VAAL UNIVERSITY OF TECHNOLOGY

ENGINEERING & TECHNOLOGY

Prospectus

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NB:

Although the information contained in this Faculty Prospectus has been compiled as accurately as possible, the Council and the Senate of the Vaal University of Technology accept no responsibility for any errors or omissions.

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1. WELCOME BY THE EXECUTIVE DEAN

As the Dean of the Faculty of Engineering and Technology (FET), I welcome all new students to Vaal University of Technology (VUT). The VUT is the only university in the region of southern Gauteng in South Africa and the FET is at the forefront of training eligible South Africans towards becoming successful engineers and entrepreneurs. The faculty comprises of four (4) departments, namely

- Department of Chemical and Metallurgical Engineering
- Department of Civil Engineering
- Department of Electrical Engineering: Consist of Power Engineering, Electronic Engineering and Process Control and Computer Systems Engineering.
- Department of Industrial Engineering and Operations Management and Mechanical Engineering

There are two (2) departments at Secunda campus which are part of the programme offering in Vanderbijlpark campus under Department of Chemical and Metallurgical Engineering, and Department of Electrical Engineering. Please note that the Secunda campus will close down at the end of 2022 academic year and all engineering programmes will be offered only in Vanderbijlpark campus.

These departments have strong foundations in knowledge, driven for career practices. The programmes in the faculties are accredited by the Engineering Council of South Africa (ECSA) and our graduates are internationally recognised through their qualification when registered with ECSA.

The focus of the faculty is to meet the strategic goals and the objectives of the VUT emanating from its vision and mission. There is a clear mandate to provide quality teaching and learning; increase research productivity; promote innovation, commercialisation and community engagement; and improve financial sustainability. The pursuit of cutting-edge technology to address the challenging needs in our environment and within the community continues to be the objective of the FET.

As you participate in the teaching and learning activities, be diligent and make use of the resources provided to develop your skills. This will enhance your personal capacity required for a good practicing engineer. The current crisis created by Covid-19 has pushed the FET to adapt and change from the face-to-face contact teaching and learning to the 'new normal' of blended learning − online teaching and learning that is shared with contact practices. The VUT online teaching and learning platform, VUTela, will be used for teaching and learning correspondence with your lecturer and you will be informed of other platforms if necessary. Therefore, you are encouraged to learn how to use VUTela as quickly as possible because it will improve your delivery and performance in all correspondence with lecturers.

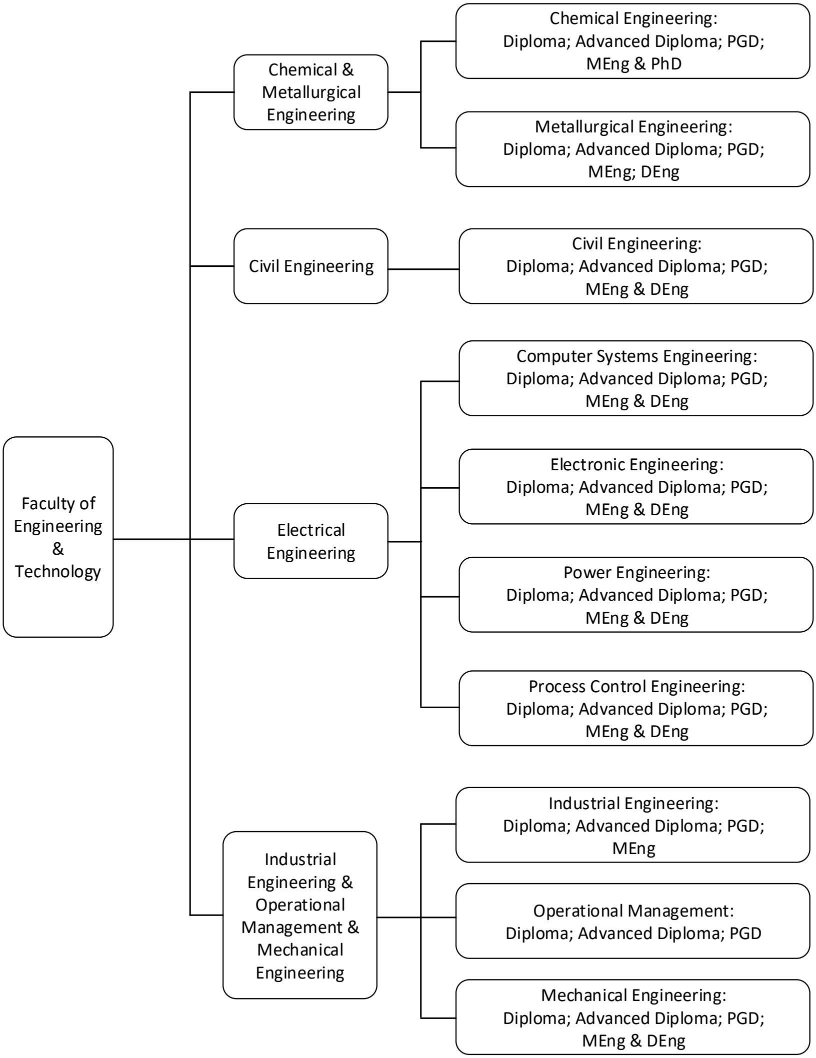
It is important to consider the essential personal values that will carry you throughout the course of your studies and contribute to your success. These include academic discipline; commitment to your studies; respect for others; attention to class attendance; attention to acceptable ethical behaviour; and willingness to complete tasks given by lecturers in order to meet deadlines. Your personal attributes and hardworking behaviour will create a lifelong character trait that will elevate you and keep you at the top of leadership in your academic-, social- and workplace environment.

Programmes offered in each department are detailed in this Prospectus. In addition, it contains the staff composition and the structure of the curricula.

Once again, I welcome you to the Vaal University of Technology! Enjoy it!!!

Prof PO Osifo
Executive Dean

2. FACULTY: DEPARTMENT STRUCTURE AND QUALIFICATIONS



3. PROFESSIONAL BODY, PROGRAMME ACCREDITATION AND PROFESSIONAL REGISTRATION

The Engineering Council of South Africa (ECSA) audit all the engineering programmes offered at the Vaal University of Technology every four years. ECSA awards an accreditation status to each programme that meets the standard for the award of the qualification. The standards are designed to meet the educational requirement towards registration as a Candidate or Professional Engineering Technician with ECSA and acceptance as a candidate to write the examinations for Certificated Engineers (for Diploma in Engineering Programmes) and the educational base required for registration as a Professional Engineering Technologist and/or Certificated Engineer with ECSA (for the Advanced Diploma in Engineering Programmes).

ECSA is a statutory body established in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000). ECSA's predecessor was established by the Engineering Profession of South Africa Act, 1990 (Act No. 114 of 1990). ECSA sees itself in partnership with the State and the engineering profession to promote a high level of education and training of practitioners in the engineering profession so as to facilitate full recognition of professionalism in the engineering profession, both locally and abroad. It enjoys full autonomy, although it is accountable to the State, the profession and the public for the fair and transparent administration of its business in the pursuit of its goals.

However, in pursuing its goal, ECSA has an implied responsibility to ensure that the interests of the profession (the practitioners) are also promoted. The interest of the public and the country can only be served properly if a profession is healthy and strong. For this reason, ECSA promotes the well-being of the voluntary societies which are active in engineering. Since the societies are the instruments through which the interests of the practitioners are served, a good balance between "public interests" (ECSA) and "own interests" (Societies) should be maintained.

3.1 Statutory Functions of ECSA

In order to achieve the Act's main focus, ECSA is empowered to perform a variety of functions, such as:

- Setting and auditing of academic standards for purposes of registration through a process of accreditation of engineering programmes at universities and universities of technology;
- Setting and auditing of professional development standards through the provision of guidelines which set out ECSA's post-qualification requirements for registration in the four professional categories of registration, namely Professional Engineer, Professional Engineering Technologist, Professional Certificated Engineer and Professional Engineering Technician as well as for Specified Categories, such as Registered Lift Inspectors;
- Prescribing requirements for Continuing Professional Development and determining the period within which registered persons must apply for renewal of their registrations;
- Prescribing a Code of Conduct and Codes of Practice, and enforcing such conduct through an Investigating Committee and a Disciplinary Tribunal;
- Identification of work of an engineering nature that should be reserved for registered persons by the Council for the Built Environment (CBE), after consultation with the Competition Board;
- Advising the Council for the Built Environment (CBE) and Minister of Public Works on matters relating to the engineering profession and cognate matters;
- Recognition of professional associations, such as engineering associations, institutes/organisations and societies;
- Publication of a guideline tariff of fees for consulting work, in consultation with government, the profession and industry; and
- Doing such other things may be necessary for the proper performance of its functions in terms of the Act.

3.2 HEQSF Alignment and Professional Registration with ECSA

Programmes offered in the Faculty of Engineering and Technology of Vaal University of Technology (VUT), Vanderbijlpark Campus are Higher Education Qualification Sub Framework (HEQSF) aligned qualifications, i.e. Diploma in Engineering and Advanced Diploma in Engineering. These programmes are a replacement of the old NATED 151 qualifications: National Diploma: Engineering and Baccalaureus Technologiae: Engineering that is not aligned to the HEQSF.

3.2.1 Why the need to be HEQSF Aligned?

ECSA pegs the accreditation of the current and upcoming Engineering Programmes on the HEQSF educational requirements, as shown in Figure 1. In terms of a graduate's need to register professionally, his/her education must also be aligned to the HEQSF requirements as well as ECSAs requirements. Figure 2 depicts a Professional Registration Pathway as a Technologist, the route that is to be followed by a graduate from this programme. Figure 3 depicts the ECSA – HEQSF articulation route.

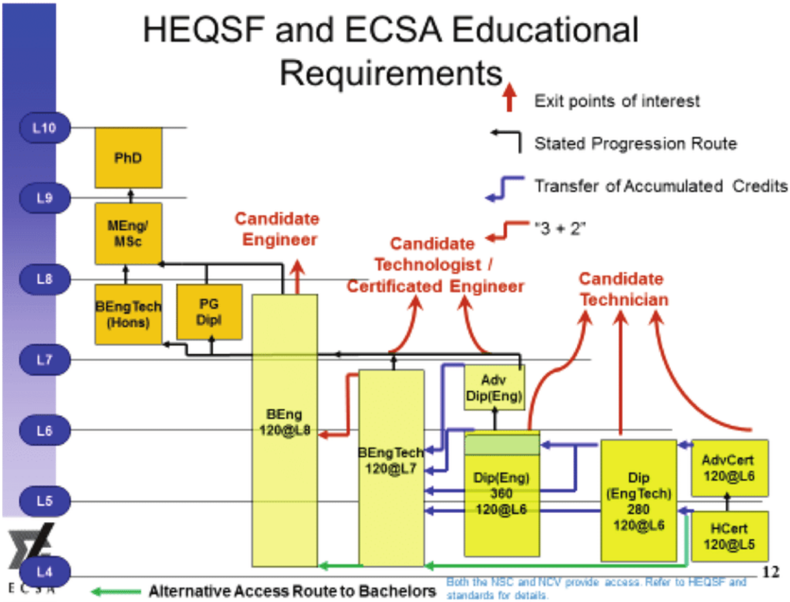


Figure 1: The HEQSF and ECSA educational requirements and progression (after ECSA) (2015)

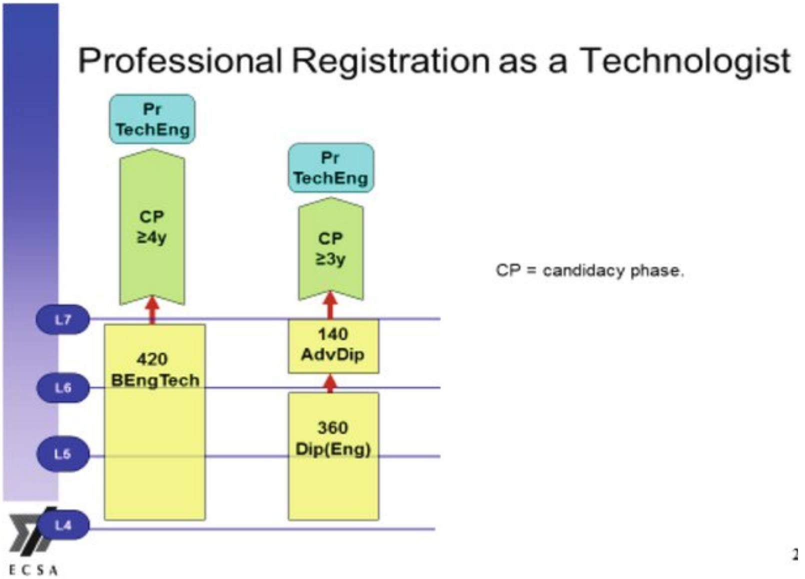


Figure 2: Professional Technologist registration (after ECSA) (2015)

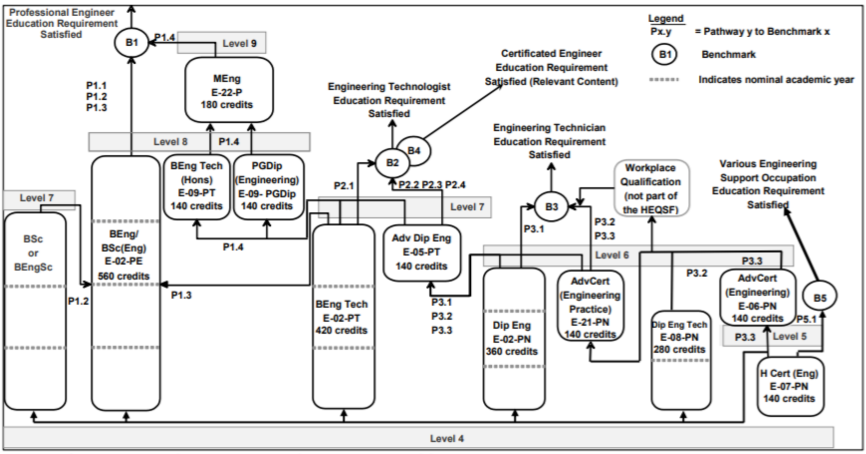


Figure 3: Graphical view of Engineering qualifications in HEQF (ECSA Doc Nr E-23-P)

The Candidacy Phase (CP) is a post-qualification practical experience period required for one to transcend from a candidate to full Professional status of registration in the respective category. More information and application forms can be obtained from the Faculty of Engineering & Technology or directly from:

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

Tel: +27 11 607 9500
Fax: +27 11 622 9295
Website: www.ecsa.co.za

4. PURPOSE OF QUALIFICATIONS

4.1 Diploma in Engineering

The primary purpose of this vocationally-oriented diploma 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 one or more engineering disciplines as a foundation for further training and experience towards becoming a competent engineering technician.

Specifically, the qualification provides:

- A thorough grounding in mathematics and natural sciences specific to the field, engineering sciences, engineering design and the ability to apply established methods. Engineering knowledge is complemented by methods for understanding the impacts of engineering solutions on people and the environment;
- Preparation for a career in engineering itself and areas that potentially benefit from engineering skills, for achieving technical proficiency and to make a contribution to the economy and national development;
- 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; and
- For graduates with an appropriate level of achievement, the ability to enter the upcoming Advanced Diploma in Engineering programme.

The candidate engineering technician (the graduate) completing this qualification will be able to demonstrate competence in the following twelve graduate attributes (GAs) as stipulated in the ECSA Qualification Standard for Diploma in Engineering: NQF Level 6 (ECSA Document E-02-PN or ECSA Document E-01-P).

Graduate Attribute 1: Problem-solving

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

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.

Graduate Attribute 3: Engineering design

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

Graduate Attribute 4: Investigations, experiments and data analysis

Conduct investigations of *well-defined* problems through locating and searching relevant codes and catalogues, conducting standard tests, experiments and measurements.

Graduate Attribute 5: Engineering methods, skills and 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.

Graduate Attribute 6: Professional and technical communication

Communicate effectively, both orally and in writing, within an engineering context.

Graduate Attribute 7: Sustainability and 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.

Graduate Attribute 8: Individual, team and multidisciplinary working

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.

Graduate Attribute 9: Independent learning ability

Engage in independent and life-long learning through *well-developed* learning skills.

Graduate Attribute 10: Engineering professionalism

Understand and commit to professional ethics, responsibilities and norms of engineering technical practice.

Graduate Attribute 11: Engineering management

Demonstrate knowledge and understanding of engineering management principles.

Graduate Attribute 12: Workplace practices

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

4.1.1 Progression and Pathway

- As shown in Figures 1 & 2, completion of this 360-credit Diploma meets the minimum entry requirement for admission to an Advanced Diploma designed to support articulation to satisfy an engineering technologist education benchmark. This Diploma provides the base for the graduate to enter training and experience toward independent practice as an engineering technician and registration as a Professional Engineering Technician.
- This qualification lies in a HEQSF Vocational Pathway.

4.2 Advanced Diploma in Engineering

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 particular field or discipline 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. Programmes leading to this qualification tend to have 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 educational programmes designed to meet this qualification is to build the necessary knowledge, understanding, abilities and skills required for further learning towards becoming a competent practising engineering technologist or certificated engineer.

This qualification provides:

- Preparation for careers in engineering itself and areas that potentially benefit from engineering skills, for achieving technological proficiency and to make a contribution to the economy and national development;

- The educational base required for registration as a Professional Engineering Technologist and/or Certificated Engineer with ECSA;
- Entry to NQF level 8 programmes, e.g. Honours, Post Graduate Diploma and B Eng programmes and then to proceed to master's programmes;
- For certificated engineers, this provides the education base for achieving proficiency in mining/factory plant and marine operations and occupational health and safety.

Engineering students completing this qualification will demonstrate competence in all the eleven Graduate Attributes (GAs) contained in the Qualification Standard for Advanced Diploma in Engineering: NQF Level 7 (ECSA Document E-05-PT or ECSA Document E-01-P). The GAs is stipulated below.

Graduate Attribute 1: Problem solving

Apply engineering principles to systematically diagnose and solve *broadly defined* engineering problems.

Graduate Attribute 2: Application of scientific and engineering knowledge

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

Graduate Attribute 3: Engineering design

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

Graduate Attribute 4: Investigations, experiments and data analysis

Conduct investigations of *broadly defined* problems through locating, searching and selecting relevant data from codes, databases and literature, designing and conducting experiments, analysing and interpreting results to provide valid conclusions.

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

Use appropriate techniques, resources, and modern engineering tools, including information technology, prediction and modelling, for the solution of *broadly defined* engineering problems, with an understanding of the limitations, restrictions, premises, assumptions and constraints.

Graduate Attribute 6: Professional and technical communication

Communicate effectively, both orally and in writing, with engineering audiences and the affected parties.

Graduate Attribute 7: Sustainability and 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 analysis and evaluation.

Graduate Attribute 8: Individual, team and multidisciplinary working

Demonstrate knowledge and understanding of engineering management principles and apply these to one's own work, as a member and leader in a team and to manage projects.

Graduate Attribute 9: Independent learning ability

Engage in independent and life-long learning through *well-developed* learning skills.

Graduate Attribute 10: Engineering professionalism

Comprehend and apply ethical principles and commit to professional ethics, responsibilities and norms of engineering technology practice.

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

Differentiation of Professional Engineering Technologist and Professional Certificated Engineer

Professional Engineering Technologist:

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

Professional Certificated Engineer:

- Professional Certificated Engineers are characterised by the ability to apply established and newly developed engineering technology to solve ***broadly defined*** problems, develop components, systems, services and processes in specific areas where a legal appointment is required in terms of either the Occupational Health and Safety Act, the Mines Health and Safety Act, or the Merchant Shipping Act, e.g. factories, mines and marine environments;
- Professional Certificated Engineers provide leadership in safety, health, engineering and commercially effective operations and have ***well-developed*** managerial skills;
- They work independently and responsibly, applying judgement to decisions arising in the application of technology and health and safety considerations to problems and associated risks;
- Professional Certificated Engineers have a specialised understanding of engineering sciences underlying manufacturing, marine, mining, plant and operations, together with financial, commercial, legal, socio-economic, health, safety and environmental methodologies, procedures and best practices.

4.2.1 Progression and Pathway

- As shown in Figures 1 & 2, completion of this 140-credit Advanced Diploma is the minimum entry requirement for admission to a Bachelor Honours Degree or Postgraduate Diploma. Entry into these qualifications is usually in the area of specialisation or in the discipline taken as a major in the Advanced Diploma, after completion of the Diploma in Engineering or equivalent. In addition, the graduate attributes are such that a graduate may also meet requirements for entry to a number of programmes including:
  - A candidacy programme toward registration as a Professional Engineering Technologist;
  - In certain disciplines, progression toward the Government Certificate of Competency;
  - With appropriate work experience, a Master of Business Administration or similar programme.
- This qualification lies on a HEQSF Professional Pathway

4.3 Postgraduate Diploma

A postgraduate diploma is a postgraduate qualification characterised by the fact that it serves to strengthen and deepen the student's knowledge in a particular discipline or profession. This qualification typically follows a bachelor's degree, advanced diploma or relevant level 7 qualification and serves to consolidate and deepen the student's expertise in a particular discipline, and develop competence to solve complex problems, and lay the foundation for research capacity in the methodology and techniques of that discipline. This qualification demands a high level of theoretical engagement and intellectual independence as well as the ability to relate knowledge to a range of contexts in order to undertake professional or highly skilled work.

