physics I
Strength of Materials and Structures N4 and N5	Strength of Materials II

3.2.2. Duration of Study

Three years consisting of Four Semesters (S1, S2, S3 & S4) of formal time (full-time study at the University) over a minimum of **two years**, and two semesters (P1 & P2) of experiential time (in-service training) undertaken at an accredited training provider/employer over **one year**, in accordance with a prescribed syllabus, and subject to the University's evaluation and approval.

- Electrical Engineering Practice I (P1) may be done after successful completion of **all S1, S2, S3 and S4** subjects.
- Electrical Engineering Practice II (P2) must be done after successful completion of **P1**.
- Electrical Engineering Practice (P1 or P2) must be registered on the date the training commences.

3.2.3. Curriculum Compilation and Pre-Requisites

i) The Diploma will be issued on completion of 30 credits from ECP's Year 1, and 268 credits of formal time taken from the S1 to S4 offerings below, and 92 credits of experiential time, for a total of 390 credits.

ii) Attendance of P0 (a work readiness program) is compulsory and is used as eligibility criterion for placement for Work Intergraded Learning.

iii) A learner doing P1 registers for Electrical Engineering Practice I, and one doing P2 registers for Electrical Engineering Practice II. **Registration must be done on the date of commencement**. Upon completion of two semesters of experiential training, in accordance with the guidelines laid down in the logbook, will generate a credit of 92.

iv) There are four specialisation streams i.e., Power Systems Engineering **(ELECPS)**, Electronics and Telecommunication Engineering **(ELECET)**, Process Automation and Control Engineering **(ELECPA)** and Mechatronics Engineering **(ELECME)**.

v) Students select their area of specialization during the S2 level enrollment. After registration for S2 no further changes of streams are allowed. For curriculum compilation, the department will consider the

electives as compulsory subjects for the chosen stream. All specialization subjects are compulsory for graduation.

vi) The offering of specialization subjects in each stream may alternate between semesters.

vii) The effective commencement date of this curriculum was the First Semester of 2021.

viii) The twelve (12) ECSA GAs are assessed in exit levels subjects.

ix) If a student fails a Graduate Attribute (GA) assessment in any exit-level subject, he/she automatically fails the subject.

x) Note that the indicated graduate attributes statements are in accordance with ECSA E-02-PN Revision 5 of September 2020. This standard will be used to assess student cohorts enrolled in the programme before 2025. The students enrolled in the programme in or after 2025, as well as repeating students, will be assessed based on the ECSA E-02-PN Revision 6 standard of August 2023, (See https://www.ecsa.co.za/ECSADocuments/Shared%20Documents/E-02-PN%20%20Qualification%20Standard%20for%20Diploma%20in%20Engineering%20NQF%20Level%206-signed.pdf for more information).

xi) Students need to achieve a sub-minimum mark of 50% in the Practical to be granted DP. Otherwise, they automatically fail the subject.

Table 2. ECSA Graduate Attributes Table at the Expose, Develop and Assessment Stages

Subjects	NQF Level	Credits	Core/ Elective	Exposure	Development	Assessment
SEMESTER I						
Mathematics I	5	12	C	**GA1, GA9**		
Physics I	5	12	C		**GA2, GA4**	
Communication Skills I	5	5	C	**GA6, GA8**		
Computer Skills I	5	5	C	**GA5, GA9**		
Electrical Engineering I	5	10	C	**GA1, GA5**		
Electronics I	5	10	C	**GA1, GA5**		
Electronics I	5	10	C	**GA1, GA5**		
Digital Systems I	5	10	C	**GA3, GA5**		
SEMESTER II						
Mathematics II	5	12	C		**GA1, GA9**	
Electrical Engineering II	5	10	C		**GA1, GA9**	
Electronics II	5	10	C		**GA1, GA5**	
Digital Systems II	5	10	C		**GA3, GA5**	
Projects I	5	10	C	**GA3, GA7**		
Electrical Machines II	5	10	E		**GA5,**	
Electronic Communication II	5	10	E		**GA2**	
Process Instrumentation II	5	10	E		**GA4**	
Strengths of Materials II	5	10	E		**GA5,**	
Electronics II	5	10	C		**GA1, GA5**	

SEMESTER III						
Digital Systems III	6	12	C		**GA3, GA5**	
Mathematics III	6	12	C		**GA1, GA9**	
Projects II	5	10	C		**GA3, GA7**	
Software Design II	6	12	C		**GA5,**	
Control Systems II	6	12	C		**GA4, GA5**	
Electrical Engineering III	6	12	E		**GA1, GA5**	
Digital Communications II	6	12	E		**GA2**	
Process Instrumentation III	6	12	E			**GA4**
Mechatronics III	6	12	E		**GA5,**	
SEMESTER IV						
Design Projects III	6	12	C			**GA3, GA6, GA7,GA8**
Software Design III	6	12	C			**GA11**
Power Electronics III	6	12	E			**GA1**
Electrical Machines III	6	12	E			**GA5**
Electrical Distribution III	6	12	E			**GA4**
Electrical Protections III	6	12	E			**GA2**
Radio Engineering III	6	12	E			**GA2**
Signal Processing III	6	12	E			**GA5**
Electronics III	6	12	E			**GA1**
Microwave Communications III	6	12	E			**GA4**
Control Systems III	6	12	E			**GA2**
Automation III	6	12	E			**GA5**
Robotics III	6	12	E			**GA4**
WIL (P1)	6	44		**GA9, GA10, GA12**	**GA9, GA10, GA12**	
WIL (P2)	6	48				**GA9, GA10,GA12**

GA1-Problem-solving
GA2-Application of scientific and engineering knowledge.
GA3-Engineering Design.
GA4-Investigation.
GA5-Engineering methods, tools, including information technology.
GA6-Professional and Technical communication.
GA7-Impact of Engineering activity.
GA8-Individual and teamwork.
GA9-Independent learning.
GA10-Engineering professionalism.
GA11-Engineering management.
GA12-Workplace practice.

3.2.4 Electrical Engineering Diploma course summary (ELENEC)

Diploma: Electrical Engineering: (4 Years)			
Foundation I		**Foundation II**	
Basic Science I		Communication Skills	
Computer Literacy I		Engineering Calculations	
Life Skills and Study Skills		Engineering Science I	
Drawing		Computer Applications I	
Mathematics		Drawing I	
S1 Subjects			
Communication Skills I			
Computer Skills I			
Mathematics I			
Electrical Engineering, I			
Electronics I			
Digital Systems I			
Physics I			
S2 Subjects			
Power Systems Engineering (ELECPS)	**Electronics and Telecommunication Engineering (ELECET)**	**Process Automation and Control Engineering (ELECPA)**	**Mechatronics Engineering (ELECME)**
Digital Systems II	Digital Systems II	Digital Systems II	Digital Systems II
Electronics II	Electronics II	Electronics II	Electronics II
Electrical Engineering II	Electrical Engineering II	Electrical Engineering II	Electrical Engineering II
Mathematics II	Mathematics II	Mathematics II	Mathematics II
Projects I	Projects I	Projects I	Projects I
Electrical Machines II	Electronic Communication II	Process Instrumentation II	Strengths of Materials II
Note: Programming I is Optional and only be offered first semester of the year			
S3 Subjects			
Digital Systems III	Digital Systems III	Digital Systems III	Digital Systems III
Mathematics III	Mathematics III	Mathematics III	Mathematics III
Projects II	Projects II	Projects II	Projects II
Software Design II	Software Design II	Software Design II	Software Design II
Electrical Engineering III	Digital Communications II	Process Instrumentation III	Mechatronics III
Control Systems II	Control Systems II	Control Systems II	Control Systems II
S4 Subjects			
Design Projects III	Design Projects III	Design Projects III	Design Projects III
Software Design III	Software Design III	Software Design III	Software Design III
Electrical Machines III	Electronics III	Electronics III	Power Electronics III
Power Electronics III	Microwave Communications III	Automation III	Automation III
Electrical Distributions III	Radio Engineering III	Control Systems III	Control Systems III
Electrical Protections III	Signal Processing III	Signal Processing III	Robotics III
Work Readiness Program	Work Readiness Program	Work Readiness Program	Work Readiness Program

3.2.5 Subjects, Curriculum Compilation, Course Codes

Diploma in Electrical Engineering **(4 Years)**								
Code	Subjects	*C/O/E	Semester /Year	Assessment Method	NQF Level	SAQA Credit	Pre-requisites	Co-requisites
BASI000	Basic Science I		Foundation/1	EX	4	3		
COLI000	Computer Literacy I		Foundation/1	CA	4	3		
LSSS000	Life Skills and Study Skills		Foundation/1	CA	4	3		
DRAW000	Drawing 1		Foundation/1	CA	4	3		
MATT000	Mathematics		Foundation/1	EX	4	3		
COSK000	Communication Skills		Foundation/2	CA	4	3	Life Skills and Study Skills	
ECAL000	Engineering Calculations		Foundation/2	EX	4	3	Mathematics	
ENGS000	Engineering Science I		Foundation/2	EX	4	3	Basic Science I	
COAP000	Computer Applications I		Foundation/2	CA	4	3	Computer Literacy I	
DRWN000	Drawing 2		Foundation/2	CA	4	3	Drawing	
Total Weighting						**30**		
COMK101	Communication Skills I	C	S1	CA	5	5	Communication Skills	
CKIL101	Computer Skills I	C	S1	CA	5	5	Computer Applications I	
MATS101	Mathematics I	C	S1	EX	5	12	Engineering Calculations	
ELEE101	Electrical Engineering I	C	S1	EX	5	10	Engineering Science I	
ELET101	Electronics I	C	S1	EX	5	10	Engineering Science I	
DIGS101	Digital Systems I	C	S1	EX	5	10	Engineering Science I	
PHCS101	Physics I	C	S1	EX	5	12	Engineering Science I	
Total S1 Weighting						**64**		
MATS102	Mathematics II	C	S2	EX	5	12	Mathematics I	
ELEE102	Electrical Engineering II	C	S2	EX	5	10	Electrical Eng. I Mathematics I	
DIGS102	Digital Systems II	C	S2	EX	5	10	Digital Systems I	
PRJT102	Project I	C	S2	CA	5	10	Electrical Eng. I Electronics I Communication Skills I	
ELET102	Electronics II	C	S2	EX	5	10	Electronics I Electrical Eng I	
ELEM102	Electrical Machines II	E	S2	EX	5	10	Electrical Eng. I Physics I	Mathematics II