This qualification provides:

- Preparation for careers in engineering itself and areas that potentially benefit from engineering skills, for achieving technological proficiency and to make a contribution to the economy and national development;
- Entry to a cognate NQF level 9 Master's Degree, e.g. MSc/MEng; and
- Access to register as a professional engineer through a relevant master's degree

Engineering students completing this qualification will demonstrate competence in all the twelve Graduate Attributes (GAs) contained in the Qualification Standard for Postgraduate Diploma in Engineering: NQF Level 8 (ECSA Document E-09-PGDip or ECSA Document E-01-P). The GAs is stipulated below.

Note: General Range Statement: The competencies defined in the eleven graduate attributes may be demonstrated in a provider-based and/or simulated workplace context.

Graduate Attribute 1: Problem solving

Identify, formulate, analyse and solve *complex problems* creatively and innovatively.

Graduate Attribute 2: Application of scientific and engineering knowledge

Demonstrate competence to apply knowledge of mathematics, natural science and engineering sciences to the conceptualisation of engineering models and to solve *complex problems*.

Graduate Attribute 3: Engineering design

Demonstrate competence to perform creative, procedural and non-procedural design and syntheses of components, systems, engineering works, products or processes of a *complex* nature.

Graduate Attribute 4: Investigations, experiments and data analysis

Demonstrate competence to conduct investigations of *complex problems,* including engagement with the research literature and use of research methods, including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

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

Demonstrate competence to use appropriate techniques, resources, and modern engineering tools, including information technology, prediction and modelling, for the solution of *complex problems*, with an understanding of the limitations, restrictions, premises, assumptions and constraints.

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.

Graduate Attribute 7: Sustainability and impact of engineering activity
Demonstrate knowledge and understanding of the impact of engineering activities on society, economy, industrial and physical environments.

Graduate Attribute 8: Individual, team and multidisciplinary working

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

Graduate Attribute 9: Independent learning ability

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

Graduate Attribute 10: Engineering professionalism

Comprehend and apply ethical principles and commit to professional ethics, responsibilities and norms of engineering practice.

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

4.4 Master of Engineering

The purpose of the qualification Master of Engineering is to develop a researcher with advanced abilities in applying fundamental technological and engineering design, synthesis and related principles to solve problems of society at large. One of the main objectives of this process is to develop an advanced capability to do research independently. It also promotes a lifelong learning approach.
The qualified student will be able to:

- Identify, assess, formulate, interpret, analyse and solve engineering research and development problems creatively and innovatively by applying relevant knowledge of, i.e. Mathematics, Basic Science and Engineering Sciences in the chosen field of research;

- Plan and manage engineering research projects, demonstrating fundamental knowledge, understanding and insight into the principles, methodologies and concepts that constitute socially responsible (to local and other communities) engineering research/development in the chosen field of research practice;
- Work effectively, individually or with others, as a member of a team, group, organisation and the community or in multi-disciplinary environments in the chosen field of research;
- Organise and manage him/herself and their activities responsibly, effectively, professionally and ethically, accept responsibility within their limits of competence, and exercise judgment based on knowledge and expertise pertaining to the field of research;
- Plan and conduct applicable levels of investigation, research and/or experiments by applying appropriate theories and methodologies, and perform data analysis and interpretation;
- Communicate effectively, both orally and in writing, with engineering and specifically research audiences and the community at large, in so far as they are affected by the research, using appropriate structure, style and graphical support;
- Use and assess appropriate research methods, skills, tools and information technology effectively and critically in engineering research/development practice, and show an understanding and a willingness to accept responsibility for the impact of engineering research/development activities on society and the environment;
- Perform procedural and non-procedural design and synthesis of components, systems, works, products or processes as a set of related systems, and assess their social, legal, health, safety and environmental impact and benefits, where applicable, in the chosen field of research;
- Employ various learning strategies and skills to master outcomes required for preparing him/herself to engage in continuous learning, to keep abreast of knowledge and skills required in the engineering field;
- Participate as a responsible citizen in the life of local, national and global communities by acting professionally and ethically in the chosen field of research;
- Demonstrate, where applicable, cultural and aesthetic sensitivity across a range of social contexts in the execution of engineering research and development activities;
- Explore, where applicable, education and career opportunities through engineering problem-solving, design, technical research and managerial skills;

- Organise and develop entrepreneurial opportunities through engineering, technical research development and/or managerial skills.

4.5 Doctor of Engineering / PhD in Engineering

The purpose of the qualification Doctor of Engineering/PhD in Engineering is to develop a researcher with advanced abilities in applying fundamental engineering and technological sciences, design, synthesis and related principles independently to specific problems of society at large. One of the main objectives of this process is to develop an advanced capability to conduct fundamental engineering research of an original nature. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields.

The qualified student will be able to:

- Identify, assess, formulate, interpret, analyse and solve original engineering research / development problems creatively and innovatively by applying relevant advanced fundamental knowledge of i.e. Mathematics, Basic Science and Engineering Sciences in the chosen field of research;
- Plan and manage advanced engineering research projects, demonstrating fundamental knowledge, understanding and insight into the principles, methodologies and concepts that constitute socially responsible (to local and other communities) engineering research/development in the chosen field of research practice;
- Work effectively, individually or with others, as a member of a team, group, organisation and the community or in multi-disciplinary environments in the chosen field of research;
- Organise and manage him/herself activities responsibly, effectively, professionally and ethically, accept responsibility within his/her limits of competence, and exercise original judgment based on knowledge and expertise, pertaining to the field of research;
- Plan and conduct advanced investigations, research and/or experiments of an original nature by applying or developing appropriate theories and methodologies, and perform data analysis and interpretation;
- Communicate effectively, both orally and in writing, with specific research audiences and the community at large, in so far as they are affected by the research, using appropriate structure, style and graphical support;
- Use and assess appropriate advanced engineering research methods, skills, tools and information technology effectively and critically in research/development practice, and show an understanding and a willingness

to accept responsibility for the impact of engineering research/development activities on society and the environment;

- Perform procedural and non-procedural design and synthesis of components, systems, works, products or processes as a set of related systems and assess their social, legal, health, safety and environmental impact and benefits, where applicable, in the chosen field of research;
- Employ various learning strategies and skills to master outcomes required for preparing him/herself to engage in continuous learning, to keep abreast of knowledge and skills required in the engineering research/development field;
- Participate as a responsible citizen in the life of local, national and global communities by acting professionally and ethically in the chosen field of research;
- Demonstrate, where applicable, cultural and aesthetic sensitivity across a range of social contexts in the execution of engineering research/development activities;
- Explore, where applicable, education and career opportunities in advanced engineering research/development;
- Organise and develop, where applicable, entrepreneurial opportunities through engineering, technical research, development and/or managerial skills.

5. PHASING OUT OF NON-ALIGNED PROGRAMMES, CREDIT ACCUMULATION AND TRANSFER (CAT)

Phased out programmes

Non-aligned programmes	*Last year of registration of new intake*	*Comments*
National Diploma (ND)	2016	Replaced by Diploma in terms of the HEQSF*
Baccalaureus Technologiae (BTech)	2019 Students are allowed until 2022 to complete outstanding modules for the qualification.	Replaced by the Advanced Diploma in terms of the HEQSF*
Magister Technologiae (MTech)	2022	Replaced by the relevant new master's qualification in terms of the HEQSF*

**A comprehensive system approved by the Minister of Higher Education and Training for the classification, registration, publication and articulation of quality-assured national qualifications*

Credit accumulation and transfer (CAT) and articulation

Description of programme	***Comments***
Non-aligned National Diplomas (ND) Credit Accumulation and Transfer (CAT)	Students in possession of credits for an incomplete non-aligned diploma may be granted credits towards the relevant new diploma *(CHE Policy on CAT 5.2.6)*. Students may be granted credits for modules (not more than 50%) *(CHE Policy on CAT 5.2.5).* Credits obtained from another institution can be transferred to a cognate VUT qualification *(VUT CAT Policy).* The granting of credits is undertaken by the relevant HoD, together with the module co-ordinator and a subject specialist. Factors such as nature of the qualification, the relationship between them, the nature, complexity, and extent of the curricula associated with the specific module to be recognised and the nature of the assessment used will be taken into consideration in the granting of credits *(CHE Policy on CAT 5.2.5).*
BTech articulation	Students in possession of a BTech qualification or an appropriate NQF level 8 qualification may be allowed to articulate into the new relevant master's qualification. The articulation is permitted within the constraining parameters set by the requirements of a specific curriculum *(CHE CAT Policy 5.15).* In addition, students must have a credit-bearing research component in the BTech or relevant NQF level 8 qualification *(Senate approval 9 November 2018*). Students who possess a BTech or relevant NQF level 8 qualification **BUT** do not meet the entry requirements into a master's qualification may be allowed to enrol for the relevant post-graduate diploma.

6. ADMISSION REQUIREMENTS: FET COLLEGES OR TVET COLLEGES

For applicants who obtained a qualification from Further Education and Training (FET) Colleges or Technical and Vocational Education and Training (TVET) Colleges:

Minimum statutory admission requirements - NC(V) level 4 Qualification:

Prospective candidates must meet the minimum statutory requirements for students in possession of an NC(V) 4 qualification, as laid out in the prescripts of the Government Gazette no. 32743 of 26 November 2006, to be eligible for admission to a diploma (Main stream/extended) i.e. 50% in three fundamental subjects, one of which must be English; and 50% in three compulsory vocational modules (see Table 1 below).
*Candidates must note that, according to Section 37 (i) of the Higher Education Act (Act 101 of 1997), the decision to admit a student to higher education study is the right and responsibility of the higher education institution concerned. This implies that **individual institutions may set additional admission requirements for specific programmes.***

Admission requirements for students with N3, N4, N5 and N6 qualifications:
The following admission requirements apply:
A candidate with a FET N3, N4, N5 or N6 certificate may qualify for admission to the first year of a diploma/extended diploma qualifications in the Faculty of Engineering and Technology, VUT.

- Based on his or her seven best subjects for N4/N5 or N5/N6 with a minimum of 50%.
- However, a candidate must meet the minimum admission requirements, including the language requirement (50%), on VUT scoring scale (see Table 2 below).
- A candidate with an N3, N4, N5 or N6 certificate does not qualify for any subject recognition.
- Subject recognition may be granted to FET students who have successfully completed their FET N6 diplomas. Such subject recognition will only be considered for first-year VUT diploma subjects and will only be based on FET N6 level diploma subjects completed successfully. These subjects must be passed at N4, N5 and N6 level with a score of 60% or above. The subject exemption must be decided by HOD and approved by the Dean of FET.
- Only students who have successfully completed FET N6 Diploma will be admitted into Diploma programmes of VUT.
- Programme prerequisites must be met before a candidate will be admitted to a specific programme of their choice if exemption is to be granted.

Table 1: Admission requirements for prospective students with NC(V)-4 qualification.

Qualification	Compulsory Subjects	Minimum for Diploma programme	*NC-V*
<u>Diploma</u>: Chemical Engineering Civil Engineering Electrical Engineering: ▪ Electronic ▪ Power ▪ Process Control & Computer Systems Industrial Engineering Mechanical Engineering Metallurgical Engineering	Mathematics	4	3 = 40 – 49% (Not yet competent) 4 = 50 – 59% (Competent) 5 = 60 – 69% (Competent) 6 = 70 – 79% (Highly competent) 7 = 80 – 89% (Outstanding competent) 8 = 90 – 100%
	Physical Sciences/ Engineering Sciences	4	
	English Language	4	
	Any other three (3) vocational subjects relevant to your discipline with a minimum competence level of 3 (50-59%)	4	
	Total	**24**	

Table 2: VUT scoring scale for N qualifications

Symbol achieved	N3	N4/N5/N6
A	6	8
B	5	7
C	4	6
D	3	5
E	2	4

7. DEPARTMENT OF CHEMICAL AND METALLURGICAL ENGINEERING

7.1 CHEMICAL ENGINEERING

Discipline Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Seodigeng, T (Dr)	HoD	PhD
Visagie AM (Ms)	Administrator	AdvDip
Rutto, HL (Prof)	Associate Professor	PhD
Shoko, L (Dr)	Senior Technologist	PhD
Ngoy, E (Dr)	Senior Lecturer	PhD
Tshilenge, KJ (Dr)	Senior Lecturer	DTech
Brink, CJ (Mrs)	Lecturer	BEng
Dube, G (Mr)	Lecturer	MTech
Khoza, CN (Mr)	Lecturer	MEng
Lerotholi, L (Mrs)	Lecturer	MEng
Mabuza, M (Dr)	Lecturer	DTech
Modiba, E (Mr)	Lecturer	MTech
Nyembe N (Mr)	Lecturer	MTech
Mathebula, G (Mr)	Laboratory Technician	BTech
Mbedzi, R (Mr)	Laboratory Technician	MTech
Muthubi, SS (Ms)	Laboratory Technician	BTech

7.1.1 Diploma in Chemical Engineering (DI0800)

7.1.1.1 Programme Structure

Three (3) year full-time qualification:

- Two and a half years (Five semesters S1 to S5) at the Vaal University of Technology
- One semester (6 months) Workplace Based Learning (WBL)

7.1.1.2 Purpose of the Diploma in Chemical Engineering

The generic purpose of the qualification is spelled out in paragraph 4.1 and must be read in conjunction with the following.

The purpose of the qualification Diploma in Chemical Engineering is to develop the necessary knowledge, unde3 a competent practicing Chemical Engineering Technician. It is intended to subsequently empower candidate Engineering Technicians to demonstrate that they are capable of applying their acquired knowledge, understanding, skills, attitudes and values in the work environments in South Africa. It is designed also to add value to the qualifying student in terms of enrichment of the person, status and recognition.

The qualified technician may find himself / herself as a member of an engineering team which may consist of engineers, scientists, artisans, process personnel, technologists and technicians from other disciplines. Functions may include the commissioning and maintenance of chemical plants, process control, design and development, optimising of chemical processes, quality control over the products of the manufacturing processes, feasibility studies and a variety of tasks related to the chemical process industry.

7.1.1.3 Admission Requirements: Diploma in Chemical Engineering

NSC	Compulsory Subjects	Minimum for the Diploma programme	Notes
National Senior Certificate	Mathematics Physical Science English Language Any other subjects with a minimum level of 3, excluding Life Orientation **Total**	4 4 4 12 **24***	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79% 7 = 80 – 89% 8 = 90 – 100%

Please note:

- The prospective student's results must meet the statutory and programme admission requirement.
- Bonus points will only be used for selection purposes. In case of a tie and all other scores remaining the same use the actual percentages to differentiate.
- *Admission requirements for any of the **3-year Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 28 and above APS points, with a minimum of 4 for Mathematics, Physical Science and English.
- *Admission requirements for any of the **4-year extended Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 24 – 27 maximum APS points, with a minimum of 4 for Mathematics, Physical Science and English. Students that need more information regarding Extended programmes should liaise with their respective HODs and/or the faculty manager. The main purpose of extended programmes is to widen access and reinforce/improve success.
- All other grade 12 or equivalent certificates will be evaluated against/according to statutory and programme requirements.
- International qualifications: All international qualifications will be evaluated by the International Office based on the Swedish scale and SAQA equivalence.
- Transfers: Applications from students to transfer from other institutions will be dealt with in terms of the Recognition of Prior Learning and CAT policies of VUT.

7.1.1.4 Career Opportunities

A profession in the field of Chemical Engineering offers a challenging and exciting career in both the private and public sectors. There is a continuous demand for trained manpower in the field of Chemical Engineering. Job designations may vary from production foremen, area superintendents, line managers and various others within several branches of heavy, light and general types of industries where the services and expertise of such persons are required.

The qualified technician may find himself / herself as a member of an engineering team which may consist of engineers, scientists, artisans, process personnel, technologists and technicians from other disciplines. Functions may include the commissioning and maintenance of chemical plants, process control, design and development, optimising of chemical processes, quality control over the products of the manufacturing processes, feasibility studies and a variety of tasks related to the chemical process industry.

7.1.1.5 Curriculum: Diploma in Chemical Engineering (3 year programme)

MODULE CODE	NAME OF MODULE	CREDITS

SEMESTER 1		
HKCOX1A	Applied Communication Skills 1.1	8
AAECH1A	Engineering Chemistry 1	10
EEESK1A	Engineering Skills 1	5
ASICT1A	ICT Skills 1	10
AMMAT1A	Mathematics 1	10
APHYS1A	Physics 1	10
EESIN1A	Social Intelligence 1	3
SEMESTER 2		
HKCOY2A	Applied Communication Skills 1.2	8
AAECH2A	Engineering Chemistry 2	10
EMEDR1A	Engineering Drawing 1	10
EHITC1A	Introduction to Chemical Engineering 1	12
AMMAT2A	Mathematics 2	10
APHYT2A	Physics 2 (Theory)	5
APHYP2A	Physics 2 (Practical)	5
EHSPA1A	Safety Principles and Law 1	5
SEMESTER 3		
HKCOX2A	Applied Communication Skills 2.1	8
BHMAN1A	Management 1	10
EHCPI1A	Chemical Process Industries 1	12
AAECH3A	Engineering Chemistry 3	10
EHMEB2A	Material and Energy Balance 2	12
AMMAT3A	Mathematics 3	10
EHMPO1A	Mechanical Operation 1	12
SEMESTER 4		
HKCOY2A	Applied Communication Skills 2.2	8
EHCOA2A	Computing Applications 2	7
EHCEL1A	Chemical Engineering Laboratory 1	12

EHCET2A	Chemical Eng. Thermodynamics 1	12
EHHMT2A	Heat and Mass Transfer 1	12
EHPCO2A	Process Control 1	12
EHPFD2A	Process Fluid Dynamics 1	12
SEMESTER 5		
EHATH3A	Applied Thermodynamics 2	12
EHCPR3A	Chemical Process Design	12
EHENE1A	Environmental Engineering 1	12
EHRTE3A	Reactor Technology 1	12
EHSEP3A	Separation Processes 1	12
EHCEL2A	Chemical Engineering Laboratory 2	12
SEMESTER 6		
EHEXL1A	Workplace Based Learning 1	60

Curriculum: Diploma in Chemical Engineering (4 year Extended programme) – DE0801

The purpose of the Extended Diploma programme is to assist students who enter the University with APS score of 24 - 27 by giving them more time to reach the level of competency similar to those who enter with higher APS scores. The programme extends the 3-year programme into 4 years by spreading the first year of study over 2 years with the inclusion of foundational modules as well as mainstream programme modules. The foundation modules in the first year of study will help students to improve their competency in Maths, Physics, Chemistry and Drawing. In the second year of study, the students will augment their foundation knowledge of Maths, Physics, Chemistry and Drawing to reach the level of the mainstream programme. Students are required to pass all modules in both years of the foundation phase to be able to proceed to the next year of study.

MODULE CODE	NAME OF MODULE	TYPE	CREDITS	
			Regular	Found

YEAR 1 - SEMESTER 1				
AAXCH1A	Foundation Chemistry 1	Foundation		10
AMXMA1A	Foundation Mathematics 1	Foundation		10
APXPH1A	Foundation Physics 1	Foundation		10
ASICT1A	ICT Skills 1	Regular	10	
EEESK1A	Engineering Skills 1	Regular	5	
EESIN1A	Social Intelligence 1	Regular	3	
HKCOX1A	Applied Communication Skills 1.1	Regular	8	
YEAR 1 - SEMESTER 2				
AAXCH2A	Foundation Chemistry 2	Foundation		10
AMXMA2A	Foundation Mathematics 2	Foundation		10
APXPH2A	Foundation Physics 2	Foundation		10
EMXDR1A	Foundation Drawing 1	Foundation		10
EHSPA1A	Safety Principles and Law 1	Regular	5	
HKCOY1A	Applied Communication Skills 1.2	Regular	8	
YEAR 2 - SEMESTER 1				
AAECH1B	Engineering Chemistry 1	Regular (Augm)	10	
AMMAT1B	Mathematics 1	Regular (Augm)	10	
APHYS1B	Physics 1	Regular (Augm)	10	
EHITC1B	Intro to Chemical Engineering 1	Regular (Augm)	12	
EMEDR1B	Engineering Drawing 1	Regular (Augm)	10	

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"(+(0,-8&#.$&%$84+2%&)(54+$/9

7.1.1.6 Workplace Based Learning (WBL)

In order to qualify for the Diploma in Chemical Engineering, a minimum six-month period of suitable work integrated learning (WIL) in addition to the prescribed theoretical University training must be successfully completed. Work integrated learning refers to that component of co-operative education that can only be conducted by the employer in the workplace. This training provides the student with an opportunity to apply and develop the academic knowledge he/she received at the university to relevant problem situations in industry and exposure to typical organizational culture, human relations and working conditions.

With suitable guidance and supervision, the student is taught the responsibility to work independently and to develop an awareness of the ethics and requirements of industry. Work integrated learning may be done after completion of the total theoretical part of the Diploma, after S5 of uninterrupted theoretical training at the University. This will give the student sufficient theoretical knowledge to benefit from the training, especially as they progress through the more advanced module matter of S5 courses. To ensure the effectiveness of the work integrated learning, employer and University must co-operate as partners. The student will enrol for the module Chemical Engineering Practice at the University. The employer will act as an examiner and must award a mark for the work integrated learning. To pass the student must obtain 50%, and to pass with distinction 75%. The University acts as a moderator for the module.

The student must have a mentor, who will certify that the student has completed the work required satisfactorily. During work integrated learning, the student must submit three-monthly progress reports (10 pages minimum) that contain enough information so that the training received can be evaluated. This report must be approved by the student's mentor before being submitted to the Department of Chemical Engineering, Vaal University of Technology. On completion of the training period, the student must submit Semester report and Project (20 pages minimum). All reports should be ring-bounded otherwise it will not be accepted for marking.

7.1.2 Advanced Diploma in Chemical Engineering (AD0800)

This qualification is offered at Vanderbijlpark only.

7.1.2.1 Programme Structure

One-year full-time qualification.

7.1.2.2 Purpose of the Advanced Diploma in Chemical Engineering

The generic purpose of the qualification is spelled out in paragraph 4.2 and must be read in conjunction with the following. The purpose of this qualification is to equip students with advanced technical skills and competencies to work in industry as a professional technologist or to progress to do higher academic qualifications. The knowledge emphasises general principles and application or technology transfer. The qualification provides students with a solid foundation in Chemical Engineering and the ability to apply their knowledge and skills in the area of Chemical Engineering, while equipping them to undertake more specialised and intensive learning. This programme leads to a qualification that has a strong professional and career focus and holders of this qualification are prepared to enter the chemical and process industry.

Specifically, the programme design is to meet the industry and community requirements, therefore the qualification's purpose is to build the necessary knowledge, understanding, abilities and skills for further learning towards becoming a competent practicing engineering technologist. This qualification provides:

1. Preparation for careers in chemical engineering, for achieving technical proficiency and to make a contribution to the economy and national development;
2. The educational base required for registration as a Professional Engineering Technologist with ECSA.
3. Entry to NQF level 8 programmes e.g. Bachelor's, Honours and Postgraduate Diploma Programmes and then to proceed to master's Programmes (NQF level 9).

Engineering students completing this qualification will demonstrate competence in all the Exit Level Outcomes (ELO's)/Graduate Attributes contained in this standard.

7.1.2.3 Admission Requirements: Advanced Diploma in Chemical Engineering

A Diploma in Chemical Engineering (NQF level 6, 360 credits) or equivalent qualification.

All other equivalent qualifications will be considered on a case-by-case basis.

7.1.2.4 Curriculum: Advanced Diploma in Chemical Engineering

MODULE CODE	NAME OF MODULE	CREDITS
	Year Modules	

EHAPD4A	Advanced Process Design	30
EHRMP4A	Research Methodology and Project	28
Semester 1		
EHAEM4A	Advanced Engineering Mathematics	12
EHARE4A	Advanced Reaction Engineering	12
EHFLM4A	Advanced Fluid Mechanics	12
EHHMX4A	Advanced Heat, Mass Transfer and Separation: Mod 1	10
Semester 2		
EHHMY4A	Advanced Heat, Mass Transfer and Separation: Mod 2	11
EHMAN4A	Engineering Management	7
EHCEL4A	Chemical Engineering Laboratory	8
EHAPC4A	Advanced Process Control	12

7.1.3 Postgraduate Diploma in Chemical Engineering (PG0800)

This qualification is offered at Vanderbijlpark only.

7.1.3.1 Programme Structure

One-year, full-time qualification.

7.1.3.2 Purpose of the Postgraduate Diploma in Chemical Engineering

The purpose of this qualification is to strengthen and deepen students' knowledge in the chemical engineering discipline with advanced technical skills and competencies to work in industry as a professional technologist and/or to progress to do higher academic qualifications. The knowledge emphasises consolidation and deepening of discipline specific expertise and developing competence to solve complex problems as well as to lay strong foundation for research capacity in the methodology and techniques in the chemical engineering discipline. The qualification provides students with a high level of theoretical engagement and solid intellectual independence as well as the ability to apply their knowledge and skills to undertake professional and highly-skilled work in the area of Chemical Engineering and related and/or specialised disciplines. This programme leads to a qualification that has a strong professional and career focus and holders of this qualification are prepared to enter the chemical and process industry.

Specifically, the programme design is to meet the industry and community requirements, therefore the qualification purpose is to build necessary knowledge content areas – specifically mathematical and natural sciences, discipline-specific advanced engineering sciences, and engineering design and synthesis have been developed meet or exceed the requirements of an NQF level 8 qualification.

This qualification provides:

1. Preparation for careers in chemical engineering, for achieving technical proficiency and to make a contribution to the economy and national development;
2. Entry to NQF level 9 programmes e.g. Master's Degree Programmes such as MSc and MEng.
3. Access to register as a profession engineer through a relevant master's degree.

Engineering students completing this qualification will demonstrate competence in all the twelve (12) Graduate Attributes (GAs) contained in the Qualification Standard for Postgraduate Diploma in Engineering: NQF Level 8 (ECSA Document E-09-PGDip or ECSA Document E-01-P).

7.1.3.3 Admission Requirements

Advanced Diploma in Chemical Engineering and equivalent qualification (on NQF level 7, minimum 120 credits) such as BTech in Chemical Engineering.

All other equivalent qualifications will be considered on a case-by-case basis.

7.1.3.4 Curriculum: Postgraduate Diploma in Chemical Engineering

MODULE CODE	NAME OF MODULE	Core/ Fundamental/ Elective	CREDITS
SEMESTER 1			
EHPRM5A	Research Project (Chemical Engineering) *Full Year	Core	40
EHPEEX5A	Environmental Engineering I (Chemical Eng)	Core	15
EHPPDX5A	Chemical Process Design I (Chemical Eng)	Core	15
	Elective Group YI**	Elective	10
SEMESTER 2			

EHPEEY5A	Environmental Engineering II (Chemical Eng)	Core	15
EHPPDY5A	Chemical Process Design II (Chemical Eng)	Core	15
	Elective Group YII***	Elective	10

*Research Project (Chemical Engineering) (Full year)

** Elective Group YI *(Elective group Y = A or B)

*** Elective Group YII *(Elective group Y = A or B)

Module Elective Groups

The learners will first select a group among petroleum, mineral processing and bioprocessing. Elective YI and YII may not come from different groups. The elective group of modules to be offered will depend on admission numbers per group (Minimum of 20 students).

MODULE CODE	NAME OF MODULE	Core/ Fundamental/ Elective	CREDITS
Elective Group A			
EHPBEX5A	Bioprocess Engineering I	Elective	10
EHPBEY5A	Bioprocess Engineering II	Elective	10
Elective Group B			
EHPPEX5A	Petrochemical Engineering I	Elective	10
EHPPEY5A	Petrochemical Engineering II	Elective	10

7.1.4 Master of Engineering (MEng) in Chemical Engineering (MP0800)

This qualification is offered at the Vanderbijlpark campus only.

7.1.4.1 Programme Structure

At least 1 year full-time research, concluded with a Master Dissertation.

7.1.4.2 Purpose of the MEng in Chemical Engineering

The purpose of this qualification is to develop a student into a researcher, able to conduct independent research with minimum guidance in a chosen field of Chemical Engineering. The outcomes of the research will contribute to knowledge production in the specialisation field. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.4.)

7.1.4.3 Admission Requirements

BEng degree in Chemical Engineering or equivalent level 8 qualification including PGD in Chemical Engineering. Proof of successful completion of a Vaal University of Technology approved course in Research Methodology is required.

Ad hoc cases will be treated on merit.

7.1.4.4 Assessment

The department follows the assessment strategy of formal written examination. The year mark is compiled from a series of not less than three tests and / or a practical mark. The year mark for admittance to the formal examination is 50%. Weights for calculating the year mark as well as the final mark will be reflected in the Learning Guide. All tests, assignments and practical work done during a particular semester, will help learners learn and understand the work.

Some modules follow the assessment strategies of Continuous Assessment (CASS). All marks obtained during the semester will make up the learner's final mark. Each Learning Guide will indicate which tests and activities will contribute according to a pre-determined weight, to the final mark.

7.1.5 Doctor of Philosophy (PhD) in Chemical Engineering (708001)

7.1.5.1 Duration of Programme

At least two years full-time research, concluded with a Doctoral Thesis.

7.1.5.2 Admission Requirements

MEng (Chemical Engineering) or equivalent. Ad hoc cases will be treated on merit.

7.1.6 Enquiries

Enquiries may be addressed to:

HoD: Chemical and Metallurgical Engineering
Faculty of Engineering & Technology
Vaal University of Technology
Private Bag X021
VANDERBIJLPARK, 1900

Tel	:	+27 16 950 9655
Fax	:	+27 16 950 9796
e-mail	:	tumisangs@vut.ac.za
		rethav@vut.ac.za
Website	:	www.vut.ac.za

or

Postgraduate Office

Ms N Kokoali
Tel : +27 16 950 9288
e-mail : nomathembak@vut.ac.za

Mr S Motsie
Tel : +27 16 950 7639
e-mail : sehlabakam@vut.ac.za

7.2 METALLURGICAL ENGINEERING

Dìscipline Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Seodigeng, T (Dr)	HoD	PhD
Visagie, R (Ms)	Administrator	AdvDip
Mendonidis, P (Prof)	Associate Professor	PhD
Otunniyi, I (Prof)	Associate Professor	PhD
Matizamhuka, W (Dr)	Senior Lecturer	PhD
Baloyi, N (Mrs)	Lecturer	MTech
Kohitlhetse, I (Mr)	Lecturer	MTech
Lepule, M (Ms)	Lecturer	MTech
Maramba, B (Mr)	Lecturer	MSc
Motsetse, K (Ms)	Lecturer	MTech
Baloyi, MF (Ms)	Technician	NDip
Jeli, N (Mr)	Technician	BTech
Nemavhola, K. (Ms)	Technician	MTech
Ayo,T (Mr)	Laboratory Assistant	BSc
Van der Schyff, A (Ms)	WIL Coordinator	MTech

7.2.1 Diploma in Metallurgical Engineering (DI0850)

7.2.1.1 Programme Structure

Three-year full-time qualification.

Five semesters, S1 to S5 at the Vaal University of Technology.

One semester Workplace Based Learning (WBL).

7.2.1.2 Purpose of the Diploma in Metallurgical Engineering

The generic purpose of the qualification is spelled out in paragraph 4.1 and must be read in conjunction with the following:

The purpose of the qualification Diploma in Metallurgical Engineering is to develop the necessary knowledge, understanding and skills required for the student's further learning towards becoming a competent practicing Metallurgical Engineering Technician. It is intended to subsequently empower candidate Engineering Technicians to demonstrate that they are capable of applying their acquired knowledge, understanding, skills, attitudes and values in the work environments in South Africa. It is designed also to add value to the qualifying student in terms of enrichment of the person, status and recognition.

7.2.1.3 Admission Requirements

NSC	Compulsory Subjects	Minimum for the Diploma programme	Notes
National Senior Certificate	Mathematics Physical Science English Language Any other subjects with a minimum level of 3, excluding Life Orientation **Total**	4 4 4 12 **24***	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79% 7 = 80 – 89% 8 = 90 – 100%

Please note:

- The prospective student's results must meet the statutory and programme admission requirement.
- Bonus points will only be used for selection purposes. In case of a tie and all other scores remaining the same use the actual percentages to differentiate.
- *Admission requirements for any of the **3-year Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 28 and above APS points, with a minimum of 4 for Mathematics, Physical Science and English.
- *Admission requirements for any of the **4-year extended Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 24 – 27 maximum APS points, with a minimum of 4 for Mathematics, Physical Science and English. Students that need more information regarding Extended programmes should liaise with their respective HODs and/or the faculty manager. The main purpose of extended programmes is to widen access and reinforce/improve success.

- All other grade 12 or equivalent certificates will be evaluated against/according to statutory and programme requirements.
- International qualifications: All international qualifications will be evaluated by the International Office based on the Swedish scale and SAQA equivalence.
- Transfers: Applications from students to transfer from other institutions will be dealt with in terms of the Recognition of Prior Learning and CAT policies of VUT.

7.2.1.4 Career Opportunities

Many opportunities exist at primary producers of both ferrous and non-ferrous metals as well as in the manufacturing industry. Metallurgical Engineering Technicians may be involved in developing new processes / procedures in the extraction / manufacturing industry as well as optimising / improving existing processes; ensuring the quality of products during the different stages of the process and testing and inspection of the final material / product.

7.2.1.5 Curriculum: Diploma in Metallurgical Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
AMMAT1A	Mathematics 1	10
AAECH1A	Engineering Chemistry 1	10
APHYS1A	Physics 1	10
EESIN1A	Social Intelligence 1	3
EEESK1A	Engineering Skills 1	5
ASICT1A	ICT Skills 1	10
HKCOX1A	Applied Communication Skills 1.1	8
SEMESTER 2		
AMMAT2A	Mathematics 2	10
EMEDR1A	Engineering Drawing 1	10
APHYS2A	Physics 2	10
AAECH2A	Engineering Chemistry 2	10
EYSPA1A	Safety Principles and Law 1	5
EYCOA2A	Computing Applications 2	7

HKCOY1A	Applied Communication Skills 1.2	8
SEMESTER 3		
EYPTH1A	Process Thermodynamics 1	10
EYEME1A	Extractive Metallurgy 1	10
EYPME1A	Physical Metallurgy 1	10
EYMPR1A	Mineral Processing 1	10
EYMAM1A	Manufacturing Metallurgy 1	10
EYEGE1A	Engineering Geology 1	10
HKCOX2A	Applied Communication Skills 2.1	8
SEMESTER 4		
EYHYD2A	Hydrometallurgy 2	10
EYPYR2A	Pyrometallurgy 2	10
EYPME2A	Physical Metallurgy 2	10
EYMPR2A	Mineral Processing 2	10
EYMAM2A	Manufacturing Metallurgy 2	10
EBQCO2A	Quality Control 2	10
HKCOY2A	Applied Communication Skills 2.2	8
SEMESTER 5		
EYHYD3A	Hydrometallurgy 3	10
EYPYR3A	Pyrometallurgy 3	10
EYPME3A	Physical Metallurgy 3	10
EYMPR3A	Mineral Processing 3	10
EYMAM3A	Manufacturing Metallurgy 3	10
BHMAN1A	Management 1	10
EYENC1A	Environmental Geochemistry 1	8
SEMESTER 6		
EYWBL1A	Workplace Based Learning 1	60

Curriculum: Diploma in Metallurgical Engineering (4 year Extended programme) – DE0851

The purpose of the Extended Diploma programme is to assist students who enter the University with APS score of 24 - 27 by giving them more time to reach the level of competency similar to those who enter with higher APS scores. The programme extends the 3-year programme into 4 years by spreading the first year of study over 2 years with the inclusion of foundational modules as well as mainstream programme modules. The foundation modules in the first year of study will help students to improve their competency in Maths, Physics, Chemistry and Drawing. In the second year of study, the students will augment their foundation knowledge of Maths, Physics, Chemistry and Drawing to reach the level of the mainstream programme. Students are required to pass all modules in both years of the foundation phase to be able to proceed to the next year of study.

MODULE CODE	NAME OF MODULE	TYPE	CREDITS	
			Regular	Found
YEAR 1 - SEMESTER 1				
AAXCH1A	Foundation Chemistry 1	Foundation		10
AMXMA1A	Foundation Mathematics 1	Foundation		10
APXPH1A	Foundation Physics 1	Foundation		10
ASICT1A	ICT Skills 1	Regular	10	
EEESK1A	Engineering Skills 1	Regular	5	
EESIN1A	Social Intelligence 1	Regular	3	
HKCOX1A	Applied Communication Skills 1.1	Regular	8	
YEAR 1 - SEMESTER 2				
AAXCH2A	Foundation Chemistry 2	Foundation		10
AMXMA2A	Foundation Mathematics 2	Foundation		10
APXPH2A	Foundation Physics 2	Foundation		10
EMXDR1A	Foundation Drawing 1	Foundation		10
EYCOA2A	Computing Applications 2	Regular	7	
EYSPA1A	Safety Principles and Law 1	Regular	5	
HKCOY1A	Applied Communication Skills 1.2	Regular	8	
YEAR 2 - SEMESTER 1				
AAECH1B	Engineering Chemistry 1	Regular (Augm)	10	

AMMAT1B	Mathematics 1	Regular (Augm)	10	
APHYS1B	Physics 1	Regular (Augm)	10	
YEAR 2 - SEMESTER 2				
AAECH2A	Engineering Chemistry 2	Regular	10	
AMMAT2A	Mathematics 2	Regular	10	
APHYP2A	Physics 2 – Practical	Regular	5	
APHYT2A	Physics 2 - Theory	Regular	5	
EMEDR1B	Engineering Drawing 1	Regular (Augm)	10	

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7.2.1.6 Workplace Based Learning

The Diploma in Metallurgical Engineering has a formal six months workplace-based learning component that is coordinated by the Department of Metallurgical Engineering.

7.2.2 Advanced Diploma in Metallurgical Engineering (AD0850)

7.2.2.1 Admission Requirements

A Diploma in Metallurgical Engineering (NQF level 6, 360 credits) or the old National Diploma: Engineering Metallurgy.

7.2.2.2 Programme Duration

It is one-year full-time programme.

7.2.2.3 Purpose of the Qualification

The generic purpose of the qualification is spelled out in paragraph 4.2 and must be read in conjunction with the following. The purpose of the qualification Advanced Diploma in Metallurgical Engineering is to develop the necessary knowledge, understanding and skills required for the student's further learning towards becoming a competent practicing Metallurgical Engineering Technologist.

It is intended to subsequently empower candidate Engineering Technologist to demonstrate that they are capable of applying their acquired knowledge, understanding, skills, attitudes and values in the work environments in South Africa. It is designed also to add value to the qualifying student in terms of enrichment of the person, status and recognition.

7.2.2.4 Curriculum: Advanced Diploma in Metallurgical Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
AMMAT3A	Engineering Mathematics	10
SEMESTER 2		
EBQCO3A	Quality Control	10
SEMESTER 1 & 2 (Year Modules)		
EYHYD4A	Hydrometallurgy	20
EYPYR4A	Pyrometallurgy	20
EYPME4A	Physical Metallurgy	20
EYMIP4A	Mineral Processing	20
EYMAM4A	Manufacturing Metallurgy	20
EYPRO2A	Metallurgical Research Methods and Project	20

7.2.2.5 Career Opportunities

A successful candidate can pursue a career as a technologist in one of the following specialisation fields: Physical Metallurgy or Extractive Metallurgy.

7.2.3 Postgraduate Diploma in Metallurgical Engineering (PG0850)

7.2.3.1 Admission Requirements:

Admission requires a 120 credit Advanced Diploma (NQF level 7) in Metallurgical Engineering.

7.2.3.2 Duration of Programme:

This is a one-year full-time programme.

7.2.3.3 Curriculum: Postgraduate Diploma in Metallurgical Engineering

PHYSICAL METALLURGY OPTION

MODULE CODE	NAME OF MODULE	CREDITS
	SEMESTER 1	
EYPTH2A	Process Thermodynamics	10
EYMKR5A	Corrosion Engineering	10
	SEMESTER 2	
EYHMT5A	Heat and Mass Transfer	10
	SEMESTER 1 & 2 (Year Modules)	
EYMAS5A	Advanced Modelling and Simulation	20
EYPRO5A	Physical Metallurgy Research Project	30
EYPME5A	Physical Metallurgy	20
EYMAM5A	Manufacturing Metallurgy	20
EYMAE5A	Materials Engineering	20

EXTRACTIVE METALLURGY OPTION

MODULE CODE	NAME OF MODULE	CREDITS
	SEMESTER 1	
EYPTH2A	Process Thermodynamics	10
EYMKR5A	Corrosion Engineering	10
	SEMESTER 2	
EYHMT5A	Heat and Mass Transfer	10
	SEMESTER 1 & 2 (Year Modules)	
EYMAS5A	Advanced Modelling and Simulation	20
EYPRO5A	Extractive Metallurgy Research Project	30
EYMIP5A	Mineral Processing	20
EYHYD5A	Hydrometallurgy	20
EYPYR5A	Pyrometallurgy	20

7.2.4 Master of Engineering in Metallurgical Engineering (MEng (Metallurgical Engineering)) (MP0850)

7.2.4.1 Admission Requirements

A BEng Degree or equivalent NQF level 8 qualification including the Postgraduate Diploma.

7.2.4.2 Duration of Programme

The equivalent of one-year, full-time study.