ELEC102	Electronic Communication II	E	S2	EX	5	10	Electronics I Digital Systems I Physics I	
PROI201	Process Instrumentation II	E	S2	EX	5	10	Electrical Eng. I Physics I	
STMA102	Strength of Materials II **(ME)**	E	S2	EX	5	10	Physics I Mathematics I	
Total S2 Weighting						**62**		
MATS201	Mathematics III	C	S3	EX	6	12	Mathematics II	
DIGS201	Digital Systems III	C	S3	EX	6	12	Digital Systems II	
SFTD201	Software Design II	C	S3	EX	6	12	Digital Systems II	
PRJT201	Projects II	C	S3	CA	5	10	Projects I Electronics II Electrical Engineering II	
CONS201	Control Systems II	C	S3	EX	6	12	Mathematics II	Mathematics III
EENG202	Electrical Engineering III	E	S3	EX	6	12	Electrical Eng. II Mathematics II	
DICM202	Digital Communications II	E	S3	EX	6	12	Electronic Comm. II	Mathematics III
PROI202	Process Instrumentation III	E	S3	EX	6	12	Process Instr. II	Mathematics III
MECE201	Mechatronics III **(ME)**	E	S3	EX	6	12	Strength of Materials II Electronics II Digital Systems II	
Total S3 Weighting						**70**		
DPRJ202	Design Project III	C	S4	CA	6	12	Projects II Digital Systems III Maths III	
ELED202	Electrical Distribution III	E	S4	EX	6	12	Electrical Eng. III	
SFTD202	Software Design III	C	S4	EX	6	12	Software Design II	
PWEL202	Power Electronics III	E	S4	EX	6	12	Electronics II Electrical Eng. II Mathematics III	
ELEM201	Electrical Machines III	E	S4	EX	6	12	Electrical Mach. II Electrical Eng. III	
ELCP202	Electrical Protection III	E	S4	EX	6	12	Electrical Eng. III Mathematics II	Electrical Distribution III
RAEN201	Radio Engineering III	E	S4	EX	6	12	Digital Communication II	
ELTR202	Electronics III	E	S4	EX	6	12	Electronics II Mathematics III	
SIGP202	Signal Processing III	E	S4	EX	6	12	Mathematics III	

MWCM202	Microwave Communication III	E	S4	EX	6	12	Mathematics III Digital Communication II	
CONS202	Control Systems III	E	S4	EX	6	12	Control Systems II Mathematics III	
ROBT202	Robotics III	E	S4	EX	6	12	Control Systems II Mechatronics III Mathematics III Digital Systems III	
ATMT202	Automation III	E	S4	EX	6	12	Control Systems II Mathematics III Digital Systems III	
ELEC000	Work Readiness Program	C	S4	CA	NA	NA		
Total S4 Weighting						**72**		
***C= Compulsory; O= Optional; E=Electives ; EX-Examination; CA-Continuous Assessment**								

3.2.6 Examination Regulations

Refer to the General Handbook Rule: G22

3.2.7 Work Integrated Learning (In-Service Training- 92 Credits)

Electrical Engineering Practice I (P1) 44
Electrical Engineering Practice II (P2) 48

Learners who acquired any form of work experience and wish for this experience to be considered for P1/P2 training will need to comply with the institution's RPL Policy (Refer to RPL Policy clause 4.2). Such applicants may be admitted to diploma qualifications through one of the purposes of RPL namely, access, exemption, accreditation and advancement;

3.2.8 Course Content

COMK101	**Electrical English Communication Skills I**
	Offered by the Service Department Communication theory, non-verbal communication (body language), oral presentations, interviews, developing leadership and participation skills. Technical reports and correspondence.
CKIL101	**Computer Skills I**
	Offered by the Service Department Learners have to acquire theory and practical skills and knowledge. Theory knowledge to be learned is Personal Computer Basics, Managing Computer Contents, Display Devices, Internet Privacy and Security, Connectors and Adapters, Network Basics, Multimedia Devices, Processors and Memory, Data Storage Devices, Network Security Overview and Safety. Practical skills to be acquired are Operating System and Application Software Microsoft Office 365 which includes Microsoft Word, Microsoft Excel, MS PowerPoint and MS Teams. Introduction to MATLAB and Simulink
MATS101	**Mathematics I**
	Formative assessment • Tutorials. **Summative assessment**

	• Three class tests, and Examination Major Test 1 40% Major Test 2 40% Minor Test 20% **Overview of Syllabus:** Basic mathematics. Differentiation. Integration. Matrices and determinants. Vectors. Data handling. Complex numbers or mensuration.
ELEE101	**Electrical Engineering I**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 35% Test 2 35% Tutorials 10% Practicals 20% **Overview of Syllabus:** Electrical and Mechanical Quantities, Basic Electrical Components, DC theory and Network Analysis, Electromagnetism and Magnetic circuits, Inductance and Capacitance, Basic AC theory.
ELET101	**Electronics I**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Practical Assignments, Examination Test 1 25% Test 2 25% Tutorials 25% Practicals 25% **Overview of Syllabus:** Oscilloscope, Semiconductor theory and atomic structure, PN Diodes and their applications Bipolar junction transistors, Operational Amplifiers
DIGS101	**Digital Systems I**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Introduction to Digital Systems, Logic gates, Boolean Algebra and Logic Simplification, Combination Logic Analysis, Functions of Combinational Logic, Number Systems:-operation and Codes.
PHCS101	**Physics I**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical and mini-project), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Remedial mathematics, basic units, vectors and scalars, kinetics, mechanics, momentum, moments, work, energy and power, pressure, density, heat, optics, waves and sound, electric current, magnetism, and radioactivity. Practical physics.
MATS102	**Mathematics II**
	Formative assessment • Tutorials. **Summative assessment** • Three class tests and Examination

	Major Test 1 40% Major Test 2 40% Minor Test 20% **Overview of Syllabus:** Revision of differentiation (Mathematics I). Differentiation of functions with more than one variable. Further integration. Numerical methods. First-order ordinary differential equations. Matrices (Gauss elimination).
ELEE102	**Electrical Engineering II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Alternating Current and Voltage generation, AC RLC circuit components and Phasors, AC Circuit Theorems, Power in AC Circuits, Series and parallel RLC resonant circuits, Introduction to Three Phase systems.
DIGS102	**Digital Systems II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Latches, Flip flops and Timers, Counters, Shift Registers, Memory and Storage, Digital Signal Interfacing and Processing, Introduction to Microcontrollers.
PRJT102	**Projects I**
	The course is assessed through continuous assessment. Final Mark (FM) = 25%x Simulation +25% x Constructed project + 30% measurement and presentation + 20% final Document **Overview of Syllabus:** PCB Design using Proteus, Simulation using Proteus, Assemble the project, Test and Debug, Report.
ELET102	**Electronics II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** DC Power supplies, BJT DC biasing, BJT AC analysis, FET Biasing, Operational Amplifiers
ELEM102	**Electrical Machines II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** D.C. Generators, D.C. Motors, Single Phase Transformers, Single Phase induction machines

ELEC102	Electronic Communication II
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Fundamental Concepts of Transmission and Reception, Frequency and Amplitude Modulation Systems, Communication Techniques, Transmitter and Receiver Measurements
STMA102	**Strength of Materials II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Introduction (Review of statics), axial loading, torsion, pure bending, beams, shearing, stress, transformations, principal stresses and columns.
MATS201	**Mathematics III**
	Formative assessment • Tutorials. **Summative assessment** • Three class tests and Examination. Major Test 1 40% Major Test 2 40% Minor Test 20% **Overview of Syllabus:** First-order ordinary differential equations. Higher-order differential equations. Laplace transforms. Infinite series. Fourier series. Matrix analysis. Probability and statistics. Elements of analytic geometry in 2D and 2D space.
DIGS201	**Digital Systems III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation Summative assessment • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 20% Practicals 30% **Overview of Syllabus:** Introduction to Embedded C Programming, Introduction to MPLAB-X, PIC architecture, PIC Programming in C Language, PIC I/O Port Programming, Serial Port Programming in C Language, LCD and Keyboard interfacing, Introduction to ADC and DAC
SFTD201	**Software Design II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Tutorials 25% Practicals 25% **Overview of Syllabus:** C++ programming structure, I/O streams and Classes, Control Structures, Arrays and strings, User Defined functions, Data abstraction and inheritance, Exception handling, Recursions

PROJ128	**Projects II**
	The course is assessed through continuous assessment. The weightings of the assessment are as follows: Final Mark (FM) = 33%x Simulation + 33% x breadboard prototype +34% x Constructed project. **Overview of Syllabus: S**imulation, Prototype development, PCB design, Report writing, Preparatory design proposal document
COSY128	**Control Systems II**
	Formative assessment • Tutorials, Classroom small-group work, WhatsApp group discussion forum, Student self-assessment through an e-learning platform. **Summative assessment** • Two class tests, Project assignment, Practical Evaluation, Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Introduction to Control Systems; Modelling of Control Systems in Frequency Domain using Laplace Transforms; Time Response of First and Second-order Control Systems; Reduction of Multiple Subsystems; Steady-State Errors; State-Space Representation of dynamic systems
ELEM138	**Electrical Machines III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Three-phase transformers, Three phase induction machines, Synchronous machines Alternators), Synchronous machines (Motors)
DICO128	**Digital Communications II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Probability and Random Processes: Probability distributions, Random variables, Random processes, Statistical averages, Correlation, Digital Modulation Techniques: Signal space analysis, BPSK, QPSK, QAM, Digital Demodulation & Detection Techniques: Correlator-demodulator, Maximum likelihood detection (MLD) in additive white Gaussian noise (AWGN), bit error rate (BER) performance, Channel Encoder/Decoder: Linear block codes, Cyclic codes, Convolutional codes, Viterbi algorithm, Information Theory: Source Entropy, Huffman Coding, Channel Capacity.
PRIN128	**Process Instrumentation II**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Control valves & pumps, Control instruments, Continuous control, Sequential control, Instrumentation documentation.