6.2.4.3 Programme Structure

This instructional programme comprises of a dissertation only.

7.2.4.4 Purpose of the Master of Engineering in Metallurgical Engineering

The purpose of this qualification is to develop a student into a researcher, able to conduct independent research with minimum guidance in a chosen field of Metallurgical Engineering. The outcomes of the research will contribute to knowledge production in the specialisation field. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.4.)

7.2.5 Doctor of Engineering in Metallurgical Engineering (DEng (Metallurgical Engineering)) (DP0850)

7.2.5.1 Admission Requirements

A MEng Degree or equivalent NQF level 9 qualification.

7.2.5.2 Duration of Programme

The equivalent of two-year, full-time study.

7.2.5.3 Programme Structure

This instructional programme comprises of a dissertation only.

7.2.5.4 Purpose of the DEng (Metallurgical Engineering)

The purpose of the qualification is to prove that the candidate is able to conduct independent research with minimum guidance in a chosen field of Metallurgical Engineering. The outcomes of the research will contribute to knowledge production in the specialisation field. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.5.)

7.2.5.5 Assessment

The thesis will be examined by two external and one internal examiner who are subject specialists. Only distinction work will qualify.

7.3 Assessment

The department follows the assessment strategy of formal written exams. The year mark is compiled from a series of not less than three tests and / or a practical mark. The year mark for admittance to the formal examination is 50%. Weights for calculating the year mark as well as the final mark will be reflected in the Learning Guide. All tests, assignments and practical work done during a particular semester, will help learners learn and understand the work.

Some modules follow the assessment strategies of Continuous Assessment (CASS). All marks obtained during the semester will make up the learner's final mark. Each module's Learning Guide will indicate which tests and activities will contribute, according to a pre-determined weight, to the final mark.

7.4 Enquiries

Enquiries may be addressed to:

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Faculty of Engineering & Technology

Vaal University of Technology

Private Bag X021

VANDERBIJLPARK, 1900

HoD

Tel	:	+27 16 950 9655
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Tel : +27 16 950 9165
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rethav@vut.ac.za
Website : www.vut.ac.za

or

Postgraduate Office

Ms N Kokoali
Tel : +27 16 950 9288
e-mail : nomathembak@vut.ac.za

Mr S Motsie
Tel : +27 16 950 7639
e-mail : sehlabakam@vut.ac.za

8. DEPARTMENT OF CIVIL ENGINEERING

8.1 Departmental Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Ochieng', GM (Prof)	HoD	DTech: Eng: Civil
Tlakeli, RN (Ms)	Administrator	PGDHE
Barnard, APA (Mr)	Senior Lecturer	BEng (Hons)
Orando, M (Dr)	Senior Lecturer	PhD
Rwanga, S (Dr)	Senior Lecturer	DTech:Eng:Civil
Acheampong, E (Mr)	Lecturer	MSc (Bldng & Const)
Beer, M (Mrs)	Lecturer	MSc (Civil Eng)
Gaborone, K (Mr)	Lecturer	BSc (Hons) Eng
Lamola, M (Mr)	Lecturer	BTech:Eng:Civil
Mukalay, J (Ms)	Lecturer	BEng (Civil)
Onyango, F (Mr)	Lecturer	MTech:Eng:Civil
Chapinduka, M (Ms)	Laboratory Technician	BTech: Eng: Civil
Modise, GS (Mrs)	Laboratory Technician	BTech: Eng: Civil
Phakathi, S (Mr)	Laboratory Technician	BTech: ICT
Smit M (Mr)	Laboratory Technician	BTech: Eng: Civil

8.2 Diploma in Civil Engineering (DI0810)

8.2.1 Programme Structure

HEQSF Specification: The qualification Diploma in Civil Engineering is HEQSF aligned and bears the following HEQSF specifications:

HEQSF Qualification Type	Diploma
Variant	Vocationally oriented
NQF Exit Level	6
Minimum Total Credits	360
Minimum Credits at Exit Level	120

Duration: This is a three-year course and consists of five semesters' university attendance (39 modules) and one semester Workplace Based Learning in industry which should be done after completion of the total theoretical part of the Diploma i.e. after the fifth semester (S5) of uninterrupted theoretical training at the University. Each semester consists of approximately sixteen weeks of theoretical studies; each week consisting of lectures, tutorials and in some module's practical work done in laboratories or on site.

8.2.2 Purpose of the Qualification

The generic purpose of the qualification is spelled out in paragraph 4.1 and must be read in conjunction with the following:

The purpose of the qualification Diploma in Engineering: Civil Engineering is to develop focused knowledge and skills as well as experience in a work-related context. The Diploma in Engineering: Civil Engineering equips graduates with the knowledge base, theory, skills and methodology of Civil Engineering as a foundation for further training and experience towards becoming a competent Civil engineering technician. This foundation is achieved through a thorough grounding in mathematics and natural sciences specific to the field of Civil 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.

8.2.3 Fields of Study

Fields of study includes but is not limited to transportation, water, structural, geotechnical, construction management and urban engineering.

8.2.4 Career Opportunities

Civil Engineering Technicians could be involved with construction projects such as reinforced concrete, structural steel, timber and masonry structures, roads, bridges, dams, canals, pipelines, water purification, sewage treatment, airports, railways, harbours, housing and services.

There is ample opportunity to attain job satisfaction and attractive financial rewards. Some past students from this department have senior positions at consulting engineering firms, construction companies, government bodies, local authorities and industry.

The following selections of careers are available:

Design Draughtsman, Project Official, Site Agent, Municipal Technician, Engineering Surveyor, Quantity Technician, Designer, Laboratory Technician, Contract Manager, Project Planner, Estimator, Quality Controller or a Geo-technician.

8.2.5 Admission Requirements: Diploma in Civil Engineering

NSC	Compulsory Subjects	Minimum for the Diploma programme	Notes
National Senior Certificate	Mathematics Physical Science English Language Any other modules with a minimum level of 3, excluding Life Orientation **Total**	4 4 4 12 **24***	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79% 7 = 80 – 89% 8 = 90 – 100%

<u>Please note</u>:

- The prospective student's results must meet the statutory and programme admission requirement.
- Bonus points will only be used for selection purposes. In case of a tie and all other scores remaining the same use the actual percentages to differentiate.

- *Admission requirements for any of the **3-year Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 28 and above APS points, with a minimum of 4 for Mathematics, Physical Science and English.
- *Admission requirements for any of the **4-year extended Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 24 – 27 maximum APS points, with a minimum of 4 for Mathematics, Physical Science and English. Students that need more information regarding Extended programmes should liaise with their respective HODs and/or the faculty manager. The main purpose of extended programmes is to widen access and reinforce/improve success.
- All other grade 12 or equivalent certificates will be evaluated against/according to statutory and programme requirements.
- International qualifications: All international qualifications will be evaluated by the International Office based on the Swedish scale and SAQA equivalence.
- Transfers: Applications from students to transfer from other institutions will be dealt with in terms of the Recognition of Prior Learning and CAT policies of VUT.

8.2.6 Assessment

In the five-semester duration that the student undertakes the theoretical component of the qualification, the student's progress is evaluated by means of tests and the presentation of projects and practical reports. At the end of each semester, final examinations are written over a two-week period on all the work done during the semester.

NB: *It is critical for the learner's success to note that: The exit level modules are evaluated by means of a learner having to show competence in the graduate attribute(s) (GAs) associated with the relevant exit level modules. The exit level modules associated with particular GAs shall be made known to the learner in advance by the Lecturer concerned and the respective rules governing the measure of achievement or none achievement of competence and the consequences thereof shall also be communicated to the learner with further instructions also included in the learner guides and the assessment documents*

8.2.7 Standard for the award of the qualification

The purpose and level of the qualification will have been achieved when the student has demonstrated:

- The knowledge defined in the Table below (knowledge area characteristics and credits – Diploma in Civil Engineering); and

- The skills and applied competence defined in section 4.1 (GAs for Diploma: Engineering).

Table: Knowledge area characteristics and credits (Diploma in Engineering: Civil Engineering)

Knowledge area	Credits
Mathematical Sciences	36
Natural Sciences	52
Engineering Sciences	127
Design and Synthesis	28
Computing and Information Technology	29
Complementary Studies	65
Work Integrated Learning	60
Total	**397**

8.2.8 Achievement of Competence in Assessed Graduate Attributes

The Department of Civil Engineering at VUT applies a 4-point Likert scale to assess the achievement level of a given Graduate Attribute. The 4-point Likert scale is defined in bands/range of percentage score in the assessed graduate attribute as shown in Table below:

Table: 4-point Likert scale Levels of Graduate Attribute (GA) Acquisition

Level	Intuitive Label	Band/Range % Score	Achievement statement
1	Emergent	0% - 24%	Not Achieved (Does not meet GA)
2	Basic	25% - 49%	Partially Achieved (Does not meet GA)
3	Adequate	50% - 74%	Achieved (Meet GA)
4	Superior	75% - 100%	Fully Achieved (Meet GA)

Levels 1-2 correspond to levels of pre-acquisition. *At level 3, mastery and/or acquisition of an attribute is deemed acceptable in a university setting*. Level 4 designate a level of excellence that may go beyond what is expected in a university setting and may not be reached by all students (Ipperciel & ElAtia, 2014).

8.2.9 Presentation of Evidence of Assessment of Graduate Attributes

For transparency and clarity in assessment outcomes, the evidence of assessment of GAs is presented as per the following template prescribed by ECSA.

Table: Presenting Evidence of Assessment of GAs

ECSA Graduate Attribute	
e.g. **GA1: Problem Solving** Apply engineering principles to systematically diagnose and solve *well-defined* engineering problems	**Assessment Details**
Where is the attribute assessed?	
How is this attribute assessed?	
What is satisfactory performance/achievement?	
What is the consequence of unsatisfactory performance/non-achievement?	

8.2.10 Curriculum: Diploma in Civil Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
HKCOX1A	Applied Communication Skills 1.1	8
ASICT1A	ICT Skills 1	10
AAECH1A	Engineering Chemistry 1	10
EEESK1A	Engineering Skills 1	5
AMMAT1A	Mathematics 1	10
APHYS1A	Physics 1	10
EESIN1A	Social Intelligence 1	3

SEMESTER 2		
HKCOY1A	Applied Communication Skills 1.2	8
ECAME1A	Applied Mechanics 1	10
ECCOA2A	Computing Applications 2	7
AAECH2A	Engineering Chemistry 2	10
ECEDR1A	Engineering Drawing 1	10
AMMAT2A	Mathematics 2	10
APHYP2A	Physics 2 – Practical	5
APHYT2A	Physics 2 - Theory	5
ECSPA1A	Safety Principles and Law 1	5
SEMESTER 3		
HKCOX2A	Applied Communication Skills 2.1	8
ECCOS1A	Construction Methods 1	10
ECCOM1A	Construction Materials 1	5
ECEDR2A	Engineering Drawing 2	10
EYEGE1A	Engineering Geology 1	10
ECESU1A	Engineering Surveying 1	10
ECSME1A	Soil Mechanics 1	5
ECST2A	Theory of Structures 2	10
SEMESTER 4		
HKCOY2A	Applied Communication Skills 2.2	8
ECCEM1A	Civil Engineering Management 1	10
ECCOM2A	Construction Materials 2	5
ECEOS2A	Elements of Structural Steel and Timber Design 2	10
ECESU2A	Engineering Surveying 2	10
ECSAN3A	Structural Analysis 3	10
ECTEN1A	Transportation Engineering 1	10
ECWEN1A	Water Engineering 1	10

SEMESTER 5		
ECCEM2A	Civil Engineering Management 2	10
ECDOC1A	Documentation 1	10
ECEOR3A	Elements of Reinforced Concrete Masonry Design 3	10
ECFMC2A	Fluid Mechanics 2 (Civil)	10
ECSME2A	Soil Mechanics 2	10
ECSAN4A	Structural Analysis 4	10
ECTEN2A	Transportation Engineering 2	10
SEMESTER 6		
ECEXL1A	Workplace Based Learning 1	60

Curriculum: Diploma in Civil Engineering (4 year Extended programme) – DE0811

The purpose of the Extended Diploma programme is to assist students who enter the University with APS score of 24 - 27 by giving them more time to reach the level of competency similar to those who enter with higher APS scores. The programme extends the 3-year programme into 4 years by spreading the first year of study over 2 years with the inclusion of foundational modules as well as mainstream programme modules. The foundation modules in the first year of study will help students to improve their competency in Maths, Physics, Chemistry and Drawing. In the second year of study, the students will augment their foundation knowledge of Maths, Physics, Chemistry and Drawing to reach the level of the mainstream programme. Students are required to pass all modules in both years of the foundation phase to be able to proceed to the next year of study.

MODULE CODE	NAME OF MODULE	TYPE	CREDITS	
			Regular	Found
YEAR 1 - SEMESTER 1				
AAXCH1A	Foundation Chemistry 1	Foundation		10
AMXMA1A	Foundation Mathematics 1	Foundation		10
APXPH1A	Foundation Physics 1	Foundation		10
ASICT1A	ICT Skills 1	Regular	10	
EEESK1A	Engineering Skills 1	Regular	5	

EESIN1A	Social Intelligence 1	Regular	3	
HKCOX1A	Applied Communication Skills 1.1	Regular	8	
YEAR 1 - SEMESTER 2				
AAXCH2A	Foundation Chemistry 2	Foundation		10
AMXMA2A	Foundation Mathematics 2	Foundation		10
APXPH2A	Foundation Physics 2	Foundation		10
EMXDR1A	Foundation Drawing 1	Foundation		10
ECCOA2A	Computing Applications 2	Regular	7	
ECSPA1A	Safety Principles and Law 1	Regular	5	
HKCOY1A	Applied Communication Skills 1.2	Regular	8	
YEAR 2 - SEMESTER 1				
AAECH1B	Engineering Chemistry 1	Regular (Augm)	10	
AMMAT1B	Mathematics 1	Regular (Augm)	10	
APHYS1B	Physics 1	Regular (Augm)	10	
EMEDR1B	Engineering Drawing 1	Regular (Augm)	10	
YEAR 2 - SEMESTER 2				
AAECH2A	Engineering Chemistry 2	Regular	10	
AMMAT2A	Mathematics 2	Regular	10	
APHYP2A	Physics 2 – Practical	Regular	5	
APHYT2A	Physics 2 - Theory	Regular	5	
ECAME1B	Applied Mechanics 1	Regular (Augm)	10	

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8.2.11 Workplace Based Learning (WBL)

In order to qualify for the Diploma in Civil Engineering, a minimum six-month period of suitable work integrated learning (WIL) in addition to the prescribed theoretical University training must be successfully completed. Work integrated learning refers to that component of co-operative education that can only be conducted by the employer in the workplace. This training provides the student with an opportunity to apply and develop the academic knowledge he/she received at the university to relevant problem situations in industry and exposure to typical organizational culture, human relations and working conditions. With suitable guidance and supervision, the student is taught the responsibility to work independently and to develop an awareness of the ethics and requirements of industry. Work integrated learning may be done after completion of the total theoretical part of the Diploma, after S5 of uninterrupted theoretical training at the University. This will give the student enough theoretical knowledge to benefit from the training, especially as they progress through the more advanced module matter of S5 courses.

To ensure the effectiveness of the work integrated learning, employer and University must co-operate as partners. The student will enrol for the module Civil Engineering Practice at the University. The employer will act as an examiner and must indicate the level of achievement of competence of the student in line with Graduate Attribute number 11 (Workplace Practice) for the qualification Diploma in Engineering. The assessment of the level of GA acquisition shall be in line with the following typifying exemplified associated competency indicators:

i. Orientation to the working environment is described in terms of company structure and conventions, rules, policies, working hours, dress codes and reporting lines.
ii. Labour practices used in the workplace are described in accordance with relevant legislation.
iii. Workplace safety is described in terms of the application of relevant safety, health and environmental legislation.
iv. General administration procedures are described in terms of how they operate and the key purpose.
v. Work activities are conducted in a manner suited to the work context.

   Range: Work activities include assisting, contributing, observing and applying <u>*at least four of the specific practices below*</u>:

   - Engineering processes, skills and tools, including measurement;
   - Investigations, experiments and data analysis;
   - Problem solving techniques;
   - Application of scientific and engineering knowledge;
   - Engineering planning and design;

- Professional and technical communication;
- Individual and teamwork; or
- The impact of engineering activity on health, safety and the environment.

vi. Knowledge and understanding gained from the work-integrated learning period is reported in a prescribed format, using appropriate language and style.

To pass the student must obtain a minimum of Level 3 (adequate achievement: 50% - 74% Range Score as stipulated in the 4-Point Likert Scale in the previous Table provided in the section under ***Assessment***), and to pass with distinction ≥75% (Level 4). The University acts as a moderator for the module.

The student must have a mentor, who will certify that the student has completed the work required satisfactorily.

During work integrated learning, the student must submit three-monthly progress reports (10 pages minimum) that contain sufficient information so that the training received can be evaluated. This report must be approved by the student's mentor before being submitted to the Department of Civil Engineering, Vaal University of Technology.

On completion of the training period, the student must submit Semester report and Project (20 pages minimum). All reports should be ring-bounded otherwise it will not be accepted for marking.

8.3 Advanced Diploma in Civil Engineering (AD0810)

8.3.1 Programme Structure

HEQSF Specification: The qualification Advanced Diploma in Civil Engineering is HEQSF aligned and bears the following HEQSF specifications:

HEQSF Qualification Type	Advanced Diploma
Variant	Professionally oriented
NQF Exit Level	7
Minimum Total Credits	140
Minimum Credits at Exit Level	120

Qualification title: Advanced Diploma in Civil Engineering

Duration: This is a one-year full-time course and consists of two semesters' university attendance (13 modules) that includes two (2) modules on Civil Engineering Research Methods and Project.

Each semester consists of approximately sixteen weeks of theoretical studies; each week consisting of lectures, tutorials and in some module's practical work done in laboratories or on site.

8.3.2 Purpose of the Qualification

The generic purpose of the qualification is spelled out in paragraph 4.2 and must be read in conjunction with the following:

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 the field of Civil Engineering and it's respective disciplines e.g. Structural, Water, Transportation, Environmental, and Urban Engineering and the ability to apply their knowledge and skills to becoming a competent Professional Civil Engineering Technologist, while equipping them to undertake more specialised and intensive learning. Programmes leading to this qualification tend to have 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 educational programmes designed to meet this qualification are to build the necessary knowledge, understanding, abilities and skills required for further learning towards becoming a competent practicing civil engineering technologist. This qualification provides:

- Preparation for careers in civil engineering and areas that potentially benefit from engineering skills, for achieving technical proficiency and to contribute to the economy and national development;
- The educational base required for registration as a Professional Civil Engineering Technologist with ECSA.
- Entry to NQF level 8 programmes e.g. Honours, Post Graduate Diploma and B Eng Programmes and then to proceed to Masters Programmes.

Civil engineering students completing this qualification will demonstrate competence in all the Graduate Attributes (Exit Level Outcomes) contained in this standard.

8.3.3 Fields of Study

Fields of study includes but is not limited to transportation, water, structural, geotechnical, construction management and urban engineering.

8.3.4 Career Opportunities

Professional Civil Engineering Technologists could be involved with construction projects such as reinforced concrete, structural steel, timber and masonry structures, roads, bridges, dams, canals, pipelines, water purification, sewage treatment, airports, railways, harbours, housing and services.

There is ample opportunity to attain job satisfaction and attractive financial rewards. Some past students from this department have senior positions at consulting engineering firms, construction companies, government bodies, local authorities and industry.

The following selections of careers are available:

Design Draughtsperson, Project Official, Site Agent, Municipal Technologist, Engineering Surveyor, Designer, Senior Laboratory Technologist, Contract Manager, Project Planner, Estimator, Quality Controller or a Geo-technologist.

8.3.5 Admission Requirements: Advanced Diploma in Civil Engineering

A student with relevant qualification on NQF level 6 (min 360 credits) can enter this Advanced Diploma in Civil Engineering on NQF level 7 (minimum 120 credits, ECSA 140 credits) or a relevant qualification (e.g. Bachelors in Civil Engineering).

8.3.6 Assessment

In the two (2) semester duration that the student undertakes the theoretical component of the qualification, the student's progress is evaluated by means of tests and the presentation of projects and practical reports. At the end of each semester, final examinations are written over a two-week period on all the work done during the semester. The Research Methodology and Research Project will be assessed by means of Continuous Assessment (CASS) strategy through project proposal writing and presentation, presentation of project work and portfolio of evidence for the project undertaken.

NB: *It is critical for the learner's success to note that: All subjects/modules presented at this level are exit level modules and shall be evaluated by means of a learner having to show competence in ALL the ten (10) graduate attribute(s) (GAs)* *associated with the relevant exit level modules. The exit level modules associated with particular GAs shall be made known to the learner in advance by the Lecturer concerned and the respective rules governing the measure of achievement or none achievement of competence and the consequences thereof shall also be communicated to the learner with further instructions also included in the learner guides and the assessment documents.*

8.3.7 Standard for the award of the qualification

The purpose and level of the qualification will have been achieved when the student has demonstrated:

- The knowledge defined in the Table below (knowledge area characteristics and credits – Advanced Diploma in Civil Engineering); and
- The skills and applied competence defined in paragraph 4.2 (GAs for Advanced Diploma in Civil Engineering).

Table: Knowledge area characteristics and credits (Advanced Diploma in Civil Engineering)

Knowledge area	**Credits**
Mathematical Sciences	18
Natural Sciences	15
Engineering Sciences	30
Engineering Design and Synthesis	26
Computing and Information Technology	18
Complementary Studies	33
Total	**140**

8.3.8 Achievement of Competence in Assessed Graduate Attributes

The Department of Civil Engineering at VUT applies a 4-point Likert scale to assess the achievement level of a given Graduate Attribute. The 4-point Likert scale is defined in bands/range of percentage score in the assessed graduate attribute as shown in Table below:

Table: 4-point Likert scale Levels of Graduate Attribute (GA) Acquisition

Level	**Intuitive Label**	**Band/Range % Score**	**Achievement statement**

1	Emergent	0% - 24%	Not Achieved (Does not meet GA)
2	Basic	25% - 49%	Partially Achieved (Does not meet GA)
3	Adequate	50% - 74%	Achieved (Meet GA)
4	Superior	75% - 100%	Fully Achieved (Meet GA)

Levels 1-2 correspond to levels of pre-acquisition. At level 3, mastery and/or acquisition of an attribute is deemed acceptable in a university setting. Level 4 designate a level of excellence that may go beyond what is expected in a university setting and may not be reached by all students (Ipperciel & ElAtia, 2014).

8.3.9 Presentation of Evidence of Assessment of Graduate Attributes

For transparency and clarity in assessment outcomes, the evidence of assessment of GAs is presented as per the following template prescribed by ECSA:

Table: Presenting Evidence of Assessment of GAs

ECSA Graduate Attribute	
e.g. **GA1: Problem Solving** Apply engineering principles to systematically diagnose and solve broadly defined engineering problems	**Assessment Details**
Where is the attribute assessed?	
How is this attribute assessed?	
What is satisfactory performance/achievement?	
What is the consequence of unsatisfactory performance/non-achievement?	

8.3.10 Curriculum: Advanced Diploma in Civil Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
ECMAT4A	Civil Engineering Materials	10
ECHTE4A	Highway and Traffic Engineering	10
ECSTR4A	Structural Analysis	10
ECWWE4A	Water and Wastewater Engineering	10

ECENS4A	Environmental Studies	10
ECREM4A	Civil Engineering Research Methodology	15
SEMESTER 2		
ECEDE4A	Earthworks Design	10
ECSRD4A	Steel and Reinforced Concrete Design	10
ECRWE4A	Railway Engineering	10
ECRED4A	Reticulation Design	10
ECBDC4A	Business Development in the Civil Engineering Environment	10
ECMTT4A	Management Tools and Techniques	10
ECREP4A	Civil Engineering Research Project	15

8.4 Postgraduate Diploma in Civil Engineering (PG0810)

8.4.1 Programme Structure

HEQSF and NQF Specification: The qualification Postgraduate Diploma in Civil Engineering is HEQSF aligned and bears the following HEQSF specifications:

HEQSF Qualification Type	Postgraduate Diploma
Variant	Professionally-oriented
NQF Exit Level	8
Minimum Total Credits	140
Minimum Credits at Exit Level	120

Qualification title: Postgraduate Diploma (PGD) in Civil Engineering

Duration: This is a one-year full-time programme (or a minimum two years part-time programme). Consists of two semesters' university attendance (8 modules) that includes two (2) modules on Civil Engineering Research Project. Each semester consists of approximately sixteen weeks of theoretical studies; each week consisting of lectures, tutorials and in some module's practical work done in laboratories or on site.

8.4.2 Purpose of the Qualification

The Postgraduate Diploma in Civil Engineering is a postgraduate qualification, exhibiting the characteristics that it prepares students for industry and research. This qualification typically follows a Bachelor's Degree, Advanced Diploma or relevant NQF level 7 qualifications and serves to consolidate and deepen the student's expertise in the field of Civil Engineering and to develop research capacity in the methodology and techniques of Civil Engineering disciplines.

This qualification demands a high level of theoretical engagement and intellectual independence. It also requires the student to have the ability to relate knowledge to a range of contexts in order to undertake professional or highly-skilled work.

This qualification provides:

1. Preparation for a career in civil engineering itself and areas that potentially benefit from civil engineering skills, for achieving technological proficiency and to make a contribution to the economy and national development; and
2. Entry to NQF level 9 Master's Degree programmes in civil engineering e.g. MSc/MEng
3. Pathway for registration as a Candidate Engineer

Civil Engineering students completing this qualification will demonstrate competence in all the graduate attributes contained in the ECSA Document for the Qualification Standard for Postgraduate Diploma in Engineering Technology: NQF Level 8 (Document No.: E-09-PGDip).

8.4.3 Fields of Study

Fields of study include transportation, water, structural, geotechnical, project and construction management and environmental engineering.

8.4.4 Career Opportunities

Postgraduate Diploma in Civil Engineering prepares candidates with a stronger and deeper knowledge in the disciplines of civil engineering. The graduates could be involved in research to solve complex civil engineering problems. The structure of the programme is such that the candidates acquire competencies that meet the educational requirements for registration in the category candidate engineer. As a researcher or engineer, the graduates could be involved at a higher level, with construction projects such as reinforced concrete, structural steel, timber and masonry structures, roads, bridges, dams, canals, pipelines, water purification, sewage treatment, airports, railways, harbours, housing and services, and environmental engineering related works.

8.4.5 Admission Requirements: PGD in Civil Engineering

A student with relevant qualification on NQF level 7 (min 120 credits) typically a Bachelor's Degree, Advanced Diploma or relevant NQF level 7 qualifications can enter this Postgraduate Diploma in Civil Engineering on NQF level 8 (minimum 120 credits, ECSA 140 credits).

8.4.6 Assessment

In the two (2) semester duration that the student undertakes the theoretical component of the qualification, the student’s progress is evaluated by means of tests and the presentation of projects and practical reports. At the end of each semester, final examinations are written over a two-week period on all the work done during the semester. The Research Projects will be assessed by means of Continuous Assessment (CASS) strategy through project proposal writing and presentation, presentation of project work and portfolio of evidence for the project undertaken.

NB: *It is critical for the learner’s success to note that: All subjects/modules presented at this level are exit level modules and shall be evaluated by means of a learner having to show competence in ALL the twelve (12) graduate attribute(s) (GAs) associated with the relevant exit level modules. The exit level modules associated with particular GAs shall be made known to the learner in advance by the Lecturer concerned and the respective rules governing the measure of achievement or none achievement of competence and the consequences thereof shall also be communicated to the learner with further instructions also included in the learner guides and the assessment documents.*

8.4.7 Standard for the award of the qualification

The qualification may be awarded when the qualification standard has been met or exceeded. The measure of this achievement is when the student has demonstrated:

- The knowledge defined in the Table below (knowledge area characteristics and credits – Postgraduate Diploma in Engineering: Civil Engineering); and
- The skills and applied competence defined in the ECSA Document for the Qualification Standard for Postgraduate Diploma in Engineering Technology: NQF Level 8 (Document No.: E-09-PGDip) – Graduate Attributes for postgraduate Diploma in Engineering Technology..

Table: Knowledge area characteristics and credits (Postgraduate Diploma in Civil Engineering)

Knowledge area	**Credits**
Mathematical Sciences	7
Natural Sciences	14
Engineering Sciences	42
Engineering Design & Synthesis	28
Computing and IT	7
Complementary Studies	7
Available for re-allocation in above areas	35
Total	**140**

8.4.8 Achievement of Competence in Assessed Graduate Attributes

The Department of Civil Engineering at VUT applies a 4-point Likert scale to assess the achievement level of a given Graduate Attribute. The 4-point Likert scale is defined in bands/range of percentage score in the assessed graduate attribute as shown in Table below:

Table: 4-point Likert scale Levels of Graduate Attribute (GA) Acquisition

Level	**Intuitive Label**	**Band/Range % Score**	**Achievement statement**
1	Emergent	0% - 24%	Not Achieved (Does not meet GA)
2	Basic	25% - 49%	Partially Achieved (Does not meet GA)
3	Adequate	50% - 74%	Achieved (Meet GA)
4	Superior	75% - 100%	Fully Achieved (Meet GA)

Levels 1-2 correspond to levels of pre-acquisition. At level 3, mastery and/or acquisition of an attribute is deemed acceptable in a university setting. Level 4 designate a level of excellence that may go beyond what is expected in a university setting and may not be reached by all students (Ipperciel & ElAtia, 2014).

8.4.9 Presentation of Evidence of Assessment of Graduate Attributes

For transparency and clarity in assessment outcomes, the evidence of assessment of GAs is presented as per the following template prescribed by ECSA:

Table: Presenting Evidence of Assessment of GAs

ECSA Graduate Attribute	
e.g. **GA1: Problem Solving** Identify, formulate, analyse and solve complex problems creatively and innovatively	**Assessment Details**
Where is the attribute assessed?	
How is this attribute assessed?	
What is satisfactory performance/achievement?	
What is the consequence of unsatisfactory performance/non-achievement?	

8.4.10 Curriculum: Postgraduate Diploma in Civil Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
ECEEN5A	Environmental Engineering	10
ECGTE5A	Geotechnical Engineering	20
ECPMC5A	Project and Construction Management	10
ECRPX5A	Research Project in Civil Engineering (Module 1)	15
SEMESTER 2		
ECSTE5A	Structural Engineering	20
ECTEN5A	Transportation Engineering	20
ECWEN5A	Water Engineering	20

ECRPY5A	Research Project in Civil Engineering (Module 2)	25

8.5 Master of Engineering (MEng) in Civil Engineering (MP0810)

8.5.1 Purpose of the MEng in Civil Engineering

The purpose of this qualification is to develop a student into a researcher, able to conduct independent research with minimum guidance in a chosen field of Civil Engineering. The outcomes of the research will contribute to knowledge production in the specialisation field. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.4)

8.5.2 Admission Requirements

A BEng degree or equivalent level 8 qualification including the Postgraduate Diploma in Civil Engineering.

Proof of successful completion of a Vaal University of Technology approved course in Research Methodology.

Ad hoc cases will be treated on merit.

8.5.3 Duration of Programme

The equivalent of one-year full-time study.

8.5.4 Programme Structure

This instructional programme comprises of a thesis only.

8.5.5 Assessment

The Masters Dissertation/thesis is assessed both internally and externally. An average mark is calculated from the allocations made by both the internal and external examiners. A pass mark of 50% is required for the qualification to be awarded.

8.6 Doctor of Engineering in Civil Engineering (DP0810)

8.6.1 Purpose of the DEng in Civil Engineering

The purpose of the qualification is to develop a researcher who will make a significant and original contribution to knowledge in a specialised area of civil engineering and technology. To develop a researcher in civil engineering with advanced abilities, to independently apply civil engineering design, synthesis, and related principles, to specific problems of society at large.

One of the main objectives in this process is to develop an advanced capability to conduct engineering research of an original nature. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.5.)

8.6.2 Admission Requirements

Master of Engineering in Civil Engineering or equivalent level 9 qualification.

Ad hoc cases will be treated on merit.

8.6.3 Duration of Programme

At least two years full-time research, concluded with a Doctoral Thesis.

8.6.4 Assessment

The Doctoral Thesis is assessed both internally and externally. No marks awarded. The thesis is assessed as either a Pass or Fail. The Doctorate is awarded when all examiners prescribe a Pass for the thesis.

8.7 Enquiries

Enquiries may be addressed to:

HoD: Civil Engineering

Faculty of Engineering & Technology

Vaal University of Technology
Private Bag X021
VANDERBIJLPARK, 1900

Tel	:	+27 16 950 9241
Fax	:	+27 16 950 9957
e-mail	:	georgeo@vut.ac.za
		rosaliat@vut.ac.za
Website	:	www.vut.ac.za

or

Postgraduate Office

Ms N Kokoali

Tel	:	+27 16 950 9288
e-mail	:	nomathembak@vut.ac.za

Mr S Motsie

Tel	:	+27 16 950 7639
e-mail	:	sehlabakam@vut.ac.za

9. DEPARTMENT OF ELECTRICAL ENGINEERING

9.1 ELECTRICAL ENGINEERING: ELECTRONIC ENGINEERING

Discipline Staff Details (Electronic Engineering)

Surname, Initials & Title	Designation	Highest Qualification
Langa, HM (Dr)	HoD	DPhil Eng
Cronjé, DJ (Mr)	Discipline Coordinator	MSc
Mwale RZ (Ms)	Administrator	PG Dip (HE)
Dicks, DA (Prof)	Director: EDSU	DTech
Bekker, WJ (Prof)	Head: Research Centre Alternative Energy	PhD
Joubert, MJ (Mr)	Senior Lecturer	MDip Tech
Sutherland, G (Dr)	Senior Lecturer	PhD
Viljoen, M (Mr)	Senior Lecturer	MTech
Vacant	Senior Lecturer	
Vacant	Senior Lecturer	
Jacobs, SJ (Mr)	Lecturer	BTech
Kotsi, NL (Mr)	Lecturer	NHD
Mokautu, EMP (Mr)	Lecturer	MSc
Moletsane, FM (Mr)	Lecturer	BTech
Mugwabana, M (Mr)	Lecturer	BTech
Schoeman, RM (Mr)	Lecturer	MTech
Viljoen, E (Mr)	Lecturer	BTech
Vacant	Lecturer	
Vacant	Lecturer	

Vacant	Lecturer	
Greeff, R (Mr)	Technician	BTech
Mawelele, T (Mr)	Technician	BTech
Akinwunmi, AT (Mr)	Technologist	MTech
Thomas, JJP (Mr)	Laboratory Assistant	Snr Certificate

9.1.1 Diploma in Electrical Engineering: Electronic (DI0823)

9.1.1.1 Programme Structure

Three years full-time qualification, min 360 credits, NQF level 6. Sixty credits are allocated to Work Integrated Learning (WIL). WIL can take various forms including simulated learning, work-directed theoretical learning, problem-based learning, project-based learning and Workplace Based Learning. The Workplace Based Learning will take place in Industry.

9.1.1.2 Purpose of the Diploma in Electrical Engineering: Electronic

The generic purpose of the qualification is spelled out in paragraph 4.1 and must be read in conjunction with the following: The purpose of the qualification Diploma in Electrical Engineering: Electronic is to develop the necessary knowledge, understanding and skills required for the student's further learning towards becoming a competent practicing Electronic Engineering Technician. It is intended to subsequently empower candidate Engineering Technicians to demonstrate that they are capable of applying their acquired knowledge, understanding, skills, attitudes, and values in the work environment in South Africa. It is designed also to add value to the qualifying student in terms of enrichment of the person, status, and recognition.

9.1.1.3 Admission Requirements

NSC	Compulsory Subjects	Minimum for the Diploma programme	Notes
National Senior Certificate	Mathematics Physical Science English Language	4 4 4	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79%

	Any other subjects with a minimum level of 3, excluding Life Orientation	12	7 = 80 – 89% 8 = 90 – 100%
	Total	**24***	

Please note:

- The prospective student's results must meet the statutory and programme admission requirement.
- Bonus points will only be used for selection purposes. In case of a tie and all other scores remaining the same use the actual percentages to differentiate.
- *Admission requirements for any of the **3-year Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 28 and above APS points, with a minimum of 4 for Mathematics, Physical Science and English.
- *Admission requirements for any of the **4-year extended Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 24 – 27 maximum APS points, with a minimum of 4 for Mathematics, Physical Science and English. Students that need more information regarding Extended programmes should liaise with their respective HODs and/or the faculty manager. The main purpose of extended programmes is to widen access and reinforce/improve success.
- All other grade 12 or equivalent certificates will be evaluated against/according to statutory and programme requirements.
- International qualifications: All international qualifications will be evaluated by the International Office based on the Swedish scale and SAQA equivalence.
- Transfers: Applications from students to transfer from other institutions will be dealt with in terms of the Recognition of Prior Learning and CAT policies of VUT.

9.1.1.4 Career Opportunities

A successful candidate can pursue a career as a technician in one of the following specialisation fields: Electronic design and development; Electronic maintenance; Electronic communication design and development.

9.1.1.5 Curriculum: Diploma in Electrical Engineering: Electronic

MODULE CODE	NAME OF MODULE	CREDITS
	SEMESTER 1	
HKCOX1A	Applied Communication Skills 1.1	8
EEESK1A	Engineering Skills 1	5
EPEEN1A	Electrical Engineering 1	10

ASICT1A	ICT Skills 1	10
AMMAT1A	Mathematics 1	10
APHYS1A	Physics 1	10
EESIN1A	Social Intelligence 1	3
	ADDITIONAL MODULE	
AAECH1A	Engineering Chemistry 1	10
SEMESTER 2		
HKCOY1A	Applied Communication Skills 1.2	8
EECOA2A	Computing Applications 2	7
EIDSY1A	Digital Systems 1	10
EPEEN2A	Electrical Engineering 2	10
AMMAT2A	Mathematics 2	10
EEELE1A	Electronics 1	10
EEWPR1A	Project 1 (WIL - Electronic)	7
EESPA1A	Safety Principles And Law 1	5
	ADDITIONAL MODULE	
EIPRI1A	Process Instrumentation 1	10
APHYT2A	Physics 2 (Theory)	5
APHYP2A	Physics 2 (Practical)	5
SEMESTER 3		
HKCOX2A	Applied Communication Skills 2.1	8
EIDSY2A	Digital Systems 2	10
EEELE2A	Electronics 2	10
EEWPR2A	Project 2 (WIL - Electronic)	7
EECAD1A	Electrical CAD 1	10
AMMAT3A	Mathematics 3	10
EEECO2A	Electronic Communication 2	10
	ADDITIONAL MODULE	
EIENP1A	Engineering Programming 1	10
BHMAN1A	Management 1	10
EINET1A	Networks 1	10

SEMESTER 4		
HKCOY2A	Applied Communication Skills 2.2	8
EEELE3A	Electronics 3	10
EEWPR3A	Project 3 (WIL - Electronic)	8
EEDCO2A	Digital Communication 2	10
EECAD2A	Electrical CAD 2	10
EEMET3A	Measurement Technology 3	10
EEPEL3A	Power Electronics 3	10
	CHOICE MODULE	
EICSY2A	Control Systems 2	10
EIENP2A	Engineering Programming 2	10
EIPRI2A	Process Instrumentation 2	10
EIDCS1A	Digital Control Systems 1	10
SEMESTER 5		
EEOEL3A	Opto-Electronics 3	10
EEWPR4A	Project 4 (WIL - Electronic)	8
EEMIC3A	Microwave Communication 3	10
EERAD3A	Radio Engineering 3	10
EETXR3A	Transmission 3 (Radio Frequency)	10
	ADDITIONAL MODULE	
EEPEL4A	Power Electronics 4	10
EIENP3A	Engineering Programming 3	10
SEMESTER 6		
WBL Placement		
EEEXL1A	Experiential Learning 1	14
EEEXL2A	Experiential Learning 2	16
EEPRJ4A	Engineering Project 4	30

Curriculum: Diploma in Electrical Engineering: Electronic (4 year Extended programme) – DE0863

The purpose of the Extended Diploma programme is to assist students who enter the University with APS score of 24 - 27 by giving them more time to reach the level of competency similar to those who enter with higher APS scores. The programme extends the 3-year programme into 4 years by spreading the first year of study over 2 years with the inclusion of foundational modules as well as mainstream programme modules. The foundation modules in the first year of study will help students to improve their competency in Maths, Physics and Chemistry. In the second year of study, the students will augment their foundation knowledge of Maths, Physics and Chemistry to reach the level of the mainstream programme. Students are required to pass all modules in both years of the foundation phase to be able to proceed to the next year of study.

MODULE CODE	NAME OF MODULE	TYPE	CREDITS	
			Regular	Found
YEAR 1 - SEMESTER 1				
AAXCH1A	Foundation Chemistry 1	Foundation		10
AMXMA1A	Foundation Mathematics 1	Foundation		10
APXPH1A	Foundation Physics 1	Foundation		10
ASICT1A	ICT Skills 1	Regular	10	
EEESK1A	Engineering Skills 1	Regular	5	
EESIN1A	Social Intelligence 1	Regular	3	
HKCOX1A	Applied Communication Skills 1.1	Regular	8	
YEAR 1 - SEMESTER 2				
AAXCH2A	Foundation Chemistry 2	Foundation		10
AMXMA2A	Foundation Mathematics 2	Foundation		10
APXPH2A	Foundation Physics 2	Foundation		10
EECOA2A	Computing Applications 2	Regular	7	
EESPA1A	Safety Principles and Law 1	Regular	5	
EEWPR1A	Project 1	Regular	7	
HKCOY1A	Applied Communication Skills 1.2	Regular	8	
YEAR 2 - SEMESTER 1				
AMMAT1B	Mathematics 1	Regular (Augm)	10	

APHYS1B	Physics 1	Regular (Augm)	10	
EPEEN1A	Electrical Engineering 1	Regular	10	

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9.1.2 Advanced Diploma (AdvDip) in Electrical Engineering: Electronic Engineering (AD0823)

9.1.2.1 Admission Requirements

For admission into the AdvDip in Electrical Engineering: Electronic Engineering (NQF level 7, min 120 credits) all applicants must have a Diploma in Electrical Engineering: Electronic Engineering (NQF level 6, min 360 credits) or equivalent. Apart from the prescribed qualification, a specified period of relevant post-qualification practical experience is a prerequisite for registration.