MECE201	**Mechatronics III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Introduction to Mechatronics, Transducers, Analogue Signal Conditioning, Actuating Systems, System Interfacing and Data Acquisition, Programmable Logic Controller
DEPR0138	**Design Projects III**
	This subject is assessed through continuous assessment. : The course components' mark weightings will be determined as follows: • Proposal Document (GA7) = 20% • Project Presentation (GA6) = 20% • Final Document (GA8) = 30% • Project Artefact (GA3) = 30% **Overview of Syllabus:** Introduction to the Engineering Design Process, Problem definition, Literature review, and Generation of multiple solutions. Analysis and selection of the most appropriate solution, Testing and implementation of the chosen solution, Feasibility study, Project implementation – design, simulation, construction, testing and documentation, and Project oral presentation.
ELEN138	**Electrical Engineering III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Applications of Complex Numbers in Phasor notations, 3-Phase AC Systems Analysis, Electrical Power Measurement and analysis in 3-Phase AC Systems, Per-unit System, Introduction to AC Power Flow Analysis, Electric Lighting Systems.
ELDI138	**Electrical Distribution III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Introduction to generation, Variable loads on power stations, Economics of power generation and Tariffs, Power factor improvement, Supply systems, Mechanical and Electrical design of overhead lines, Performance of transmission lines, Underground cables.
SOFD038	**Software Design III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation

	Summative assessment • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Practical's 50% **Overview of Syllabus:** Installing a Local Web Server, Installing PHP, MySQL and Apache, PHP Syntax and Functions, Working with PHP in Websites, Creating Databases and working With MySQL, Security in PHP
POEL138	**Power Electronics III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Introduction to power electronics, Power electronics switches, AC to DC converters, DC to DC converters, DC to AC converters, AC to AC converters, Introduction to drives.
ELPR138	**Electrical Protection III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Three phase Theory Revision, Introduction to Electrical protection, Symmetrical fault calculations, Instrument transformers, Unsymmetrical fault calculations, Switchgears; circuit breakers, protective relays, fuses, switches, Protection of alternator and transformers, Protection of bus-bars, Overvoltage protection
RADE138	**Radio Engineering III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Electromagnetic waves, Radio propagation techniques and Antennas, Introduction to Radar Systems, Introduction to Cellular networks and Frequencies management, Introduction to Mobile Networks
ELET138	**Electronics III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignment/Project 10% Practicals 50% **Overview of Syllabus:** Feedback and Oscillator Circuits, Voltage Regulators –SMPS, Two-Terminal Devices, PNPN Devices, Linear-Digital ICs, Op-Amp Applications – Amplifiers, Filters, Multi-stage amplifiers
SIPR138	**Signal Processing III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation

	Summative assessment • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Signals and signal processing systems, Discrete-time systems in the time domain, Discrete-time signals in the frequency domain, The z-Transform
MICE138	**Microwave Communication III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** A Review of Electromagnetic Theories and Frequencies Management, Transmission Line Theory, Transmission Lines and Waveguides, Microwave Network Analysis, Impedance Matching and Tuning, Power Dividers, Mixers and Directional Couplers, Microwave Filters, Digital Line-of-Sight Microwave Radio Links.
PRIN138	**Process Instrumentation III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Automatic Process Control, Control Systems & Instrumentation, Analytical & Renewable Energy Sensors, Boilers, Heat Exchangers & Distillation Columns, Safety & Environmental Control, Industry 4.0
COSY138	**Control Systems III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 25% Test 2 25% Assignments 25% Practicals 25% **Overview of Syllabus:** Modelling 1st, 2nd Order systems, Stability, Laplace-Domain Analysis, Frequency-Domain techniques, Feedback compensation, PID Controller Tuning, Case study: SISO system Compensation Simulation.
ROBT238	**Robotics III**
	Formative assessment • Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Robotics overview, Basic mechanics, Robot locomotion principles, Robot environmental interaction (Sensor and actuators), Power sources for robots, Robot Brains, Embedded robotics - systems design process.
PTAT038	**Automation III**
	Formative assessment

	• Tutorials, Homework, quizzes, Practical Evaluation **Summative assessment** • Two class tests, Assignments (Theoretical), Examination Test 1 20% Test 2 20% Assignments 10% Practicals 50% **Overview of Syllabus:** Automation Fundamentals, Automation Justification and Productivity Concepts, Computer Numerical Control (CNC), Introduction to Industrial Robots, Programmable Logic Controllers (PLCs), Programming PLCs, Manufacturing Systems, Industrial Networks and SCADA Systems.
ELEC000	**Work Readiness Program**
	Overview of Syllabus: Integrate an understanding of the experiential learning process, Identify their own skills Conduct Job Searches, compile a CV and Cover Letter, Prepare adequately for interviews, Understand his/her role in the workplace: Increase efficiency (Productivity), Identify waste in the workplace, Understand the impact of waste on company productivity, Understand the importance of planning in the workplace, Understand problem identification and solving, Understand concepts of Quality, Cost and Delivery, Understand Plan Do, Check, Action (PDCA) cycle.

3.2.9 Additional Regulation and Rules

- A learner is not allowed to register for an offering unless the pre-requisite subject(s) have been passed.
- If, for any reason, a learner is found to be registered for any subject without the pre-requisite, the learner will automatically be de-registered in that subject.
- Learners may not register for any S4 level subject unless all subjects have been passed at the S1 and S2 level.
- A learner is only allowed to register across two consecutive levels, e.g. S1 & S2 or S2 & S3 or S3 & S4. It is not allowed to register across S1 & S3 or S2 & S4. If, for any reason, a learner is found to be registered for any subject without the pre-requisite, the learner will be de-registered immediately.
- Switching streams after selection in S2 will only be allowed once the student has graduated.
- Registration of additional modules after completing the suite of modules in the stream is subject to the University regulatory framework.

3.3 Pre-Technician Programme

The course is a bridging programme which prepares learners for entry to the Diploma in Electrical Engineering.

3.3.1 Entry Requirements

i) National Senior Certificate with rating codes:

English Home Language	(3)
(or)	
English First Additional Language	(3)
Mathematics	(3)
Physical Science	(3)

ii) Senior Certificate or equivalent with a minimum subject-related symbol as follows:

Physical Science	D (SG) / E (HG)
Mathematics	D (SG) / E (HG)
English	D (SG) / E (HG)

Please take note of the following:

- **Selection may be based on merit and availability of space.**
- **Meeting the minimum requirements does not, in any way, guarantee admission.**

3.3.2 Diploma Entry Requirements

Learners who pass the Pre-Technician programme will gain access to the Diploma Programme subject to the learner passing all subjects in this programme.

3.3.3 Repeating Pre-Technician Programme

This programme may not be repeated.

3.3.4 Examination Regulations

Refer to the General Handbook Rule: G22

3.3.5 Subjects, Curriculum Compilation, Course Codes

Pre-Technician Programme: Electrical Engineering		
Code	**Subjects**	**Assessment Method**
AMATE11	Electrical Engineering Mathematics	Examination
ACOME11	English Communication	Examination
AINLO11	Introduction to Logic Systems	Examination
APREN11	Principles of Electrical Engineering	Examination
ABASE11	Basic Electronics	Examination
AINTR11	Introduction to Computers	Continuous
AEPRA11	Engineering Project	Continuous
All Subjects are compulsory.		

3.4 Departmental Regulations

Reference, together with departmental regulations, will be made to all institutional rules in the "General Regulations for Students".

- Students who are found to be contravening the minimum requirements after registration, for any reason, will be de-registered immediately. The departmental decision on registration matters is final.
- Students who have failed Pre-Tech in any other department will not be allowed to register in the Department of Electrical Engineering.
- Students who are guilty of plagiarism in any assessment will automatically fail the assessment.
- A minimum of 80% attendance of all lectures is compulsory per institutional rules.
- The National Diploma was discontinued in 2018 and its last registration was in 2023. Affected students will have to move to the Diploma program and comply with all requirements thereof.

4. DEPARTMENT OF MECHANICAL ENGINEERING

The National Diploma programmes were phased out in 2018 and replaced with the Diploma programmes.

The returning students will be requested to migrate to the new qualification.

The department rules are aligned with the Mangosuthu University of Technology's General Handbook Rules.

4.1 Qualification name: Diploma in Mechanical Engineering (MEENDI)

SAQA Qualification ID 72293 CESM Code 081501
SAQA Credits : Minimum 360 NQF Level : 6
Duration: 3 years

Rationale for the Qualification

The Engineering profession contributes to the technological, socio-economic, built environment and environmental infrastructure of the country, facilitating socio-economic growth and sustainability The Diploma in Engineering Technology in Mechanical Engineering is primarily vocational, or industry oriented, characterized by underpinning theoretical knowledge and general principles and the application thereof to real situations or technology transfer. The qualification provides learners with a sound knowledge base in a field of Mechanical Engineering in response to the needs of the community, as well as local, regional, and national industry by producing competent graduates.

Statement of Purpose

The primary purpose of the diploma in Mechanical Engineering is to develop focused knowledge and skills as well as experience in a work-related context. The Diploma equips graduates with the knowledge base, theory, skills, and methodology of Mechanical Engineering as a foundation for further training and experience towards becoming a competent engineering technician. This foundation is achieved through a thorough grounding in mathematics and natural sciences specific to Mechanical Engineering, engineering sciences, engineering design and the ability to apply established methods. Engineering knowledge is complemented by methods for understanding of the impacts of engineering solutions on people and the environment.

A student will be awarded with the qualification and will be able to register as a professional technician with the Engineering Council of South Africa (ECSA) when he/she has demonstrated the knowledge and competence in Mechanical Engineering and the graduate attributes defined below.

ECSA Graduate Attributes

Please note that the indicated graduate attributes statements are in accordance with ECSA E-02-PN Revision 5 of September 2020. This standard will be used to assess student cohorts enrolled in the programme before 2025. The students enrolled in the programme in or after 2025, as well as repeating students, will be assessed based on the ECSA E-02-PN Revision 6 standard of August 2023 (see https://www.ecsa.co.za/ECSADocuments/Shared%20Documents/E-02-PN%20-%20Qualification%20Standard%20for%20Diploma%20in%20Engineering%20NQF%20Level%206-signed.pdf

Graduate Attribute 1: Problem Solving

Level Descriptor: Well-defined engineering problems:

a. Can be solved mainly by practical engineering knowledge, underpinned by related theory,

and have one or more of the characteristics:

b. are largely defined but may require clarification;
c. are discrete, focused tasks within engineering systems;
d. are routine, frequently encountered, may be unfamiliar but in familiar context;

and have one or more of the characteristics:

e. can be solved in standardized or prescribed ways.
f. is encompassed by standards, codes and documented procedures; requires authorization to work outside limits;
g. information is concrete and largely complete but requires checking and possible supplementation.
h. involves several issues but few of these imposing conflicting constraints and a limited range of interested and affected parties.

Graduate Attribute 2: Application of scientific and engineering knowledge

Apply knowledge of mathematics, natural science, and engineering sciences to applied engineering procedures, processes, systems and methodologies to solve well-defined engineering problems.

Range Statement: Knowledge of mathematics, natural science and engineering science is characterized by:

1) A coherent range of fundamental principles in mathematics and natural science underlying a sub-discipline or recognized practice area.
2) A coherent range of fundamental principles in engineering science and technology underlying an engineering sub-discipline or recognized practice area.
3) A codified practical knowledge in recognized practice area.
4) The use of mathematics, natural sciences, and engineering sciences, supported by established mathematical formulas, codified engineering analysis, methods and procedures to solve well-defined engineering problems.

Graduate Attribute 3: Engineering Design

Perform procedural design of components, systems, works, products or processes to meet desired needs normally within applicable standards, codes of practice and legislation.

Range Statement: Design problems used in assessment must conform to the definition of well- defined engineering problems:

1) A design project should be used to provide evidence of compliance with this outcome.
2) The problem would be typical of those in which the graduate would participate in an employment situation shortly after graduation.
3) The selection of components, systems, engineering works, products or processes to be designed is dependent on the sub-discipline.
4) A design project should include one or more of the following impacts: social, economic, legal, health, safety, and environmental.

Graduate Attribute 4: Investigation
Conduct investigations of well-defined problems through locating and searching relevant codes and catalogues, conducting standard tests, experiments, and measurements.

Range Statement: The balance of investigation should be appropriate to the discipline. An investigation should be typical of those in which the graduate would participate in an employment situation shortly after graduation.
Note: An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon.

Graduate Attribute 5: Engineering methods, skills, tools, including Information Technology Use appropriate techniques, resources, and modern engineering tools including information technology for the solution of well-defined engineering problems, with an awareness of the limitations, restrictions, premises, assumptions, and constraints.

Range Statement: A range of methods, skills, and tools appropriate to the discipline of the program including:
1. Sub-discipline specific tools, processes, or procedures.
2. Computer packages for computation, simulation, and information handling.
3. Computers and networks and information infrastructures for accessing, processing, managing, and storing information to enhance personal productivity and teamwork.
4. Basic techniques from economics, management, and health, safety and environmental protection.

Graduate Attribute 6: Professional and Technical Communication
Communicate effectively, both orally and in writing within an engineering context.

Range Statement: Material to be communicated is in a simulated professional context:
1. Audiences are engineering peers, academic personnel and related engineering persons using appropriate formats.
2. Written reports range from short (minimum 300 words) to long (a minimum of 2000 words excluding tables, diagrams and appendices), covering material at the exit level.
3. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, physical models, and bills of quantities as well as subject-specific methods.

Graduate Attribute 7: Impact of Engineering Activity
Demonstrate knowledge and understanding of the impact of engineering activity on the society, economy, industrial and physical environment, and address issues by defined procedures.

Range Statement: The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the sub-discipline of the qualification. Evidence may include case studies typical of the technical practice situations in which the graduate is likely to participate.
Issues and impacts to be addressed:

1. Are encompassed by standards and documented codes of practice.
2. Involve a limited range of stakeholders with differing needs.
3. Have consequences that are locally important and are not far reaching.
4. Are well-defined and discrete and part of an engineering system.

Graduate Attribute 8: Individual and Teamwork
Demonstrate knowledge and understanding of engineering management principles and apply these to one's own work, as a member and leader in a technical team and to manage projects.

Range Statement:

1. The ability to manage a project should be demonstrated in the form of the project indicated in Graduate Attribute 3 (GA 3).
2. Tasks are discipline specific and within the technical competence of the graduate.
3. Projects could include laboratories, business plans, design, etc.
4. Management principles include:

Planning: set objectives, select strategies, implement strategies, and review

a. achievement.
b. Organising: set operational model, identify, and assign tasks, identify inputs, delegate responsibility and authority.
c. Leading: give directions, set example, communicate, motivate.
d. Controlling: monitor performance, check against standards, identify variations and take remedial action.

Graduate Attribute 9: Independent Learning
Engage in independent and life-long learning through well-developed learning skills.
Range Statement: The learning context is well-structured with some unfamiliar elements.

Graduate Attribute 10: Engineering Professionalism
Understand and commit to professional ethics, responsibilities and norms of engineering technical practice.

Range Statement: Evidence includes case studies, memorandum of agreement, code of conduct, membership of professional societies, etc typical of engineering practice situations in which the graduate is likely to participate.**Graduate Attribute 11: Engineering management**
Demonstrate knowledge and understanding of engineering management principles.

Range Statement: Basic techniques from project management applied to one's own work, as a member and leader in a technical team, and to manage projects in multidisciplinary environments.

Graduate Attribute 12: Workplace practices
Demonstrate an understanding of workplace practices to solve engineering problems consistent with academic learning achieved.
Note: The purpose of work-integrated learning is to enable the learner to connect academic learning with workplace practice.

Range Statement: Tasks to demonstrate this outcome may be performed in one or more of the following curriculum types:

1. Work-directed theoretical learning: in which theoretical forms of knowledge are introduced and sequences in ways that meet both academic criteria and are applicable and relevant to the career-specific components.
2. Problem-based learning: where students work in small self-directed groups to define, carry out and reflect on a task which is usually a real-life problem.
3. Project-based learning: that brings together intellectual enquiry, real world problems and student engagement in meaningful work.
4. Workplace learning: where students are placed in a professional practice or simulated environment within a training programme.
5. Simulated learning.

a. **Admission Requirements**

i) National Senior Certificate (Grade 12) with rating codes:

English Home Language (4)
Or
English First Additional Language (4)
Mathematics (4)
Physical Science (4)
Technical Drawing or equivalent (4)

Additional recommended school subject: Mechanical Technology

ii) Senior Certificate or equivalent with a minimum symbol D (HG) or C (SG) in Mathematics, Physical Science, English and Technical Drawing. Additional recommended school subject: Mechanical Technology

iii) Pass in all Pre-Tech subjects (6 subjects) with a minimum of 50% for each

iv) An appropriate N3 certificate with a minimum of four subjects passed at 50% each including Mathematics, Technical Drawing and Engineering Science and Grade 12 level English passed with at least symbol D (SG)

v) An appropriate GCE, GCSE, IGCSE, or Cambridge School Certificate with at least five subjects at GCE 'O' level including Mathematics, Physics, Chemistry, English, and Technical Drawing, each being passed with an A, B or C symbol. Three of the five subjects must have been passed at the same examination sitting

vi) NCV Admission Requirements
NCV Level 4 with a minimum of 50% pass in the following subjects:
Three fundamental subjects which must include English and Mathematics and a minimum of 60% in the three compulsory subjects from the Engineering and Related Design programme plus Mechanical Draughting and Technology plus Physical Science.

NB: It is important to note that each student will be assessed on merit. All admissions are based on a selection process only!

- **Transfer from Technical / FET Colleges**
  Students having passed subjects as listed below (with a minimum of 50% each) will be granted exemptions according to the Recognition of Prior Learning.

Technical/FET College Subjects	**University Exempted Subjects**
Communication N4	Communication Studies I
Mathematics N4 and N5	Mathematics I
Mechanotechnics N5	Mechanics I
Mechanotechnics N6	Mechanics of Machines II
Power Machines N6	Thermodynamics II
Strength of Materials N6	Strength of Materials II
Mech Eng Drawing & Design N5	Mech Eng Drawing I
Mech Eng Drawing & Design N6	Mech Eng Design II

It is important to note that each student will be assessed on merit.

Applications for credits and exemptions must be submitted to the Head of Department before the registration date.

b. **Duration of Study**

The duration of the course is three years comprising two years academic studies at the University and one year Work Integrated Learning (Experiential Learning) in industry undertaken at an appropriate training provider, in accordance with a prescribed programme as stated in a logbook. Logbooks for Work Integrated Learning will be issued to students at the commencement of their training. Students who do not register for their Work Integrated Learning cannot be monitored training which must be done prior to commencement of training. A student can only register P1 after attending S4.
Students who did not complete all theS4 courses must first get permission from the HOD to register for P1.

c. **Curriculum Compilation**

The curriculum compilation for the Diploma in Mechanical Engineering is as follows:

Subjects, Curriculum Compilation, Course Codes

Code	Subjects	*C/E	Year / Semester	Assessment Method	NQF Level	Credits	Pre-requisites
CSKL101	Communication Skills I	C	Y1(S1)	Examination	5	7	
CPSK101	Computer Skills I	C	Y1(S1)	Examination	5	7	
ELEC101	Electrotechnology I	C	Y1(S1)	Examination	5	12	
MATI101	Mathematics I	C	Y1(S1)	Examination	5	12	
MEED101	Mech. Engineering Drg. I	C	Y1(S1)	Continuous	5	12	
MEME101	Mech. Manuf. Eng. I	C	Y1(S1)	Examination	5	12	
MECH101	Mechanics I	C	Y1(S1)	Examination	5	12	
FLME102	Fluid Mechanics II	C	Y1(S2)	Examination	5	12	Mechanics I & Mathematics I
MATI102	Mathematics II	C	Y1(S2)	Examination	5	12	Mathematics I
COAD102	Comp. Aided Draught I	C	Y1(S2)	Continuous	5	12	Mechanical Engineering Drawing I and Computer Skills
STOM102	Strength of Materials II	C	Y1(S2)	Examination	5	12	Mechanics I & Mathematics I
THER102	Thermodynamics II	C	Y1(S2)	Examination	5	12	Mathematics I
MEOM102	Mechanics of Machines II	C	Y1(S2)	Examination	5	12	Mechanics I & Mathematics I
MEDS201	Mech. Eng. Design II	C	Y2(S1)	Examination	6	12	Mech. Eng. Drawing I Strength of Mechanics II
FLME201	Fluid Mechanics III	C	Y2(S1)	Examination	6	12	Fluid Mechanics II
MEOM201	Mechanics of Machines III	C	Y2(S1)	Examination	6	12	Mechanics of Machines II
STOM201	Strength of Materials III	C	Y2(S1)	Examination	6	12	Strength of Materials II

THER201	Thermodynamics III	C	Y2(S1)	Examination	6	12	Thermodynamics II
MTHM102	Mathematics III	C	Y2 (S1)	Examination	6	12	Mathematics II
APSM202	Applied Strength of Materials III	C	Y2(S2)	Examination	6	12	Strength of Materials III
MAEN202	Maintenance Eng. I	C	Y2(S2)	Examination	5	12	Mathematics I, Mech. Manufacturing Eng. I
HYDM202	Hydraulic Machines III	C	Y2(S2)	Examination	6	12	Fluid Mechanics III
STPL202	Steam Plant III	C	Y2(S2)	Examination	6	12	Thermodynamics III
THMA202	Theory of Machines III	C	Y2(S2)	Examination	6	12	Mechanics of Machines III & Mathematics II
MEDS202	Mech. Eng. Design III	C	Y2(S2)	Examination	6	12	Mech. Eng. Design II & Computer Aided Drg. I
WORKRP0	Mech. Eng. Practice 0, P0	*C*	*Y2 (S2)*	Attendance	5	6	
MEPR301	Mech. Eng. Practice I, P1	*C*	*Y3 (S1)*	WIL Logbook	5	40	CSKL101, MATI1101 MEED101, MECH101, WORKRP0
MEPR302	Mech. Eng. Practice II, P2	*C*	*Y3 (S2)*	WIL Logbook	6	44	MEDES21, Mechanical Eng. Pract. I
C=Compulsory; E=Electives							

b. **Elective Subjects**:
The following subjects are offered to sufficient students wanting to do the subject. They are conducted after hours, at an extra cost, and they carry a full credit value.