9.1.2.2 Duration of Programme: One-year, full-time qualification.

9.1.2.3 Curriculum: Advanced Diploma in Electrical Engineering: Electronic Engineering

MODULE CODE	NAME OF MODULE	CREDITS
	SEMESTER 1	
	COMPULSARY	
EEPRO4A	Electrical Engineering Project (Electronic)	25
EEREM4A	Engineering Research Methods (Electronic)	15
	ELECTIVES	
EEAEL4A	Electronics	20
EERAD4A	Radio Engineering	20
EIDSP4A	Digital Signal Processing	20
EISPC4A	Signal Processing	20
	SEMESTER 2	
	COMPULSARY	

AMAEM4A	Advanced Engineering Mathematics	15
BHEMN4A	Engineering Management	10
	ELECTIVES	
EEAMI4A	Microwave Engineering	20
EEAOE4A	Opto-Electronics	20
EESAT4A	Satellite Communication	20
EICIA4A	Circuit Analysis	20
EIDCS4A	Digital Control Systems	20

9.1.3 Postgraduate Diploma (PGDip) in Electrical Engineering: Electronic Engineering (PG0823)

9.1.3.1 Programme Structure

It is a one-year, full-time qualification. The Postgraduate Diploma in Electrical Engineering: Electronic Engineering is a postgraduate qualification at NQF level 8 (Min 120 credits at level 8). The qualification is characterised by the fact that it prepares students for industry and research. This qualification typically follows a Bachelor's Degree, Advanced Diploma in Electrical Engineering: Electronic Engineering or relevant NQF level 7 qualification and serves to consolidate and deepen the student's expertise in Electrical Engineering: Electronic Engineering and to develop research capacity in the methodology and techniques of Electrical Engineering: Electronic Engineering.

9.1.3.2 Purpose of the PGDip in Electrical Engineering: Electronic Engineering

The Postgraduate Diploma in Electrical Engineering: Electronic Engineering is aligned with the DHET's HEQFS – sub framework document and SAQA requirements. To cope with the changing needs, developing markets and new technologies, this programme focuses on equipping students with a sound knowledge base in Electrical Engineering: Electronic Engineering and the ability to develop new knowledge and skills in this field. This qualification demands a high level of theoretical engagement and intellectual independence.

Through benchmarking with national and international higher education institutions as well as consultation with relevant stakeholders it has become clear that a research component needs to be an integral component of the qualification.

This qualification provides:

1. Preparation for careers in Electrical Engineering: Electronic Engineering itself and areas that potentially benefit from Electronic Engineering skills, for achieving technological proficiency and to contribute to the economy and national development; and

2. Entry to NQF level 9 Masters programmes e.g. MSc/MEng.

Engineering students completing this qualification will demonstrate competence in all the required Exit Level Outcomes contained in this qualification. This programme compares favourably with honours level (NQF level 8) studies at local and international universities. Inputs were received from the advisory committee/board and other stakeholders in the discipline, therefore meeting the needs of industry.

Students completing this qualification will have an advantage in the discipline of Electrical Engineering: Electronic Engineering in that they will be prepared to conduct industry relevant research. VUT students meet the needs of the surrounding community. The Vaal Triangle and surrounding areas has many enterprises that employ graduates from VUT.

9.1.3.3 Admission Requirements

Students who have completed the Advanced Diploma in Electrical Engineering: Electronic Engineering automatically qualify for entry into this Postgraduate Diploma in Electrical Engineering: Electronic Engineering. Students who have completed another relevant qualification are subjected to an RPL process. A relevant qualification is one that is deemed to provide the necessary background by way of content and outcome for continued study at the Post Graduate Diploma level. Within the faculty an internal RPL processes is followed for relevant qualifications, which adheres to institutional (VUT's) RPL policy.

9.1.3.4 Curriculum: PGDip in Electrical Engineering: Electronic Engineering

MODULE CODE	NAME OF MODULE	CREDITS
	COMPULSORY MODULES	
	Engineering Research Project	30
	Research Statistics	15
	MINUMUM OF 3 ELECTIVES	
	Advanced Measurement Technology	25

	Alternative Energy Feasibility	25
	Energy Management	25
	Microwave Design	25
	Energy Efficiency Management	25

9.1.4 Master of Engineering in Electrical Engineering: Electronic Engineering (MP0820)

This qualification is offered at the Vanderbijlpark campus only.

9.1.4.1 Programme Structure

At least one-year, full-time research, concluded with a master's dissertation.

9.1.4.2 Purpose of the MEng in Electrical Engineering: Electronic Engineering

The purpose of this qualification is to develop a student into a researcher, able to conduct independent research with minimum guidance in a chosen field of Electrical Engineering: Electronic Engineering. The outcomes of the research will contribute to knowledge production in the specialisation field. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.4).

9.1.4.3 Admission Requirements

A BEng degree or equivalent level 8 qualification including the Postgraduate Diploma. Proof of successful completion of a Vaal University of Technology approved course in Research Methodology. Ad hoc cases will be treated on merit.

9.1.5 Master of Engineering in Energy Efficiency (MEng (Energy Efficiency)) – MP0823

The MEng (Energy Efficiency) was developed under the guidance and with the support of the PEESA project (http://peesa.usz.edu.pl)

9.1.5.1 Admission Requirements

An appropriate BEng or equivalent level 8 qualification, including a Postgraduate Diploma.

9.1.5.2 Duration of Programme

One-year full-time or two years part time.

9.1.5.3 Curriculum: MEng (Energy Efficiency)

Module	Module Content
Energy Accounting & Economics (EEACC6A) Credits: 20	• Building energy use and economic analysis and life cycle costing • Building envelopes and insulation • Energy auditing • Audit instruments • Codes standards and protocols • Energy purchasing • Energy accounting and benchmarking • Energy rates structures • Electrical systems and electricity management
Process Energy Management (EPPEM6A) Credits: 25	• Fan systems • Pumps and pump systems • Air systems components management. • Heating, ventilating and air conditioning • Understanding and managing boilers: - Operation - Boiler components - Boiler controls and gauges - Boiler fuels - Heat balance for boilers - Boiler efficiency and improvements • Steam distribution systems: - Introduction - Steam distribution components - Tracer lines - Waste heat recovery - Improving the hot water distribution system - Cogeneration
Electrical Systems (EPESS6A) Credits: 20	• Rate structures • Electrical systems • Electric motors and drives • Tariffs and structures • Electrical protection systems • Energy systems maintenance • Control systems and computers - Need for controls

	- Types of controls Manual systems Basic automatic controls Web based building automation systems
Renewable Energy (EERNE6A) Credits: 25	• Renewable energy sources and water management: - Wind generation - Water energy systems - Geothermal energy - Solar energy - Thermal energy storage - Hydrogen and Fuel Cells • Distributed generation (DG) - Economics of DG - Technologies - Analysing your own facility for DG application - A case study
Research Project (EERPE6A) (EPRPE6A) Credits: 90	• Research Project relating to energy sources and/or water management systems pertaining to: - Wind generation systems and optimization - Water energy systems and optimization - Geothermal energy systems and optimization - Solar energy systems and optimization - Thermal energy storage systems and optimization - Hydrogen and Fuel Cell systems and optimization

9.1.5.4 Enquiries (MEng Energy Efficiency):

Prof WJ Bekker
Tel: (016) 950-9410
E-mail: bekkerj@vut.ac.za

9.1.6 Doctor of Engineering (DEng) in Electrical Engineering: Electronic Engineering (DP0820)

9.1.6.1 Programme Structure

At least two years full-time research, concluded with a Doctoral Thesis.

This qualification is offered at the Vanderbijlpark campus only.

9.1.6.2 Purpose of the DEng in Electrical Engineering: Electronic Engineering

The purpose of the qualification is to develop a researcher who will make a significant and original contribution to knowledge in a specialised area of electrical engineering and technology. To develop a researcher in Electrical Engineering: Electronic Engineering with advanced abilities, to independently apply electrical engineering design, synthesis, and related principles, to specific problems of society at large. One of the main objectives in this process is to develop an advanced capability to conduct engineering research of an original nature. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.5).

9.1.6.3 Admission Requirements

MEng in Electrical Engineering: Electronic Engineering

Ad hoc cases will be treated on merit.

9.1.7 Assessment

The department follows the assessment strategy of formal written exams. The year mark is compiled from a series of not less than three tests and / or a practical mark. The year mark for admittance to the formal examination is 50%. Weights for calculating the year mark as well as the final mark will be reflected in the Learning Guide. All tests, assignments and practical work done during a particular semester, will help learners learn and understand the work.

Some modules follow the assessment strategies of Continuous Assessment (CASS). All marks obtained during the semester will make up the learner’s final mark. Each module’s Learning Guide will indicate which tests and activities will contribute according to a pre-determined weight, to the final mark.

9.1.8 Enquiries

Enquiries may be addressed to:

HoD: Electrical Engineering

Faculty of Engineering & Technology

Vaal University of Technology

Private Bag X021

VANDERBIJLPARK, 1900

HoD: Electrical Engineering

Tel : +27 16 950 9929
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Discipline Coordinator: Electronic Engineering

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Fax : +27 16 950 9796
e-mail : dawiec@vut.ac.za
refilwem1@vut.ac.za
Website : www.vut.ac.za

or

Postgraduate Office

Ms N Kokoali
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e-mail : nomathembak@vut.ac.za

Mr S Motsie
Tel : +27 16 950 7639
e-mail : sehlabakam@vut.ac.za

9.2 ELECTRICAL ENGINEERING: POWER ENGINEERING

Discipline Staff Details (Power Engineering)

Surname, Initials & Title	Designation	Highest Qualification
Langa, HM (Dr)	HoD	DPhil Eng
Mwale RZ (Ms)	Administrator	PG Dip (HE)
Joubert, T (Ms)	Senior Lecturer	MTech
Oosthuysen, NJ (Mr)	Senior Lecturer (C)	MDip Tech
Adeniyi AO (Mr)	Lecturer	MTech
Momubaghan, PU (Mr)	Lecturer	BSc
Pulutsoane, MGE (Mr)	Lecturer	BTech
Thekiso, MQ (Mr)	Lecturer	BTech
Kaaiye, S (Mr)	Junior Lecturer	MSc Eng
Makhalima, AT (Mr)	Junior Lecturer	BTech
Motloung, DP (Mr)	Junior Lecturer	ND
Sebueng, S (Mr)	Junior Lecturer	BTech
Shittu, AM (Mr)	Junior Lecturer	BSc
Adaurhere RE	Technician	MPhil
Djeumen, JS (Mr)	Technician	MTech
Ralebona, ER (Mr)	Technician	BTech
Kyere, IK (Mr)	Technologist	MTech
Hlongwana A (Mr)	Lab Technician	BTech
Ntshangase M (Mr)	Lab Technician	BTech
Mtambo, BA (Mr)	Laboratory Assistant	Sr Certificate

9.2.1 Diploma in Electrical Engineering: Power (DI0824)

9.2.1.1 Programme Structure

Three years full-time qualification, min 360 credits, NQF level 6. Sixty credits are allocated to Workplace Based Learning (WBL). WBL is the last section of the qualification to be completed in Industry. Students to be placed in Industry with approved companies, monitored and assessed by University staff.

9.2.1.2 Purpose of the Diploma in Electrical Engineering: Power

The generic purpose of the qualification is spelled out in paragraph 4.1 and must be read in conjunction with the following.

The purpose of the qualification Diploma in Electrical Engineering: Power is to develop the necessary knowledge, understanding and skills required for the student's further learning towards becoming a competent practicing Power Engineering Technician. It is intended to subsequently empower candidate Power Engineering Technicians to demonstrate that they are capable of applying their acquired knowledge, understanding, skills, attitudes and values in the work environments in South Africa. It is designed also to add value to the qualifying student in terms of enrichment of the person, status and recognition.

9.2.1.3 Admission Requirements

NSC	Compulsory Subjects	Minimum for the Diploma programme	Notes
National Senior Certificate	Mathematics Physical Science English Language Any other subjects with a minimum level of 3, excluding Life Orientation)	4 4 4 12	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79% 7 = 80 – 89% 8 = 90 – 100%
	Total	**24***	

Please note:

- The prospective student's results must meet the statutory and programme admission requirement.

- Bonus points will only be used for selection purposes. In case of a tie and all other scores remaining the same use the actual percentages to differentiate.
- *Admission requirements for any of the **3-year Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 28 and above APS points, with a minimum of 4 for Mathematics, Physical Science and English.
- *Admission requirements for any of the **4-year extended Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 24 – 27 maximum APS points, with a minimum of 4 for Mathematics, Physical Science and English. Students that need more information regarding Extended programmes should liaise with their respective HODs and/or the faculty manager. The main purpose of extended programmes is to widen access and reinforce/improve success.
- All other grade 12 or equivalent certificates will be evaluated against/according to statutory and programme requirements.
- International qualifications: All international qualifications will be evaluated by the International Office based on the Swedish scale and SAQA equivalence.
- Transfers: Applications from students to transfer from other institutions will be dealt with in terms of the Recognition of Prior Learning and CAT policies of VUT.

9.2.1.4 Career Opportunities

A successful candidate can pursue a career as a Power Engineering technician in one of the following specialisation fields: Electrical machines; generation of electricity; electrical transmission and distribution, electrical protection, alternative energy and energy management. The specialisation fields above each offer careers in design and development and maintenance.

9.2.1.5 Curriculum: Diploma in Electrical Engineering: Power

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
HKCOX1A	Applied Communication Skills 1.1	8
EEESK1A	Engineering Skills 1	5
EPEEN1A	Electrical Engineering 1	10
ASICT1A	ICT Skills 1	10
AMMAT1A	Mathematics 1	10
APHYS1A	Physics 1	10
EESIN1A	Social Intelligence 1	3
SEMESTER 2		

HKCOY1A	Applied Communication Skills 1.2	8
EPCOA2A	Computing Applications 2	7
EIDSY1A	Digital Systems 1	10
EPEEN2A	Electrical Engineering 2	10
EEELE1A	Electronics 1	10
AMMAT2A	Mathematics 2	10
EESPA1A	Safety Principles And Law 1	5
	CHOICE MODULES (CHOOSE 1)	
EMEDR1A	Engineering Drawing 1	10
APHYT2A	Physics 2 Theory	5
APHYP2A	Physics 2 Practical	5
SEMESTER 3		
HKCOX2A	Applied Communication Skills 2.1	8
EPEEN3A	Electrical Engineering 3	10
EPEMA2A	Electrical Machines 2	10
EPSYS2A	Power Systems 2	10
AMMAT3A	Mathematics 3	10
EEELE2A	Electronics 2	10
	CHOICE MODULE (CHOOSE 1)	
EIDSY2A	Digital Systems 2	10
BHMAN1A	Management 1	10
EIPRI1A	Process Instruments 1	10
EMMEC1A	Mechanics 1	10
SEMESTER 4		
HKCOY2A	Applied Communication Skills 2.2	8
EPSYS3A	Power Systems 3	10
EEPEL3A	Power Electronics 3	10
EPAEN2A	Alternative Energy 2 (Power)	10
EPEMA3A	Electrical Machines 3	10
	CHOICE MODULE (CHOOSE 1)	
EICSY2A	Control Systems 2	10

SEMESTER 5		
EPEPR3A	Electrical Protection 3	10
EPAEN3A	Alternative Energy 3 (Power)	10
EPEMA4A	Electrical Machines 4	10
EPTXP3A	Transmission 3 (Power)	10
EEPEL4A	Power Electronics 4	10
EPEMN2A	Energy Management 2	10
	CHOICE MODULE (CHOOSE 1)	
EEELE3A	Electronics 3	10
SEMESTER 6		
WBL Placement		
EPEXL1A	Experiential Learning 1	14
EPEXL2A	Experiential Learning 2	16
EPPRJ4A	Engineering Project 4	30

Curriculum: Diploma in Electrical Engineering: Power (4 year Extended programme) – DE0864

The purpose of the Extended Diploma programme is to assist students who enter the University with APS score of 24 – 27 by giving them more time to reach the level of competency similar to those who enter with higher APS scores. The programme extends the 3-year programme into 4 years by spreading the first year of study over 2 years with the inclusion of foundational modules as well as mainstream programme modules. The foundation modules in the first year of study will help students to improve their competency in Maths, Physics and Chemistry. In the second year of study, the students will augment their foundation knowledge of Maths, Physics and Chemistry to reach the level of the mainstream programme. Students are required to pass all subjects in both years of the foundation phase to be able to proceed to the next year of study.

MODULE CODE	NAME OF MODULE	TYPE	CREDITS	
			Regular	Found
YEAR 1 - SEMESTER 1				
AAXCH1A	Foundation Chemistry 1	Foundation		10

AMXMA1A	Foundation Mathematics 1	Foundation		10
APXPH1A	Foundation Physics 1	Foundation		10
ASICT1A	ICT Skills 1	Regular	10	
EEESK1A	Engineering Skills 1	Regular	5	
EESIN1A	Social Intelligence 1	Regular	3	
HKCOX1A	Applied Communication Skills 1.1	Regular	8	
YEAR 1 - SEMESTER 2				
AAXCH2A	Foundation Chemistry 2	Foundation		10
AMXMA2A	Foundation Mathematics 2	Foundation		10
APXPH2A	Foundation Physics 2	Foundation		10
EPCOA2A	Computing Applications 2	Regular	7	
EESPA1A	Safety Principles and Law 1	Regular	5	
HKCOY1A	Applied Communication Skills 1.2	Regular	8	
YEAR 2 - SEMESTER 1				
AMMAT1B	Mathematics 1	Regular (Augm)	10	
APHYS1B	Physics 1	Regular (Augm)	10	
EPEEN1A	Electrical Engineering 1	Regular	10	

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"(+(0,-8&#.$&%$84+2%&)(54+$/9

9.2.2 Government Certificate of Competency (GCC)

The Certificate of Competency as a Mechanical and / or Electrical Engineering: Power Engineering Technician is issued by the Department of Labour (Factories) or the Department of Minerals and Energy Affairs (Mines) to a person with the necessary academic diploma / degree and practical experience and who has passed a qualifying examination. A person with such a certificate must take responsibility for the operation of a factory or mine where the consumption of electricity exceeds a certain limit.

This University is one of a few tertiary institutions accredited to offer Diplomas complying with the requirements for admission to the GCC examination. This is not a GCC qualification, only a subject package complying with the entry requirements to the GCC examination.

This is for the combination of subjects of the National Diploma and **NOT** for the Diploma in Engineering.

Government Certificate of Competency (GCC)	
• Computer & Programming Skills I	• Electrical Engineering, I
• Mathematics I	• Electrical Engineering II
• Mathematics II	• Electrical Engineering III
• Industrial Electronics II	• Electrical Machines II
• Power Electronics III	• Electrical Machines III
• Electronics I	• Electrical Protection III
• Electronics II	• Digital Systems I
• Mechanics I	• Applied Communication Skills 1.1
• Mechanical Engineering Drawing I	• Applied Communication Skills 1.2
• Mechanical Technology I	• Applied Communication Skills 2.1
• Mechanical Technology II	• Applied Communication Skills 2.2
• Mechanical Technology III	• EDL
• Design Project III	• Strength of Materials II
• Electrical Distribution 3	• Strength of Materials III

Government Certificate of Competency Contact Information:

Written application for admission to the examination for the Certificate of Competency can be addressed to:

Mines & Industries : Department of Minerals & Energy Affairs
Private Bag X59
Pretoria, 0001

The written application must also include a letter stating that all the prescribed theoretical requirements have been met. This letter is obtainable from the Department of Power Engineering.

9.2.3 Advanced Diploma in Electrical Engineering: Power Engineering (AD0824)

9.2.3.1 Admission Requirements

For admission into the AdvDip: Electrical Engineering: Power Engineering (NQF level 7, min 120 credits), all applicants must have a Diploma in Electrical Engineering: Power (NQF level 6, min 360 credits) or equivalent. Apart from the prescribed qualification, a specified period of relevant post-qualification practical experience is a prerequisite for registration.

9.2.3.2 Duration of Programme

One-year, full-time qualification.