Subjects, Curriculum Compilation, Course Codes

Code	Subjects	*C/E	Year / Semester	Assessment Method	NQF Level	Credit	Pre-requisites
MOVE102	Motor Vehicle Eng. I	E	Y1 (S2)	Continuous	5	12	
MEME102	Mech. Manuf. Eng. II	E	Y1 (S2)	Continuous	5	12	Mech. Manuf. Eng. I
MEME201	Mech. Manuf. Eng. III	E	Y2 (S3)	Continuous	6	12	Mech. Manuf. Eng. II
MASK102	Management Skills I	E	Y1 (S2)	Examination	5	12	Communication Studies I
MACD202	Machine Design III	E	Y2 (S2)	Continuous	6	12	Mech. Eng. Design III
ELEC201	Electrotechnology II	E	Y2(S1)	Examination	5	12	Electrotechnology I
EMAS102	Engineering Materials & Science I	E	Y1 (S2)	Examination	5	12	Mech. Manuf. Eng. I
C=Compulsory; E=Electives							

e. Examination Regulations
Refer to the General Handbook Rule: G22.

f. Assessments
A candidate will undergo two distinct assessments in the diploma programme: academic assessment and graduate attributes assessment.

g. Pass Requirements

To pass a subject the candidate must obtain a final mark of 50% or more in the academic assessment and must satisfy the requirements of the graduate attribute development and/ or assessment concurrently.

h. Pre-requisite

A pre-requisite for an academic pass is that a candidate should have a minimum of 40% in the examination mark, otherwise he/she fails (even if the course mark and exam mark together total 50% or more.)

i. **Practicals**

The attendance of all practical classes is compulsory. Failure to attend practicals will result in the candidate not obtaining a course mark for that subject and may not meet the requirements of graduate attribute.

j. **Timetable Clashes** (Refer to Rule G.16 in the General Handbook)

Students may not register for any subjects that result in a timetable clash.

k. **Work Integrated Learning (WIL)**

It consists of P1 (6 months) and P2 (6 months) and it is the student's responsibility to register his/her training. This must be done before or on commencement of the training. Students who do not register their work integrated learning cannot be monitored nor evaluated and their training will not be recognised. Student must obtain his/her logbook from the Department of Mechanical Engineering before the commencement of their training. Students are only eligible for graduation after completion, submission and acceptance of all the required reports.

4.2 **Diploma in Mechanical Engineering -Extended Curriculum (MEENEC)**

Qualification name: Diploma in Mechanical Engineering (MEENC)

HEQSF Qualification Type 63 SAQA Qualification ID 72293 CESM Code 081501 SAQA Credits: Minimum 360 NQF Level : 6

Duration : 4 years

Diploma in Mechanical Engineering (4-Year Programme)

The minimum study period for the Diploma: Engineering: Mechanical is usually three years. However, students are usually under-prepared and complete the programme in 4, 5 or 6 years. A 4-year programme (also known as an Extended Curriculum programme) has been designed to provide structured support to students over a period of four years. A range of additional interventions are offered to students who are accepted in this programme. This programme has been a response to the well-known inequalities in South African society and to cater for varying levels of student preparedness. It ensures that sufficient support is provided during the initial years of study while guaranteeing the same exit standards as the 3-year programme.

The 4-year programme addresses gaps and disparities in students' educational and life experience so that they can be better equipped to manage the Diploma programme. It also provides students with broad educational and life skills, including Mathematics, language literacy and subject knowledge. While students are mostly tutored separately in small classes in their first year, they undertake their studies and lectures as integral members of the Diploma student group.This programme in Mechanical Engineering is further unique and designed in such a way that after the first semester, students may transfer to similar programmes in Civil Engineering or Electrical Engineering without sacrificing time or quality of training.

Rationale for the Qualification

The Engineering profession contributes to the technological, socio-economic, built environment and environmental infrastructure of the country, facilitating socio-economic growth and sustainability The Diploma in Engineering Technology in Mechanical Engineering is primarily vocational, or industry oriented, characterized by underpinning theoretical knowledge and general principles and the application thereof to real situations or technology transfer. The qualification provides learners with a sound knowledge base in a field of Mechanical Engineering in response to the needs of the community, as well as local, regional and national industry by producing competent graduates.

Statement of Purpose

The primary purpose of the diploma in Mechanical Engineering is to develop focused knowledge and skills as well as experience in a work-related context. The Diploma equips graduates with the knowledge base, theory, skills and methodology of Mechanical Engineering as a foundation for further training and experience towards becoming a competent engineering technician. This foundation is achieved through a thorough grounding in mathematics and natural sciences specific to Mechanical Engineering, engineering sciences, engineering design and the ability to apply established methods. Engineering knowledge is complemented by methods for understanding of the impacts of engineering solutions on people and the environment.

A student will be awarded with the qualification and will be able to register as a professional technician with the Engineering Council of South Africa (ECSA) when he/she has demonstrated the knowledge in Mechanical Engineering and the graduate attributes defined below

ECSA Graduate Attributes

Please note that the indicated graduate attributes statements are in accordance with ECSA E-02-PN Revision 5 of September 2020. This standard will be used to assess student cohorts enrolled in the programme before 2025. The students enrolled in the programme in or after 2025, as well as repeating students, will be assessed based on the ECSA E-02-PN Revision 6 standard of August 2023 (see https://www.ecsa.co.za/ECSADocuments/Shared%20Documents/E-02-PN%20-%20Qualification%20Standard%20for%20Diploma%20in%20Engineering%20NQF%20Level%206-signed.pdf for more information).

Graduate Attribute 1: Problem Solving

Apply engineering principles to systematically diagnose and solve well-defined engineering problems.

and have one or more of the characteristics:

a. is largely defined but may require clarification.
b. are discrete, focused tasks within engineering systems.
c. is routine, frequently encountered, may be unfamiliar but in familiar context.

and have one or more of the characteristics:

d. can be solved in standardized or prescribed ways.
e. is encompassed by standards, codes and documented procedures; requires authorization to work outside limits;
f. information is concrete and largely complete, but requires checking and possible supplementation.
g. involves several issues but few of these imposing conflicting constraints and a limited range of interested and affected parties

Graduate Attribute 2: Application of scientific and engineering knowledge
Apply knowledge of mathematics, natural science and engineering sciences to applied engineering procedures, processes, systems and methodologies to solve well-defined engineering problems.

Range Statement: Knowledge of mathematics, natural science and engineering science is characterized by:

1. A coherent range of fundamental principles in mathematics and natural science underlying a sub-discipline or recognized practice area.

A coherent range of fundamental principles in engineering science and technology underlying an engineering sub-discipline or recognized Level Descriptor: Well-defined engineering problems:

i. Can be solved mainly by practical engineering knowledge, underpinned by related theory.
2. practice area.
3. A codified practical knowledge in recognized practice area.
4. The use of mathematics, natural sciences, and engineering sciences, supported by established mathematical formulas, codified engineering analysis, methods and procedures to solve well-defined engineering problems.

Graduate Attribute 3: Engineering Design
Perform procedural design of components, systems, works, products, or processes to meet normally within applicable standards, codes of practice and legislation.

Range Statement: Design problems used in assessment must conform to the definition of well- defined engineering problems:

1. A design project should be used to provide evidence of compliance with this outcome.
2. The problem would be typical of those in which the graduate would participate in an employment situation shortly after graduation.
3. The selection of components, systems, engineering works, products, or processes to be designed is dependent on the sub-discipline.
4. A design project should include one or more of the following impacts: social, economic, legal, health, safety, and environmental.

Graduate Attribute 4: Investigation
Conduct investigations of well-defined problems through locating and searching relevant codes and catalogues, conducting standard tests, experiments and measurements.

Range Statement: The balance of investigation should be appropriate to the discipline. An investigation should be typical of those in which the graduate would participate in an employment situation shortly after graduation.

Note: An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon.

Graduate Attribute 5: Engineering methods, skills, tools, including Information Technology Use appropriate techniques, resources, and modern engineering tools including information technology for the solution of well-defined engineering problems, with an awareness of the limitations, restrictions, premises, assumptions, and constraints.

Range Statement: A range of methods, skills and tools appropriate to the discipline of the program including:

1. Sub-discipline specific tools, processes, or procedures.
2. Computer packages for computation, simulation, and information handling.
3. Computers and networks and information infrastructures for accessing, processing, managing, and storing

information to enhance personal productivity and teamwork.
4. Basic techniques from economics, management, and health, safety and environmental protection.

Graduate Attribute 6: Professional and Technical Communication
Communicate effectively, both orally and in writing within an engineering context.

Range Statement: Material to be communicated is in a simulated professional context:
1. Audiences are engineering peers, academic personnel and related engineering persons using appropriate formats.
2. Written reports range from short (minimum 300 words) to long (a minimum of 2000 words excluding tables, diagrams, and appendices), covering material at the exit level.
3. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, physical models, and bills of quantities as well as subject-specific methods.

Graduate Attribute 7: Impact of Engineering Activity
Demonstrate knowledge and understanding of the impact of engineering activity on the society, economy, industrial and physical environment, and address issues by defined procedures.

Range Statement: The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the sub-discipline of the qualification. Evidence may include case studies typical of the technical practice situations in which the graduate is likely to participate.
Issues and impacts to be addressed:

Are encompassed by standards and documented codes of practice.
1. Involve a limited range of stakeholders with differing needs.
2. Have consequences that are locally important and are not far reaching.
3. Are well-defined and discrete and part of an engineering system.

Graduate Attribute 8: Individual and Teamwork
Demonstrate knowledge and understanding of engineering management principles and apply these to one's own work, as a member and leader in a technical team and to manage projects.

Range Statement:
- The ability to manage a project should be demonstrated in the form of the project indicated in Graduate Attribute 3 (GA 3).
- Tasks are discipline specific and within the technical competence of the graduate.
- Projects could include laboratories, business plans, design, etc.
- Management principles include:
  - Planning: set objectives, select strategies, implement strategies and review achievement.
  - Organising: set operational model, identify and assign tasks, identify inputs, delegate responsibility and authority.
  - Leading: give directions, set example, communicate, motivate.
  - Controlling: monitor performance, check against standards, identify variations and take remedial action.

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

Range Statement: The learning context is well-structured with some unfamiliar elements.

Graduate Attribute 10: Engineering Professionalism
Understand and commit to professional ethics, responsibilities and norms of engineering technical practice.

Range Statement: Evidence includes case studies, memorandum of agreement, code of conduct, membership of professional societies, etc typical of engineering practice situations in which the graduate is likely to participate.

Graduate Attribute 11: Engineering management
Demonstrate knowledge and understanding of engineering management principles.

Range Statement: Basic techniques from project management applied to one's own work, as a member and leader in a technical team, and to manage projects in multidisciplinary environments.

Graduate Attribute 12: Workplace practices
Demonstrate an understanding of workplace practices to solve engineering problems consistent with academic learning achieved.

Note: The purpose of work-integrated learning is to enable the learner to connect academic learning with workplace practice.

Range Statement: Tasks to demonstrate this outcome may be performed in one or more of the following curriculum types:

1. Work-directed theoretical learning: in which theoretical forms of knowledge are introduced and sequences in ways that meet both academic criteria and are applicable and relevant to the career-specific components.
2. Problem-based learning: where students work in small self-directed groups to define, carry out and reflect on a task which is usually a real-life problem.
3. Project-based learning: that brings together intellectual enquiry, real world problems and student engagement in meaningful work.
4. Workplace learning: where students are placed in a professional practice or simulated environment within a training programme.
5. Simulated learning.

a. **Admission Requirements**

i) National Senior Certificate (Grade 12) with rating codes:
English Home Language (4)
or English First Additional Language (4) Mathematics (4)
Physical Science (4)
Technical Drawing or equivalent (4)
Additional recommended school subject: Mechanical Technology

ii) Senior Certificate or equivalent with a minimum symbol D (HG) or C (SG) in Mathematics, Physical Science, English and Technical Drawing. Additional recommended school subject: Mechanical Technology

iii) An appropriate N3 certificate with a minimum of four subjects passed at 50% each including Mathematics, Technical Drawing and Engineering Science and Grade 12 level English passed with at least symbol D (SG)

v) An appropriate GCE, GCSE, IGCSE, or Cambridge School Certificate with at least five subjects at GCE 'O' level including Mathematics, Physics, Chemistry, English and Technical Drawing, each being passed with an A, B or C symbol. Three of the five subjects must have been passed at the same examination sitting.

vi) **NCV Admission Requirements**

NCV Level 4 with a minimum of 50% pass in the following subjects:
Three fundamental subjects which must include English and Mathematics and a minimum of 60% in the three compulsory subjects from the **Engineering and Related Design** programme plus **Physical Science**.

NB: It is important to note that each student will be assessed on merit.

ADMISSION IS BASED ON A SELECTION PROCESS ONLY!!!

b. **Duration of Study**

4 years full time

c. **Subjects, Curriculum Compilation, Course Codes**

Code	Subjects	*C/E	Semester /Year	Assessment Method	NQF Level	Credit	Pre-requisites
BASC000	Basic Science I	C	Y1 (S1)	Examination	5		
CMLI000	Computer Literacy I	C	Y1 (S1)	Examination	5		
LSAS000	Life Skills and Study Skills	C	Y1 (S1)	Examination	5		
DING000	Drawing	C	Y1 (S1)	Examination	5		
MATI000	Mathematics	C	Y1 (S1)	Examination	5		
COMS000	Communication Skills	C	Y1 (S2)	Examination	5		Life Skills and Study Skills (LIFE001)
ENCA000	Engineering Calculations	C	Y1 (S2)	Examination	5		Mathematics (MATS001)
ENSC000	Engineering Science I	C	Y1 (S2)	Examination	5		Basic Science I (BASC000)
CAPP000	Computer Applications I	C	Y1 (S2	Examination	5		Computer Literacy I (CMLI000)
DWNG000	Drawing I	C	Y1 (S2)	Examination	5		Drawing I (DRAW001)
CTIO101	Communication Studies I	C	Y2 (S1)	Examination	5	7	Communication Skills (COMS001)
CMPS101	Computer Skills I	C	Y2 (S1)	Examination	5	7	Computer Applications I
ELTR101	Electrotechnology I	C	Y2 (S1)	Examination	5	12	Engineering Calculations Engineering Science I
MTMA101	Mathematics I	C	Y2 (S1)	Examination	5	12	Engineering Calculations
MEND101	Mech. Eng. Drawing I	C	Y2 (S1)	Continuous	5	12	Drawing I (DRAW002)
MMAE101	Mech. Manuf. Eng. I	C	Y2 (S1)	Examination	5	12	Drawing I (DRAW002)
MCHA101	Mechanics I	C	Y2 (S1)	Examination	5	12	Engineering Calculations Engineering Science I
FLUM102	Fluid Mechanics II	C	Y2 (S2)	Examination	5	12	Mechanics I & Mathematics I
MTMA102	Mathematics II	C	Y2 (S2)	Examination	5	12	Mathematics I

CAID102	Comp. Aided Draught. I	C	Y2 (S2)	Continuous	5	12	Mechanical Engineering Drawing I Computer Skills I
SOMA102	Strength of Materials II	C	Y2 (S2)	Examination	5	12	Mechanics I & Mathematics I
TERM102	Thermodynamics II	C	Y2 (S2)	Examination	5	12	Mathematics I
MOMA102	Mechanics of Machines II	C	Y2 (S2)	Examination	5	12	Mechanics I & Mathematics I
FLUM201	Fluid Mechanics III	C	Y3 (S1)	Examination	6	12	Fluid Mechanics II
MOMA201	Mech. Of Machines III	C	Y3 (S1)	Examination	6	12	Mechanics of Machines II
SOMA201	Strength of Materials III	C	Y3 (S1)	Examination	6	12	Strength of Materials II
TERM201	Thermodynamics III	C	Y3 (S1)	Examination	6	12	Thermodynamics II
MTMA201	Mathematics III	C	Y3 (S1)	Examination	6	12	Mathematics II
MNGD201	Mech. Eng. Design II	C	Y3 (S1)	Examination	6	12	Mech. Eng. Drawing I, CAD Strength of Materials II
MNGD202	Mech. Eng. Design III	C	Y3 (S2)	Examination	6	12	Mech. Eng. Design II & Computer Aided Drawing I
ASMA202	Applied Strength of Mat. III	C	Y3 (S2)	Examination	6	12	Strength of Materials III
MAIN202	Maintenance Eng. I	C	Y3 (S2)	Examination	5	12	Mathematics I, Mech. Manufacturing Eng. I
HMAC202	Hydraulic Machines III	C	Y3 (S2)	Examination	6	12	Fluid Mechanics III
STMP202	Steam Plant III	C	Y3 (S2)	Examination	6	12	Thermodynamics III
TMAC202	Theory of Machines III	C	Y3 (S2)	Examination	6	12	Mechanics of Machines III & Mathematics II
WORKRP0	Mech. Eng. Practice 0, P0	C	Y3 (S2)	Attendance	5	6	
MECP301	Mech. Eng. Practice I, PI	C	Y4 (S1)	WIL Logbook	5	40	MTMA101, CTIO101 MCHA101, MEND101, WORKRP0,
MECP302	Mech. Eng. Practice II, PII	C	Y4 (S2)	WIL Logbook	6	44	MNGD201,Mechanical Eng. Pract I
C=Compulsory; E=Electives							

b. **Additional, Optional Subjects**:The following subjects are offered to sufficient students wanting to do the subject. They are conducted after hours, at an extra cost, and they carry a full credit value.

Subjects, Curriculum Compilation, Course Codes

Code	Subjects	*C/E	Year / Semester	Assessment Method	NQF Level	Credits	Pre-requisites
MVEE102	Motor Vehicle Eng. I	E	Y2 (S2)	Continuous	5	12	
MMAE102	Mech. Manuf. Eng. II	E	Y2 (S2)	Continuous	5	12	Mech. Manuf. Eng. I

MMAE201	Mech. Manuf. Eng. III	E	Y3 (S1)	Continuous	6	12	Mech. Manuf. Eng. II
MANS201	Management Skills I	E	Y2 (S2)	Examination	5	12	Communication Studies I
ENMS102	Engineering Materials & Science I	E	Y2 (S2)	Examination	5	12	Mech. Manuf. Eng. I
MDSN202	Machine Design III	E	Y3 (S2)	Continuous	6	12	Mech. Eng. Design III
ELTR201	Electrotechnology II	E	Y3 (S1)	Examination	5	12	Electrotechnology I
C=Compulsory; E=Electives							

e. **Examination Regulations**
Refer to the General Handbook Rule: G22.

f. **Assessments**
A candidate will undergo two distinct assessments in the diploma programme: academic assessment and graduate attributes assessment.

g. **Pass Requirements**
To pass a subject the candidate must obtain a final mark of 50% or more in the academic assessment and must satisfy the requirements of the graduate attribute development and/ or assessment concurrently.

h. **Pre-requisite**
A pre-requisite for an academic pass is that a candidate should have a minimum of 40% in the examination mark, otherwise he/she fails (even if the course mark and exam mark together total 50% or more.)

i. **Practicals**
The attendance of all practical classes is compulsory. Failure to attend practicals will result in the candidate not obtaining a course mark for that subject and may not meet the requirements of graduate attribute.

j. **Timetable Clashes (Refer to Rule G.16 in the General Handbook)**
Students may not register for any subjects that result in a timetable clash.

k. **Work Integrated Learning (WIL)**
It consists of P1 (6 month) and P2 (6 month) and it is the student's responsibility to register his/her training. This must be done before or on commencement of the training. Students who do not register their work integrated learning cannot be monitored nor evaluated and their training will not be recognised. Student must obtain his/her logbook from the Department of Mechanical

Engineering before the commencement of their training. Students are only eligible for graduation after completion, submission, and acceptance of all the required reports.

5.2 Access Course: Mechanical Engineering (Pre-Tech course)
The course is a diploma-specific bridging course which prepares students for entry to the Diploma in Mechanical Engineering.

a. **Admission Requirements**
i) National Senior Certificate with rating

codes: English Home Language (3) **or**
ii) English First Additional Language (3)
iii) Mathematics (3)
Physical Science (3)

iv) Satisfactory achievement rating code (4) in their Home Language.
A minimum of 130 total credits; with a maximum of 60 credits with "Partial Achievement", at NQF Level 4 with a minimum of 50% pass in English, Mathematics and Physical Science

v) Grade 12 Certificate or equivalent, including passes in
Mathematics D (SG) / E (HG)
Physical Science D (SG) / E (HG)
English D (SG) / E (HG)

vi) A full N3 certificate (4 subjects including Mathematics and Physical Science with a minimum 50% pass for each) and Grade 12 English symbol D (SG)

vii) An appropriate GCE, GCSE, IGCSE or Cambridge School certificate must have passed five approved ordinary level subjects including English Language, provided three subjects have been passed at the same examination sitting. Only symbols A, B or C are accepted as passes.

viii) **NCV Admission Requirements**
NCV Level 4 with a minimum of 50% pass in the following subjects:
Three fundamental subjects which must include English and Mathematics and a minimum of 60% in the three compulsory subjects from the **Engineering and Related Design** programme plus Physical Science.