9.2.3.3 Curriculum: Advanced Diploma in Electrical Engineering: Power Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
	COMPULSARY	
EPPRO4A	Electrical Engineering Project	25

9.2.4 Postgraduate Diploma (PGDip) in Electrical Engineering: Power Engineering (PG0824)

9.2.4.1 Programme Structure

One-year, full-time qualification. The Postgraduate Diploma in Electrical Engineering: Power Engineering is a postgraduate qualification at NQF level 8 (Min 120 credits at level 8). The qualification is characterised by the fact that it prepares students for industry and research. This qualification typically follows a Bachelor's Degree, Advanced Diploma in Electrical Engineering: Power Engineering or relevant NQF level 7 qualification and serves to consolidate and deepen the student's expertise in Electrical Engineering: Power Engineering and to develop research capacity in the methodology and techniques of Electrical Engineering: Power Engineering.

9.2.4.2 Purpose of the PGDip in Electrical Engineering: Power Engineering

The Postgraduate Diploma in Electrical Engineering: Power Engineering is a postgraduate qualification at NQF level 8 (Min 120 credits at level 8). The qualification is characterised by the fact that it prepares students for industry and research. This qualification typically follows a Bachelor's Degree, Advanced Diploma in Electrical Engineering: Power Engineering or relevant NQF level 7 qualification and serves to consolidate and deepen the student's expertise in Electrical Engineering: Power Engineering and to develop research capacity in the methodology and techniques of Electrical Engineering: Power Engineering. The Postgraduate Diploma in Electrical Engineering: Power Engineering is aligned with the DoHET's HEQFS – sub framework document and SAQA requirements. To cope with the changing needs, developing markets and new technologies, this programme focuses on equipping students with a sound knowledge base in Electrical Engineering: Power Engineering and the ability to develop new knowledge and skills in this field.

This qualification demands a high level of theoretical engagement and intellectual independence. Through benchmarking with national and international higher education institutions as well as consultation with relevant stakeholders it has become clear that a research component needs to be an integral component of the qualification. This qualification provides:

1. Preparation for careers in Electrical Engineering: Power Engineering itself and areas that potentially benefit from engineering skills, for achieving technological

proficiency and to make a contribution to the economy and national development; and

2. Entry to NQF level 9 Masters programmes e.g. MSc/MEng

Engineering students completing this qualification will demonstrate competence in all the required Exit Level Outcomes contained in this qualification. This programme compares favourably with honours level (NQF level 8) studies at local and international universities. Inputs were received from the advisory committee/board and other stakeholders in the discipline, therefore meeting the needs of industry.

Students completing this qualification will have an advantage in the discipline of Electrical Engineering in that they will be prepared to conduct industry relevant research. VUT students meet the needs of the surrounding community. The Vaal Triangle and surrounding areas has many enterprises that employ graduates from VUT.

9.2.4.3 Admission Requirements

Normal admission is an Advanced Diploma in Electrical Engineering: Power Engineering at NQF 7. An appropriate 360 credit Bachelor's Degree at NQF 7 which provides the necessary foundational knowledge can also provide admission to this qualification.

9.2.4.4 Curriculum: Postgraduate Diploma in Electrical Engineering: Power Engineering

MODULE CODE	NAME OF MODULE	CREDITS
	COMPULSORY	
	Engineering Research Project	30
	Research Statistics	15
	MINIMUM OF 3 ELECTIVES	
	Alternative Energy Feasibility	25
	Electrical Protection	25
	Energy Efficiency Management	25
	Energy Management	25
	High Voltage Engineering	25

	Power Systems	25

9.2.5 Master of Engineering (MEng) in Electrical Engineering: Power Engineering (MP0820)

This qualification is offered at the Vanderbijlpark campus only.

9.2.5.1 Programme Structure

At least one-year, full-time research, concluded with a Master's Dissertation.

9.2.5.2 Purpose of the MEng in Electrical Engineering: Power Engineering

The purpose of this qualification is to develop a student into a researcher, able to conduct independent research with minimum guidance in a chosen field of Electrical Engineering: Power Engineering. The outcomes of the research will contribute to knowledge production in the specialisation field. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.4).

9.2.5.3 Admission Requirements

BEng degree (Power) or equivalent.

Proof of successful completion of a Vaal University of Technology approved course in Research Methodology.

Ad hoc cases will be treated on merit.

9.2.6 Doctor of Engineering (DEng) in Electrical Engineering: Power Engineering (DP0820)

This qualification is offered at the Vanderbijlpark campus only.

9.2.6.1 Programme Structure

At least two years full-time research, concluded with a Doctoral Thesis.

9.2.6.2 Purpose of the DEng in Electrical Engineering: Power Engineering

The purpose of the qualification is to develop a researcher who will make a significant and original contribution to knowledge in a specialised area of Electrical

Engineering: Power Engineering and technology. To develop a researcher in Electrical Engineering: Power Engineering with advanced abilities, to independently apply electrical engineering design, synthesis, and related principles, to specific problems of society at large. One of the main objectives in this process is to develop an advanced capability to conduct engineering research of an original nature. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.5).

9.2.6.3 Admission Requirements

Master of Engineering in Electrical Engineering: Power Engineering.

Ad hoc cases will be treated on merit.

9.2.7 Assessment

The department follows the assessment strategy of formal written exams. The year mark is compiled from a series of not less than three tests and / or a practical mark. The year mark for admittance to the formal examination is 50%. Weights for calculating the year mark as well as the final mark will be reflected in the Learning Guide. All tests, assignments and practical work done during a particular semester, will help learners learn and understand the work.

Some modules follow the assessment strategies of Continuous Assessment (CASS). All marks obtained during the semester will make up the learner's final mark. Each module's Learning Guide will indicate which tests and activities will contribute according to a pre-determined weight, to the final mark.

9.2.8 Enquiries

Enquiries may be addressed to:

HoD: Electrical Engineering

Faculty of Engineering & Technology

Vaal University of Technology

Private Bag X021

VANDERBIJLPARK, 1900

Tel : +27 16 950 9929
Fax : +27 16 950 9795
e-mail : hendrickl@vut.ac.za
refilwem1@vut.ac.za
Website : www.vut.ac.za

or

Postgraduate Office

Ms N Kokoali
Tel : +27 16 950 9288
e-mail : nomathembak@vut.ac.za

Mr S Motsie
Tel : +27 16 950 7639
e-mail : sehlabakam@vut.ac.za

9.3 ELECTRICAL ENGINEERING: PROCESS CONTROL ENGINEERING

Discipline Staff Details (Process Control and Computer Systems)

Surname, Initials & Title	Designation	Highest Qualification
Langa, HM (Dr)	HoD	DPhil Eng
Mwale, RZ (Ms)	Administrator	PG Dip (HE)
Mathaba, T (Dr)	Discipline Coordinator	PhD Eng
Joubert, A (Dr)	Senior Lecturer	DTech Eng
Joubert, AG (Mr)	Senior Lecturer	MDip Tech
Loubser, JB (Mr)	Senior Lecturer	MTech
Mitton, PJ (Mr)	Senior Lecturer	MDip Tech
Claassen, CJ (Mr)	Lecturer	MTech
Maloka, TV (Mr)	Lecturer	BTech
Nel, BCD (Mr)	Lecturer	BTech
Otunniyi, TO (Ms)	Lecturer	MTech
Tukisi, TW (Mr)	Lecturer	MEng
Van Aardt, CC (Mr)	Lecturer	MSc
Vosloo, AM (Ms)	Lecturer	BTech
Benson, MJM (Mr)	Junior Lecturer	BTech
Mohapi, MJ (Ms)	Junior Lecturer	MTech
Nshimba, KT (Mr)	Junior Lecturer	MSc
Pretorius, PD (Mr)	Snr Research Technologist	MTech
Baxter, R (Mr)	Technician	BTech
Du Rand, F (Mr)	Technician	MTech
Roos, L (Mr)	Technician	BTech
Van Tonder, Z (Ms)	Technician	BTech
Fataki, MJ (Mr)	Lab Assistant	BTech
Ojoseriki, DF (Mr)	Lab Assistant	BTech

9.3.1 Diploma in Electrical Engineering: Process Control (DI0825)

9.3.1.1 Programme Structure

Offered full-time, contact classes are for a period for six semesters (three years) followed by a one-year Workplace Based Learning (WBL) (carried out through attachment to industry) component. The student will be assisted by the university to look for suitable industry opportunities (companies) to complete the required WBL training and skills development. Due to this component this programme is likely to take longer than 3 years to complete. This programme is presented at the Vanderbijlpark campus and the exit level of the qualification is at NQF 6, min 360 credits.

9.3.1.2 Purpose of the Diploma in Electrical Engineering: Process Control

The generic purpose of the qualification is spelled out in paragraph 4.1 and must be read in conjunction with the following: The purpose of the qualification is to develop the necessary knowledge, understanding and skills required for the student's further learning towards becoming a competent practicing Process Control Technician. A qualifying learner at this level is competent in process control and instrumentation operations, maintenance and problem solving. It is intended to subsequently empower candidate Process Control Engineering Technicians to demonstrate that they are capable of applying their acquired knowledge, understanding, skills, attitudes and values in the process control and instrumentation work environments in South Africa. It is designed also to add value to the qualifying student in terms of enrichment of the person, status and recognition.

9.3.1.3 Admission Requirements

NSC	Compulsory Subjects	Minimum for the Diploma programme	Notes
National Senior Certificate	Mathematics Physical Science English Language Any other subjects with a minimum level of 3, excluding Life Orientation **Total**	4 4 4 12 **24***	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79% 7 = 80 – 89% 8 = 90 – 100%

Please note:

- The prospective student's results must meet the statutory and programme admission requirement.
- Bonus points will only be used for selection purposes. In case of a tie and all other scores remaining the same use the actual percentages to differentiate.
- *Admission requirements for any of the **3-year Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 28 and above APS points, with a minimum of 4 for Mathematics, Physical Science and English.
- *Admission requirements for any of the **4-year extended Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 24 – 27 maximum APS points, with a minimum of 4 for Mathematics, Physical Science and English. Students that need more information regarding Extended programmes should liaise with their respective HODs and/or the faculty manager. The main purpose of extended programmes is to widen access and reinforce/improve success.
- All other grade 12 or equivalent certificates will be evaluated against/according to statutory and programme requirements.
- International qualifications: All international qualifications will be evaluated by the International Office based on the Swedish scale and SAQA equivalence.
- Transfers: Applications from students to transfer from other institutions will be dealt with in terms of the Recognition of Prior Learning and CAT policies of VUT.

9.3.1.4 Curriculum: Diploma in Electrical Engineering: Process Control

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
HKCOX1A	Applied Communication Skills 1.1	8
EEESK1A	Engineering Skills 1	5
EPEEN1A	Electrical Engineering 1	10
ASICT1A	ICT Skills 1	10
AMMAT1A	Mathematics 1	10
APHYS1A	Physics 1	10
EESIN1A	Social Intelligence 1	3
SEMESTER 2		
HKCOY1A	Applied Communication Skills 1.2	8
EICOA2A	Computing Applications 2	7
EIDSY1A	Digital Systems 1	10

AMMAT2A	Mathematics 2	10
EIPRI1A	Process Instrumentation 1	10
APHYP2A	Physics 2 Practical	5
APHYT2A	Physics 2 Theory	5
EESPA1A	Safety Principles and Law 1	5
SEMESTER 3		
HKCOX2A	Applied Communication Skills 2.1	8
EPEEN2A	Electrical Engineering 2	10
EEELE1A	Electronics 1	10
EIENP1A	Engineering Programming 1	10
EINET1A	Networks 1	10
EIPRI2A	Process Instrumentation 2	10
AMMAT3A	Mathematics 3	10
SEMESTER 4		
EIDCS1A	Digital Control Systems 1	10
HKCOY2A	Applied Communication Skills 2.2	8
EIDSY2A	Digital Systems 2	10
EEELE2A	Electronics 2	10
EIENP2A	Engineering Programming 2	10
EINET2A	Networks 2	10
EIPRI3A	Process Instrumentation 3	10
SEMESTER 5		
EEPEL3A	Power Electronics 3	10
EIDSY3A	Digital Systems 3	10
EINET3A	Networks 3	10
EICSY2A	Control Systems 2	10
EIDCS2A	Digital Control Systems 2	10
EIENP3A	Engineering Programming 3	10
SEMESTER 6		
	OPTIONAL ADDITIONAL	

EIDSY4A	Digital Systems 4	10
EICSY3A	Control Systems 3	10
EINET4A	Networks 4	10
WBL PLACEMENT		
EIEXL1A	Experiential Learning 1	14
EIEXL2A	Experiential Learning 2	16
EIPRJ4A	Engineering Project 4A	30

Curriculum: Diploma Electrical Engineering: Process Control (4 year Extended programme) – DE0865

The purpose of the Extended Diploma programme is to assist students who enter the University with APS score of 24 - 27 by giving them more time to reach the level of competency similar to those who enter with higher APS scores. The programme extends the 3-year programme into 4 years by spreading the first year of study over 2 years with the inclusion of foundational modules as well as mainstream programme modules. The foundation modules in the first year of study will help students to improve their competency in Maths, Physics and Chemistry. In the second year of study, the students will augment their foundation knowledge of Maths, Physics and Chemistry to reach the level of the mainstream programme. Students are required to pass all modules in both years of the foundation phase to be able to proceed to the next year of study.

MODULE CODE	NAME OF MODULE	TYPE	CREDITS	
			Regular	Found
YEAR 1 - SEMESTER 1				
AAXCH1A	Foundation Chemistry 1	Foundation		10
AMXMA1A	Foundation Mathematics 1	Foundation		10
APXPH1A	Foundation Physics 1	Foundation		10
ASICT1A	ICT Skills 1	Regular	10	
EEESK1A	Engineering Skills 1	Regular	5	
EESIN1A	Social Intelligence 1	Regular	3	
HKCOX1A	Applied Communication Skills 1.1	Regular	8	
YEAR 1 - SEMESTER 2				

AAXCH2A	Foundation Chemistry 2	Foundation		10
AMXMA2A	Foundation Mathematics 2	Foundation		10
APXPH2A	Foundation Physics 2	Foundation		10
EICOA2A	Computing Applications 2	Regular	7	
EESPA1A	Safety Principles and Law 1	Regular	5	
HKCOY1A	Applied Communication Skills 1.2	Regular	8	
YEAR 2 - SEMESTER 1				
AMMAT1B	Mathematics 1	Regular (Augm)	10	
APHYS1B	Physics 1	Regular (Augm)	10	
EPEEN1A	Electrical Engineering 1	Regular	10	

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"(+(0,-8&#.$&%$84+2%&)(54+$/9

9.3.1.5 Workplace Based Learning

The Diploma in Electrical Engineering: Process Control has a formal Workplace Based Learning (WBL) component of 60 credits. This takes place at an accredited employer (company). The student will be assisted to find suitable placement after which the student will register for the WBL modules. The student will provide progress reports at regular intervals, in co-operation with a work-based mentor, to confirm that the necessary practical outcomes are being achieved.

9.3.2 Advanced Diploma in Electrical Engineering: Process Control Engineering (AD0825)

9.3.2.1 Admission Requirements

For admission into the AdvDip in Electrical Engineering: Process Control Engineering (NQF level 7, min 120 credits), all applicants must have a Diploma in Electrical Engineering: Process Control (NQF level 6, min 360 credits) or equivalent.

9.3.2.2 Duration of Programme: One-year, full-time qualification.

9.3.2.3 Curriculum: Advanced Diploma in Electrical Engineering: Process Control Engineering

MODULE CODE	NAME OF MODULE	CREDITS
	SEMESTER 1	
	COMPULSORY	
EIPRO4A	Electrical Engineering Project	25
EIREM4A	Engineering Research Methods	15
	ELECTIVES	
EIPRI4A	Process Instrumentation	20
EIDSP4A	Digital Signal Processing	20
	SEMESTER 2	
	COMPULSORY	
AMAEM4A	Advanced Engineering Mathematics	15
BHEMN4A	Engineering Management	10
	ELECTIVES	
EIDCS4A	Digital Control Systems	20
EIINT4A	Industrial Network Systems	20

9.3.2.4 Typical work environment for the Process Control Engineering Technologist

The environment where a Process Control Engineering technologist will function is in measurement and control of pressure, level, flow and temperature parameters. The design, installation and maintenance of process control systems and instrumentation. Installation, commissioning and optimisation of various control systems, industrial networks, Safety Systems and Distributed Control Systems (DCS).

9.3.2.5 Career Opportunities

The computerisation of modern instrumentation and process control platforms in various industries, created a vacuum period in training of skills development for technicians in this modern industrial environment which led to a huge demand for technical skilled manpower in this field.

9.3.2.6 Career Status

The Instrument Technician can register for professional status with ECSA, the Control Board for Engineering Technicians. The South African Institute for Measurement and Control is another professional body.

9.3.3 Postgraduate Diploma in Electrical Engineering: Process Control Engineering (PG0825)

9.3.3.1 Admission Requirements

For admission into the PGD in Electrical Engineering: Process Control Engineering (NQF level 8, min 120 credits), all applicants must have an Advanced Diploma in Electrical Engineering: Process Control Engineering (NQF level 7, min 120 credits).

9.3.3.2 Duration of Programme: One-year, full-time qualification.

9.3.3.3 Curriculum: Postgraduate Diploma in Electrical Engineering: Process Control Engineering

MODULE CODE	NAME OF MODULE	CREDITS
	SEMESTER 1	
	COMPULSORY	
	Engineering Research Project	30
	Research Statistics	15
	MINIMUM OF 3 ELECTIVES	
	Advanced DCS and Safety Systems Engineering	25
	Advanced Process Instrumentation Systems	25
	Process Control System Design & Development	25
	Smart Digital Instrumentation Engineering	25
	Smart Industrial Network Control	25

9.3.4 Master of Engineering in Electrical Engineering: Process Control Engineering (MP0820)

9.3.4.1 Programme Structure

At least 1 year full-time research, concluded with a Master's Dissertation. This qualification is offered at the Vanderbijlpark campus only.

9.3.4.2 Purpose of the MEng in Electrical Engineering: Process Control Engineering

The purpose of this qualification is to develop a student into a researcher, able to conduct independent research with minimum guidance in a chosen field of Electrical Engineering: Process Control Engineering. The outcomes of the research will contribute to knowledge production in the specialisation field. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.4.)

9.3.4.3 Admission Requirements

A BEng degree in Electrical Engineering: Process Control Engineering or equivalent level 8 qualification. Proof of successful completion of Vaal University of Technology approved course in Research Methodology. Ad hoc cases will be treated on merit.

9.3.5 Doctor of Engineering in Electrical Engineering: Process Control Engineering (DP0820)

9.3.5.1 Programme Structure

At least two years' full-time research, concluded with a Doctoral Thesis. This qualification is offered at the Vanderbijlpark campus only.

9.3.5.2 Purpose of the Doctor of Engineering in Electrical Engineering: Process Control Engineering

The purpose of the qualification is to develop a researcher who will make a significant and original contribution to knowledge in a specialised area of electrical engineering in Process Control Engineering and related technologies. To develop a researcher in Electrical Engineering in Process Control Engineering with advanced abilities, to independently apply Electrical Engineering: Process Control Engineering industrial based designs, synthesis, and related computer systems engineering principles, to specific problems of society at large.

One of the main objectives in this process is to develop an advanced capability to conduct engineering research of an original nature. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (See also paragraph 4.5.)

9.3.5.3 Admission Requirements

MEng in Electrical Engineering: Process Control Engineering. Ad hoc cases will be treated on merit.

9.4 ELECTRICAL ENGINEERING: COMPUTER SYSTEMS ENGINEERING

9.4.1 Diploma in Electrical Engineering: Computer Systems (DI0822)

9.4.1.1 Duration of Programme

Three years qualification, min 360 credits, NQF level 6. Offered full-time, contact classes are for a period for six semesters (three years) followed by a one-year Workplace Based Learning (WBL) (carried out through attachment to industry) component. The student will be assisted by the university to look for suitable industry opportunities (companies) to complete the required WBL training and skills development.

9.4.1.2 Admission Requirements

NSC	Compulsory Subjects	Minimum for the Diploma programme	Notes
National Senior Certificate	Mathematics Physical Science English Language Any other subjects with a minimum level of 3, excluding Life Orientation **Total**	4 4 4 12 **24***	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79% 7 = 80 – 89% 8 = 90 – 100%

<u>Please note</u>:

- The prospective student's results must meet the statutory and programme admission requirement.
- Bonus points will only be used for selection purposes. In case of a tie and all other scores remaining the same use the actual percentages to differentiate.
- *Admission requirements for any of the **3-year Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 28 and above APS points, with a minimum of 4 for Mathematics, Physical Science and English.
- *Admission requirements for any of the **4-year extended Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 24 – 27 maximum APS points, with a minimum of 4 for Mathematics, Physical Science and English. Students that need more information regarding Extended programmes should liaise with their respective HODs and/or the faculty manager. The main purpose of extended programmes is to widen access and reinforce/improve success.
- All other grade 12 or equivalent certificates will be evaluated against/according to statutory and programme requirements.
- International qualifications: All international qualifications will be evaluated by the International Office based on the Swedish scale and SAQA equivalence.
- Transfers: Applications from students to transfer from other institutions will be dealt with in terms of the Recognition of Prior Learning and CAT policies of VUT.