ADMISSION IS BASED ON A SELECTION PROCESS!!!

b. **Duration of Study**
Study will be for a period of six months.

c. **Subjects, Curriculum Compilation, Course Codes**

Code	Subjects	*C/E	Semester /Year	Assessment Method	NQF Level	Pre-requisites
ACOMM11	Communication	C	PRETECH	Examination	5	
ADRAM11	Drawing	C	PRETECH	Continuous	5	
AMATM11	Mathematics	C	PRETECH	Examination	5	
APITE11	Industrial Technology	C	PRETECH	Continuous	5	
AINME11	Introduction to Mechanics	C	PRETECH	Examination	5	
ABASC11	Basic Engineering Sc.	C	PRETECH	Examination	5	
C=Compulsory; E=Electives						

d. **Examination Regulations**
Refer to Part One: Rule 1.22

e. **Pass Requirements**
Students must pass ALL six subjects at 50% each during a single examination session, for promotion to the S1

level. This course may not be repeated.

f. **Practicals**
Students are expected to attend all practical sessions offered in the course.

g. Pre-Technician students are not excluded from writing examinations if their course mark is below 40%, i.e. all students will gain entry to the examination regardless of their course mark.

h. **Repeating Pre-Technician Course**
This course may not be repeated.

COURSE CURRICULUM

Subject Code	Subject includes
S1, semester 1	
Mechanics I	Vectors, resultants and equilibrants, determining unknown forces on a system of coplanar concurrent forces, moments, friction and centres of gravity, linear motion with uniform acceleration, motion in a vertical plane, angular motion, work and power, momentum, impulse and Newton's laws, potential and kinetic energy, centrifugal and centripetal force, simple lifting machines
Mechanical Engineering Drawing I	Orthographic projection: first and third angle, isometric drawing, interpenetration and developments, sectioning and assembly drawing, auxiliary drawing, introduction to CAD (AutoCAD 2016), 2D drawing commands in AutoCAD
Mechanical Manufacturing Engineering I	Safety and safety legislation, identification on materials and their property, ferrous, non- ferrous, non-metals, synthetic and composite materials, application and manufacturing of various materials. Measuring equipment: micrometers, vernier and protractors, hand, and machine tools: lathe, shaper, pedestal grinder. Drilling machine, fly press, welding , Fits and Limits
Electrotechnology 1	General concept of atomic theory, electric current, electricity basics, electric resistance, electric circuits, electromagnetism, induction capacitors, measuring instruments, storage cells
Mathematics I	Basic algebra and trigonometry, differential calculus with applications, integral calculus with applications, statistics, complex numbers, and hyperbolic functions
Computer Skills and Programming I	Hardware, software, data communications, computer applications, theory of computer and introductions to office suite which include MS Word, MS Excel, MS Power Point, network overview and security, data storage, introduction to programming
Communication Studies I	Academic writing skills, communication theory, meetings, public speaking & presentations, technical report writing and correspondence

S2 Semester 2	
Fluid Mechanics II	Fluid properties, pressure in fluids, hydrostatic forces, buoyancy, hydrostatic machines, fluid flow, flow measurement, flow through pipelines (Darcy and Chezy formula, minor losses)

Strength of Materials II	Simple plain trusses, simple stress and strain, thin cylinders, shafts and rigid couplings, close – coiled helical springs, geometric properties of beam sections, bending moment and shear force, Simple Stresses & Theories of failure, Combined Stresses,
Mechanics of Machine II	General dynamics. Vehicle dynamics, hoists and haulages, power transmission (belts, clutches, chain drives, gearboxes), brakes, simple harmonic motion
Computer Aided Draughting I	AUTOCAD (drawing with precision, creating and editing objects, Dimensioning, working with text, hatching, blocks & X-refs, plotting) INTRODUCTION TO INVENTOR (creating base features, sketched secondary features, creating pick and place, features, work features, model and display manipulation, advanced features and duplication tools, assembly environment, manipulating the assembly, display, assembly tools, drawing basics), Design process steps/cycle
Thermodynamics II	Thermodynamics laws & systems, gases and single-phase systems, steam and two- phase systems, steam plant, combustion.
Mathematics II	Exponential Equations, Hyperbolic functions, Differentiation, Inverse Trigonometric functions, inverse hyperbolic functions, Partial Differentiation, Integration, Numerical Methods, First Order Differential equations
S3 Semester 3	
Mechanics of Machines III	Simple mechanisms, velocity and acceleration in mechanisms, toothed gearing, gear trains (including epicyclic arrangements), balancing of rotating masses.
Mechanical Engineering Design II	Pipes & pipe joints design, Pipe insulation (cold & hot fluid pipes), Permanent joints (riveted & Welded Joint design), Threaded Fasteners Joint design, keys & splines, couplings. Cotter & Knuckle joints, Pulley and belt design, Clutch design; Design project assignment based on the components covered.
Strength of Materials III	Space trusses, second moment of area, bending stresses, eccentric load on short columns and loaded beams, temperature stresses, strain energy due to direct stress, fatigue, basic two-dimensional stress analysis,
Thermodynamics III	Steady flow energy equation, Gas and steam nozzles, air reciprocating compressors, heat engine and refrigerators, Ideal gas cycle, I.C Engine and engine Trial, refrigeration cycles.
Fluid Mechanics III	Pipe friction, flow under varying head, and introduction to pumps, piping systems, channel flow, viscous flow, and vortices. forces exerted by a moving fluid, transmission of power by pipelines
Mathematics III	Fourier Series, Linear differential equations with constant coefficients, Laplace transforms
S4 Semester 4	
Mechanical Engineering Design III	Shaft Design (Solid, hollow, stepped and cranked shafts), Gear design (spur, helical and bevel), Bearing Design, Brake Design (Shoe brakes, Band brakes, differential brakes), Spring Design (coil and leaf spring design); Design project based on the components covered.

Steam Plant III	Power generation, Ideal Rankine cycle, Reheat and regenerative cycles, condensers and cooling towers, steam and gas turbines, Heat transfer: conduction, convection, radiation, Psychometrics

Hydraulic Machines III	Centrifugal pump design and performance, pumps in systems: series and parallel, positive displacement pumps, impulse water turbines, reaction water turbines.
Theory of Machines III	Turning moment/crank effort diagrams, analytical analysis of cam motion, balancing of reciprocating and rotating masses, free vibrations & introduction to 2^{nd} order differential equations
Maintenance Engineering, I	Maintenance function, maintenance strategies, assets register, reliability centred maintenance (RCM), failure modes and effect analysis (FMEM), maintenance documentation, backlog management, life cycle costing, turning maintenance into profit centre,
Applied Strength of Materials III	Deflection of beams, complex strain, 3-D strain & strain gauges, strains in thin-walled vessels subjected to fluid pressure, thick cylinders subjected to an internal pressure, transformation of internal stresses: complex stress systems, buckling, struts &slender column
Electives subjects	
Engineering Materials & Science I	Introduction to the Structure of Matter, Atomic Structure, Crystal Structure, Imperfections in the Atomic Arrangement, Mechanical Properties & Testing, Strengthening Mechanisms in Metals, Solidifications and Dispersion Strengthening, Corrosion & Wear
Machine Design III	Review of component designs of power transmission mechanisms, manufacturing methods, assembly and joining methods, practical maintenance of the machine, Project Report (Project Proposals, Literature Review, Methodology, Results and presentation, Discussion, conclusions and Recommendations, Oral presentations, Submission of the write up)
Management Skills I -Mech Eng	Introduction to Management, Business Leadership/Management, Productivity & Work Study, The Economic Structure, Basic Accounting, Engineering Contracts, Technical Report Writing Skills
Motor Vehicle Engineering I	Engine outlay and cycles, cylinder head and valves, cylinder block, crankshafts, piston, rings and connecting rods, lubrication circuit, Cooling system, Fuel system, Starting circuit, Ignition circuit, Gearboxes, Clutch, Differentials, Body structure, Suspension, Braking systems, Tyres
Mechanical Manufacturing Engineering II	Manufacturing Overview, Safety &Work holding devices, Quality standards, Measurement and Tolerances, Metal joining methods, non –traditional Machining, Bulk Metal Deformation, Powder Metallurgy, Plastic Moulding processes
Mechanical Manufacturing Engineering III	Automation and Control Technologies, Material Handling Systems and Identification Technologies, Computer Numerical Control of Machines (CNC), Manufacturing Operations and Production Concepts, Rapid Prototyping, Flexible Manufacturing Systems (FMS) and Assembly Lines, Industrial Robotics, CAD/CAM,
Electrotechnology II	A.C voltage generation, electrical measurements, AC circuits, Power in AC circuits, Resonance in AC circuit, Complex numbers Three phase system, Transformer, DC current machines and motors
Electrotechnology II	A.C voltage generation, electrical measurements, AC circuits, Power in AC circuits, Resonance in AC circuit, Complex numbers Three phase system, Transformer, DC current machines and motors

4.3 **Qualification name: Advanced Diploma in Mechanical Engineering (ADMECHEN)**

SAQA Qualification ID : 119525 CESM
Code 081501
NQF Level : 7
SAQA Credits : Minimum 120

Rationale for the Qualification

The Engineering profession contributes to the technological, socio-economic, built environment and environmental infrastructure of the country, facilitating socio-economic growth and sustainability. The Advanced Diploma in Engineering Technology in Mechanical Engineering is primarily vocational, or industry oriented, characterized by underpinning theoretical knowledge and general principles and the application thereof to real situations or technology transfer. The qualification provides students with a sound knowledge base in a field of Mechanical Engineering in response to the needs of the community, as well as local, regional, and national industry by producing competent graduates.

A range of additional interventions are offered to students who are accepted in this programme. Such interventions include counselling and mentorship programmes. The Advanced Diploma programme has been a response to the well-known inequalities in South African society and to cater for varying levels of student preparedness. It ensures that sufficient support is provided during the initial years of study while guaranteeing expected graduate attributes.

The Advanced Diploma programme closes the gaps and disparities in students' educational and life experience so that they can be better equipped to contribute the economy. It also provides students with broad educational and life skills, including Mathematics, mechanical engineering subject specific knowledge. While students are mostly tutored separately in small groups, they undertake their studies and lectures as integral members of the Advanced Diploma student group.

The Advanced Diploma programme in Mechanical Engineering is designed in such a way that after completing the programme, a student can progress to a bachelor's in engineering technology Honours programme.

Statement of Purpose

The Advanced Diploma in Mechanical Engineering is intended for mechanical engineering practitioners who, on achieving this qualification, will be able to apply management, analytical and practical engineering techniques, and knowledge to conduct operations and solve problems in a mechanical engineering working environment in the areas of design, manufacturing, maintenance, environmental engineering and automation and control.

The Advanced Diploma in Mechanical Engineering is aligned with ECSA prescribed standards, and the graduate must be able to demonstrate competence in the Graduate Attributes (GAs) 1 to 11.

The graduate attributes are designed to meet the educational requirement towards registration as a Candidate or Professional Engineering Technician with the Engineering Council of South Africa and acceptance as a candidate to write the examinations for Certificated Engineers.

ECSA Graduate Attributes

Please note that the indicated graduate attributes statements are in accordance with ECSA E-05-PT Revision 5 of September 2020. This standard will be used to assess student cohorts enrolled in the programme before 2025. The students enrolled in the programme in or after 2025, as well as repeating students, will be assessed based on the ECSA E-05-PT Revision 6 standard of August 2023 (see

https://www.ecsa.co.za/ECSADocuments/Shared%20Documents/E-05-PT%20%20%20Qualification%20Standard%20for%20Advanced%20Diploma%20in%20Engineering%20NQF%20Level%207-signed.pdf for more information).

The graduate attributes defined below are stated generically and may be assessed in various engineering disciplinary or cross-disciplinary contexts in a provider-based or simulated practice environment.

General Range Statement: The competencies defined in the eleven graduate attributes may be demonstrated in a university-based, simulated workplace context. Competencies stated generically may be assessed in various engineering disciplinary or cross-disciplinary contexts.

Graduate Attribute 1: Problem solving.

Identify, formulate, analyze and solve broadly defined engineering problems.

Graduate Attribute 2: Application of scientific and engineering knowledge

Apply knowledge of mathematics, natural sciences, engineering fundamentals and an engineering specialty to solve broadly defined engineering problems.
Range Statement: Mathematics, natural science and engineering sciences are applied in formal analysis and modelling of engineering situations, and for reasoning about and conceptualizing engineering problems.

Graduate Attribute 3: Engineering design

Perform creative, procedural, and non-procedural design and synthesis of components, systems, engineering works, products or processes.
Range Statement: Design problems used in exit-level assessment must conform to the definition of a broadly defined engineering problem.

1. A major design problem should be used to provide evidence.

2. The selection of components, systems, engineering works, products or processes to be designed are dependent on the discipline or practice area

Graduate Attribute 4: Investigations, experiments, and data analysis

Demonstrate competence to design and conduct investigations and experiments.
Range Statement: The balance of investigation and experiment should be appropriate to the discipline. Research methodology is to be applied in research or an investigation where the student engages with selected knowledge in the research literature of the discipline.

Note: An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon and a recommended course of action rather than specifying how an artifact could be produced.

Graduate Attribute 5: Engineering methods, skills, and tools, including information technology.

Demonstrate competence to use appropriate engineering methods, skills, and tools, including those based on information technology.

Range Statement: A range of methods, skills, and tools appropriate to the disciplinary designation of the program including:

1. Discipline-specific tools, processes, or procedures.

2. Computer packages for computation, modelling, simulation, and information handling.

3. Computers and networks and information infrastructures for accessing, processing, managing, and storing information to enhance personal productivity and teamwork.

Graduate Attribute 6: Professional and technical communication

Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large.

Range Statement: Material to be communicated is in an academic or simulated professional context.

1. Audiences range from engineering peers, management, and lay persons, using appropriate academic or professional discourse.
2. Written reports range from short (300-1000 words plus tables diagrams) to long (10 000 to 15 000 words plus tables, diagrams, and appendices), covering material at exit-level. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject- specific methods.

Graduate Attribute 7: Sustainability and impact of engineering activity

Demonstrate critical awareness of the sustainability and impact of engineering activity on thesocial, industrial, and physical environment.

Range Statement: The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the discipline or other designation of the qualification. Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: health, safety, and environmental protection; risk assessment and management and the impacts of engineering activity: economic, social, cultural, environmental and sustainability.

Graduate Attribute 8: Individual, team and multidisciplinary working

Demonstrate competence to work effectively as an individual, in teams and in multidisciplinary environments.

Range Statement: Multidisciplinary tasks require co-operation across at least one disciplinary boundary. Co-operating disciplines may be engineering disciplines with different fundamental bases other than that of the programme or may be outside engineering.

Graduate Attribute 9: Independent learning ability

Demonstrate competence to engage in independent learning through well-developed learning skills.

Range Statement: Operate independently in complex, ill-defined contexts requiring personal responsibility and initiative, accurately self-evaluate and take responsibility for learning requirements; be aware of social and ethical implications of applying knowledge in particular contexts.

Graduate Attribute 10: Engineering professionalism

Demonstrate critical awareness of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence.

Range Statement*:* Evidence includes case studies typical of engineering practice situations in which the graduate is likely to participate. Ethics and the professional responsibility of an engineer and the contextual knowledge specified in the range statement of Graduate Attribute 7 is generally applicable here.

Graduate Attribute 11: Engineering management

Demonstrate knowledge and understanding of engineering management principles and economic decision-making.

Range Statement: Basic techniques from economics, business management; project management applied to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Admission Requirements

The admission to the proposed programme is subject to the MUT's general academic admission rules andthe specific requirements of the

Faculty of Engineering. In addition, students must be in possession of:

- National Diploma in Mechanical Engineering (NQF Level 6)
- Diploma in Mechanical Engineering (NQF Level 6)
- An appropriate National Diploma in Mechanical Engineering equivalent to NQF Level 6
- A cognate qualification in mechanical engineering equivalent to NQF level 6 – foreign qualifications approved by SAQA.

Duration of Study
The minimum study period for the Advanced Diploma in Mechanical Engineering is one-year full time or two years part -time.

Curriculum Compilation
The curriculum compilation for Advanced Diploma in Mechanical Engineering is as follows:

SUBJECT CODE	MODULE TITLE	S1/S2/Y	NQF LEVEL	ASSESSMENT SE/C	CREDITS	COMPULSORY/ ELECTIVE	Pre-requisites
DEPR 470	Design Project IV	Y	7	Continuous	28	C	
MTHM 471	Mathematics IV,	S1	7	Examination	12	C	
THER 471	Thermodynamics IV,	S1	7	Examination	12	C	
FLUM 471	Fluids IV,	S1	7	Examination	12	C	
MEVI 471	Mechanical vibration,	S1	7	Examination	12	C	
ENPM 471	Engineering Business and Project management	S1	7	Examination	8	C	
TURB 472	Turbomachinery,	S2	7	Examination	12	C	Fluid Mechanics IV
STAN 472	Stress Analysis,	S2	7	Examination	12	C	
AUCO 472	Automatic Control	S2	7	Examination	12	C	
RACO 472	Refrigeration and air conditioning	S2	7	Examination	12	C	Thermodynamics IV,
EENG 472	Environmental engineering	S2	7	Examination	12	C	

Examination Regulations
Refer to the General Handbook Rule: G22.

i. **Assessments**
A candidate will undergo two distinct assessments in the Advanced diploma programme: academic assessment and graduate attributes assessment.

ii. **Pass Requirements**
To pass a subject the candidate must obtain a final mark of 50% or more in the academic assessment and must satisfy the requirements of the graduate attribute development and/ or assessment concurrently.

iii. **Practicals**
The attendance of all practical classes is compulsory. Failure to attend practicals will result in the candidate not obtaining a course mark for that subject.

COURSE CURRICULUM

Subject Code	Subject includes
	Annual
Design Project IV	The Literature Review; Design Project Methodology; Design Project Calculations; Results and Discussion; Design Project / Manufacturing drawings and Formatting and Formalities
	Semester 1
Mathematics IV	Multiple Integrals; Partial Differential Equations; Vector Calculus
Thermodynamics IV	One Dimensional Steady State Heat Conduction; Multi-dimensional Steady State Heat Conduction; Unsteady State Heat Conduction; Convection; Heat Exchangers; Boiling and Condensation; Radiation Heat Transfer and Mass Transfer
Fluid IV	Flow in Pipe Networks; Boundary Layers; External flow over bodies and Fluid Friction; Dimensional Analysis and Similarity; Compressible Flow
Mechanical Vibration	• Single degree of freedom of systems (SDOF): Free Vibration; Forced Vibration; Application of forced SDOF Systems • Multi degree of freedom of systems (MDOF)
Eng. Business & Project Management	Engineering Project Management; Project Life Cycle and Phases; Project Planning and Scheduling; Project Costing; Organizational Structures; Entrepreneurship; Marketing Plan; Organizational and financial Plan; Business Transportation and Logistics
	Semester 2
Refrigeration & Air-conditioning	Heat Transfer; Refrigeration and air conditioning applications; Cycle Diagrams; Multi- Stage Vapour Compression Refrigeration Systems; Vapour Absorption Refrigeration Systems; Refrigeration Plant Components; Psychometrics; Air conditioning systems; Air conditioning equipment, components, and controls; Heat load calculations.
Turbo Machines	Basic Concepts of Turbo Machines; Basic Equations and dimensional analysis; Centrifugal compressors and fans; Axial flow compressors and fans; Axial flow steam and gas turbines; Radial flow gas turbines.
Stress Analysis	Mechanical Properties of Metals; Cracking in Metals; Fracture Mechanics; Finite Element Method (FEM) and Finite Element Analysis (FEA)
Automatic Control	Principles of control systems; Control Loop Block Diagrams; Two Position and PID Control Systems (Controllers; Actuators; Sensors & Programming).
Environmental Engineering	Industry Approaches to Waste Management; Cost of Environmental Management; Environmental System Analysis & Risk Assessment; Occupational Health and Safety Act 85 of 1993 and Regulations; Solid waste management, Air pollution Control; Wastewater management.

IMPORTANT NOTICE

The department rules must be read in conjunction with the Mangosuthu University of Technology's General Handbook Rules.

INDEMNITY CLAUSE

Mangosuthu University of Technology is not liable to the learner or any third party for any demands, loss of life or amenities caused in whatever manner to the learner at the workplace where the Work Integrated Learning takes place. Despite the, it is the responsibility of the learner to inform Mangosuthu University of Technology in writing of an unsafe or unhealthy conditions in the workplace where the student is receiving the training. Whilst every effort will be made to help students in securing placement for Work Integrated Learning the University does not guarantee such placements.