9.4.1.3 Curriculum: Diploma in Electrical Engineering: Computer Systems

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
HKCOX1A	Applied Communication Skills 1.1	8
EEESK1A	Engineering Skills 1	5
EPEEN1A	Electrical Engineering 1	10
ASICT1A	ICT Skills 1	10
AMMAT1A	Mathematics 1	10
APHYS1A	Physics 1	10
EESIN1A	Social Intelligence 1	3
SEMESTER 2		
HKCOY1A	Applied Communication Skills 1.2	8
EICOA2A	Computing Applications 2	7
EIDSY1A	Digital Systems 1	10
EPEEN2A	Electrical Engineering 2	10
AMMAT2A	Mathematics 2	10

APHYP2A	Physics 2 Practical	5
APHYT2A	Physics 2 Theory	5
EESPA1A	Safety Principles and Law 1	5
SEMESTER 3		
HKCOX2A	Applied Communication Skills 2.1	8
EIDSY2A	Digital Systems 2	10
EEELE1A	Electronics 1	10
EIENP1A	Engineering Programming 1	10
EINET1A	Networks 1	10
EISEN1A	Software Engineering 1	10
EIOSY1A	Operating Systems 1	10
SEMESTER 4		
HKCOY2A	Applied Communication Skills 2.2	8
EIDSY3A	Digital Systems 3	10
EEELE2A	Electronics 2	10
EIENP2A	Engineering Programming 2	10
EINET2A	Networks 2	10
EIOSY2A	Operating Systems 2	10
EISEN2A	Software Engineering 2	10
SEMESTER 5		
EIENP3A	Engineering Programming 3	10
AMMAT3A	Mathematics 3	10
EINET3A	Networks 3	10
EIOSY3A	Operating Systems 3	10
EISEN3A	Software Engineering 3	10
EIDSY4A	Digital Systems 4	10
SEMESTER 6		
	CHOICE (At least 1)	
EIENP4A	Engineering Programming 4	10
EINET4A	Networks 4	10
WBL Placement		

EIEXC1A	Experiential Learning 1 (Computer Systems)	14
EIEXC2A	Experiential Learning 2 (Computer Systems)	16
EIPRC4A	Engineering Project 4	30

Curriculum: Diploma in Electrical Engineering: Computer Systems (4 year Extended programme) – DE0862

The purpose of the Extended Diploma programme is to assist students who enter the University with APS score of 24 - 27 by giving them more time to reach the level of competency similar to those who enter with higher APS scores. The programme extends the 3-year programme into 4 years by spreading the first year of study over 2 years with the inclusion of foundational modules as well as mainstream programme modules. The foundation modules in the first year of study will help students to improve their competency in Maths, Physics and Chemistry. In the second year of study, the students will augment their foundation knowledge of Maths, Physics and Chemistry to reach the level of the mainstream programme. Students are required to pass all modules in both years of the foundation phase to be able to proceed to the next year of study.

MODULE CODE	NAME OF MODULE	TYPE	CREDITS	
			Regular	Found
YEAR 1 - SEMESTER 1				
AAXCH1A	Foundation Chemistry 1	Foundation		10
AMXMA1A	Foundation Mathematics 1	Foundation		10
APXPH1A	Foundation Physics 1	Foundation		10
ASICT1A	ICT Skills 1	Regular	10	
EEESK1A	Engineering Skills 1	Regular	5	
EESIN1A	Social Intelligence 1	Regular	3	
HKCOX1A	Applied Communication Skills 1.1	Regular	8	
YEAR 1 - SEMESTER 2				
AAXCH2A	Foundation Chemistry 2	Foundation		10
AMXMA2A	Foundation Mathematics 2	Foundation		10
APXPH2A	Foundation Physics 2	Foundation		10

EICOA2A	Computing Applications 2	Regular	7	
EESPA1A	Safety Principles and Law 1	Regular	5	
HKCOY1A	Applied Communication Skills 1.2	Regular	8	
YEAR 2 - SEMESTER 1				
AMMAT1B	Mathematics 1	Regular (Augm)	10	
APHYS1B	Physics 1	Regular (Augm)	10	
EPEEN1A	Electrical Engineering 1	Regular	10	

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9.4.1.4 Workplace Based Learning / Experiential Learning

The Diploma in Electrical Engineering: Computer Systems has a formal Workplace Based Learning (WBL) component of 60 credits. This takes place at an accredited employer (company). The student will be assisted to find suitable placement after which the student will register for the WBL modules. The student will provide progress reports at regular intervals, in co-operation with a work-based mentor, to confirm that the necessary practical outcomes are being achieved.

9.4.2 Advanced Diploma in Electrical Engineering: Computer Systems Engineering (AD0822)

9.4.2.1 Admission Requirements

For admission into the AdvDip in Electrical Engineering: Computer Systems Engineering (NQF level 7, min 120 credits), all applicants must have a Diploma in Electrical Engineering: Computer Systems (NQF level 6, min 360 credits) or equivalent.

9.4.2.2 Duration of Programme: One-year, full-time qualification.

9.4.2.3 Curriculum: Advanced Diploma in Electrical Engineering: Computer Systems Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
	COMPULSARY	

EIPRE4A	Electrical Engineering Project	25
EIREM4A	Engineering Research Methods	15
	ELECTIVES	
EIMSD4A	Micro Systems Design	20
EEAEL4A	Electronics	20
EINTP4A	New Technology Programming	20
EIDBP4A	Database Programming	20
	SEMESTER 2	
	COMPULSARY	
AMAEM4A	Advanced Engineering Mathematics	15
BHEMN4A	Engineering Management	10
	ELECTIVES	
EISEN4A	Software Engineering	20
EIWDC4A	Wireless Data Communications	20
EICNS4A	Computer Network Security	20
EIDBS4A	Database Administration	20
EIARI4A	Artificial Intelligence	20

9.4.2.4 Typical work environment for the Computer Systems Engineering Technologist

Hardware design and development using microcontroller and mobile systems. Data communications, design, installation and maintenance of network and data management systems. Programming and data processing. Database applications. Design and development of fully engineered systems.

9.4.2.5 Career Opportunities

The computerisation and digitization of most facets of modern business and industry, together with the great demand for technical skilled manpower created a multitude of possibilities for such a career in Computer Systems Engineering.

9.4.2.6 Career Status

The Computer Systems Engineering Technologist can register for professional status with ECSA, the Control Board for Engineering Technologists.

9.4.3 Postgraduate Diploma in Electrical Engineering: Computer Systems Engineering (PG0822)

9.4.3.1 Admission Requirements

All applicants must have an Advanced Diploma in Electrical Engineering: Computer Systems Engineering (NQF level 7, min 120 credits).

9.4.3.2 Duration of Programme: One-year, full-time qualification (NQF level 8, min 120 credits).

9.4.3.3 Curriculum: Postgraduate Diploma in Electrical Engineering: Computer Systems Engineering

MODULE CODE	NAME OF MODULE	CREDITS
COMPULSORY		
	Engineering Research Project	30
	Research Statistics	15
MINIMUM OF 3 ELECTIVES		
Complementary Modules (Mod 1 and 2 of a module must be taken together)		
	Advanced Networking Module 1	25
	Advanced Networking Module 2	25
	Advanced Software Engineering Module 1	25
	Advanced Software Engineering Module 2	25
	Systems Engineering Module 1	25
	Systems Engineering Module 2	25
Independent Modules (Any 1 module can be taken if a set of complementary modules were chosen)		
	Advanced Hardware Systems	25
	Computer Systems Security	25

	Emerging Systems	25
	Operating System Design	25
	Intelligent Systems	25

9.4.4 Master of Engineering in Electrical Engineering: Computer Systems Engineering (MP0820)

9.4.4.1 Programme Structure

At least 1 year full-time research, concluded with a Master's Dissertation. This qualification is offered at the Vanderbijlpark campus only.

9.4.4.2 Purpose of the MEng in Electrical Engineering: Computer Systems Engineering

The purpose of this qualification is to develop a student into a researcher, able to conduct independent research with minimum guidance in a chosen field of Electrical Engineering: Computer Systems Engineering. The outcomes of the research will contribute to knowledge production in the specialisation field. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.4.)

9.4.4.3 Admission Requirements

A BEng degree in Electrical Engineering: Computer Systems Engineering or equivalent level 8 qualification. Proof of successful completion of Vaal University of Technology approved course in Research Methodology. Ad hoc cases will be treated on merit.

9.4.5 Doctor of Engineering in Electrical Engineering: Computer Systems Engineering (DP0820)

9.4.5.1 Programme Structure

At least two years' full-time research, concluded with a Doctoral Thesis. This qualification is offered at the Vanderbijlpark campus only.

9.4.5.2 Purpose of the Doctor of Engineering in Electrical Engineering: Computer Systems Engineering

The purpose of the qualification is to develop a researcher who will make a significant and original contribution to knowledge in a specialised area of electrical engineering in Computer Systems Engineering and related technologies. To develop a researcher in Electrical Engineering in Computer Systems Engineering with advanced abilities, to independently apply Electrical Engineering: Computer Systems Engineering industrial based designs, synthesis, and related computer systems engineering principles, to specific problems of society at large.

One of the main objectives in this process is to develop an advanced capability to conduct engineering research of an original nature. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (See also paragraph 4.5.)

9.4.5.3 Admission Requirements

MEng in Electrical Engineering: Computer Systems Engineering. Ad hoc cases will be treated on merit.

9.5 Enquiries

Enquiries may be addressed to:

HoD: Electrical Engineering
Faculty of Engineering & Technology
Vaal University of Technology
Private Bag X021
Vanderbijlpark, 1900

HoD: Electrical Engineering

Tel	:	+27 16 950 9929
Fax	:	+27 16 950 9795
e-mail	:	hendrickl@vut.ac.za
		refilwem1@vut.ac.za

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Tel : +27 16 950 9254
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e-mail : tebellom1@vut.ac.za
refilwem1@vut.ac.za
Website: www.vut.ac.za

or

Postgraduate Office

Ms N Kokoali
Tel : +27 16 950 9288
e-mail : nomathembak@vut.ac.za

Mr S Motsie
Tel : +27 16 950 7639
e-mail : sehlabakam@vut.ac.za

10. DEPARTMENT OF INDUSTRIAL ENGINEERING & OPERATIONS MANAGEMENT AND MECHANICAL ENGINEERING

10.1 INDUSTRIAL ENGINEERING AND OPERATIONS MANAGEMENT

Discipline Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Tengen, TB (Prof)	HoD	PhD
Nakedi, K (Ms)	Administrator	PGD
Sukraj, R (Mr)	Senior Lecturer	BTech
Van Wyk, T (Ms)	Senior Lecturer	MBL, Pr Tech Eng
Adeyemi, OS (Mr)	Lecturer	MSc
Ikome, JM, (Mr)	Lecturer	MTech
Khumalo, I (Mr)	Lecturer	MSc
Nhlabathi, GS (Mr)	Lecturer	MTech
Mallane, TM (Ms)	Junior Lecturer	BTech
Sivambu, JC (Mr)	Technician	BTech

10.1.1 Diploma in Industrial Engineering (DI0830)

A diploma will be issued on the completion of 36 modules, made up of five semesters of theoretical learning and one-semester Workplace-Based Learning (WBL) at an accredited employer. The six-month period of Workplace-Based Learning is registered at the University. The WBL training is undertaken upon completion of S5 or at least 90% of all the theoretical components of the training.

The University will look for placement for students who complete ALL the theoretical components of the qualification, while students who only complete around 90% of the theoretical components will have the responsibility to look for THEIR OWN placements.

10.1.1.1 Programme Structure

Three-year full-time qualification:

- Five semesters (S1 to S5) of theoretical learning at the Vaal University of Technology
- One semester (at least) of Work Integrated learning (Industry)

Each semester of theoretical consists of approximately 15 weeks of tuition, comprising of lectures, tutorials and practical work done in laboratories for some modules. During this time, the student's progress is evaluated by means of written tests, assignments (individual or group), practical evaluations, continuous assessments, case-based studies, documented investigation/research, presentations, documented projects, computer-based assessments and simulations. At the end of each semester, final examinations are written on all the work done during the semester over an approximatelytwo2 weeks' period for those modules that were not assessed on a continuous assessment basis.

10.1.1.2 Purpose of the Diploma in Industrial Engineering

The generic purpose of the qualification is spelt out in paragraph 4.1 and must be read in conjunction with the following: The purpose of the qualification Diploma in Industrial Engineering is to develop the necessary knowledge, understanding and skills required for the student's further learning towards becoming a competent practising Industrial Engineering Technician. It is intended to subsequently empower candidate Engineering Technicians to demonstrate that they can apply their acquired knowledge, understanding, skills, attitudes and values in the work environments in South Africa and the world at large. It is also designed to add value to the qualifying student in terms of enrichment of the person, status and recognition.

The main objective of this discipline is to constantly improve methods, procedures and practice within an organisation in order to increase productivity and profits. More value is added if inputs like manpower, materials, machinery and money are converted more effectively with sound management principles into products and services. Such a person is continually engaged in core aspects such as communication, co-operation, quality, planning, scheduling, cycle time, capacity, utilisation, economic analysis, problem-solving, materials handling, facility layout, etc. Industrial Engineering, therefore, requires persons who like working with people, who enjoy analysing and solving problems, developing solutions, gaining co-operation, motivating people and always seek better, quicker and cheaper ways of doing things.

10.1.1.3 Admission Requirements: Diploma in Industrial Engineering

NSC	Compulsory Subjects	Minimum for the Diploma programme	Notes
National Senior Certificate	Mathematics Physical Science English Language Any other subjects with a minimum level of 3, excluding Life Orientation **Total**	4 4 4 12 **24***	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79% 7 = 80 – 89% 8 = 90 – 100%

Please note:

- The prospective student's results must meet the statutory and programme admission requirement.
- Bonus points will only be used for selection purposes. In case of a tie and all other scores remaining the same use the actual percentages to differentiate.
- *Admission requirements for any of the **3-year Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 28 and above APS points, with a minimum of 4 for Mathematics, Physical Science and English.
- *Admission requirements for any of the **4-year extended Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 24 – 27 maximum APS points, with a minimum of 4 for Mathematics, Physical Science and English. Students that need more information regarding Extended programmes should liaise with their respective HODs and/or the faculty manager. The main purpose of extended programmes is to widen access and reinforce/improve success.
- All other grade 12 or equivalent certificates will be evaluated against/according to statutory and programme requirements.
- International qualifications: All international qualifications will be evaluated by the International Office based on the Swedish scale and SAQA equivalence.
- Transfers: Applications from students to transfer from other institutions will be dealt with in terms of the Recognition of Prior Learning and CAT policies of VUT.

10.1.1.4 Career Opportunities

There is a great need for persons who are well trained in Industrial Engineering. Job opportunities abound in all types of manufacturing companies as well as service organisations as advisors, industrial analysts, production personnel, planning personnel and line managers. Experience has shown that people with a qualification in Industrial Engineering and a dynamic personality quickly progress to the management level or start their own business.

10.1.1.5 Curriculum: Diploma in Industrial Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
HKCOX1A	Applied Communication Skills 1.1	8
AAECH1A	Engineering Chemistry 1	10
EEESK1A	Engineering Skills 1	5
ASICT1A	ICT Skills 1	10
AMMAT1A	Mathematics 1	10
APHYS1A	Physics 1	10
EESIN1A	Social Intelligence 1	3
SEMESTER 2		
HKCOY1A	Applied Communication Skills I.2	8
EBCOA2A	Computing Applications 2	7
AAECH2A	Engineering Chemistry 2	10
EMEDR1A	Engineering Drawing 1	10
EBMRE2A	Manufacturing Relations 2	10
AMMAT2A	Mathematics 2	10
APHYT2A	Physics 2 (Theory)	5
APHYP2A	Physics 2 (Practical)	5
EBSPA1A	Safety Principles and Law 1	5
SEMESTER 3		
HKCOX2A	Applied Communication Skills 2.1	8

EPEEN1A	Electrical Engineering 1	10
EBEWS1A	Engineering Work Study 1	10
EMMEN1A	Manufacturing Engineering 1	10
EBPEN1A	Production Engineering 1	10
EBQTE1A	Qualitative Techniques 1	10
EMMEC1A	Mechanics 1	10
AMMAT3A	Mathematics 3	10
SEMESTER 4 (All Compulsory and 1 Elective)		
	Compulsory (All):	
HKCOY2A	Applied Communication Skills 2.2	8
BACOS2A	Costing 2	10
EBEWS2A	Engineering Work Study 2	10
EBFLA2A	Facility Layout and Material Handling 2	10
EMMEN2A	Mechanical Manufacturing Engineering 2	10
EBPEN2A	Production Engineering 2	10
EBQAS2A	Quality Assurance 2	10
	Electives* (Only 1):	
EBCAD1A	Computer-Aided Draughting 1*	10
EPEEN2A	Electrical Engineering 2*	10
EMMAE1A	Maintenance 1*	10
EMMOM2A	Mechanics of Machines 2*	10
EMSOM2A	Strength of Materials 2*	10
SEMESTER 5		
EBAUT3A	Automation 3	10
EBEWS3A	Engineering Work Study 3	10
EBIAC3A	Industrial Accounting 3	10
EBILE3A	Industrial Leadership 3	10
EBORE3A	Operations Research 3	10
SEMESTER 6		

EBWIL1A	Workplace Based Learning (Industrial)	60

Progression and Pathway:
To move to POS B, student should have obtained at least 13 credits in POS A;
To move to POS C, student should have obtained at least 15 credits in POS B;
To move to POS D, student should have obtained at least 20 credits in POS C.
To move to POS E, student should have obtained at least 10 credits in POS D.
Only modules for which the pre-requisite has been passed can be enrolled.

Upon completion of the Diploma in Industrial Engineering (NQF Level 6, minimum 360 credits), the graduate meets the minimum entry requirement for admission to the Advanced Diploma in Industrial Engineering (NQF Level 7), designed to support articulation to satisfy a Professional Industrial Engineering Technologist education benchmark.

Curriculum: Diploma in Industrial Engineering (4 year Extended programme) – DE0831

The purpose of the Extended Diploma programme is to assist students who enter the University with APS score of 24 - 27 by giving them more time to reach the level of competency similar to those who enter with higher APS scores. The programme extends the 3-year programme into 4 years by spreading the first year of study over 2 years with the inclusion of foundational modules as well as mainstream programme modules. The foundation modules in the first year of study will help students to improve their competency in Maths, Physics, Chemistry and Drawing. In the second year of study, the students will augment their foundation knowledge of Maths, Physics, Chemistry and Drawing to reach the level of the mainstream programme. Students are required to pass all modules in both years of the foundation phase to be able to proceed to the next year of study.

MODULE CODE	NAME OF MODULE	TYPE	CREDITS	
			Regular	Found
YEAR 1 - SEMESTER 1				
AAXCH1A	Foundation Chemistry 1	Foundation		10
AMXMA1A	Foundation Mathematics 1	Foundation		10
APXPH1A	Foundation Physics 1	Foundation		10
ASICT1A	ICT Skills 1	Regular	10	

EEESK1A	Engineering Skills 1	Regular	5	
EESIN1A	Social Intelligence 1	Regular	3	
HKCOX1A	Applied Communication Skills 1.1	Regular	8	
YEAR 1 - SEMESTER 2				
AAXCH2A	Foundation Chemistry 2	Foundation		10
AMXMA2A	Foundation Mathematics 2	Foundation		10
APXPH2A	Foundation Physics 2	Foundation		10
EMXDR1A	Foundation Drawing 1	Foundation		10
EBCOA2A	Computing Applications 2	Regular	7	
EBSPA1A	Safety Principles and Law 1	Regular	5	
HKCOY1A	Applied Communication Skills 1.2	Regular	8	
YEAR 2 - SEMESTER 1				
AAECH1B	Engineering Chemistry 1	Regular (Augm)	10	
AMMAT1B	Mathematics 1	Regular (Augm)	10	
APHYS1B	Physics 1	Regular (Augm)	10	
EMMEC1B	Mechanics 1	Regular (Augm)	10	
YEAR 2 - SEMESTER 2				
AAECH2A	Engineering Chemistry 2	Regular	10	
AMMAT2A	Mathematics 2	Regular	10	
APHYP2A	Physics 2 – Practical	Regular	5	
APHYT2A	Physics 2 - Theory	Regular	5	
EBMRE2A	Manufacturing Relations 2	Regular	10	
EMEDR1B	Engineering Drawing 1	Regular (Augm)	10	

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Progression Rules:

Students on the extended programme that fail modules can carry them over to the nest semester in which those modules are offered. The timetable will probably allow for this in most cases since these students take reduced numbers of modules. This will also apply for modules that are prerequisites to follow up modules. Modules failed during the second year of the extended programme will have to be carried over beyond the duration of the extended first year. In such cases, the HoD must determine the workload and degree of progression as per standard practice in the regular programme.

The continuation of studies policy (CoS) will apply to the extended programme as it does for all VUT programmes. Essentially, in terms of the CoS, students that have not completed their first semester modules (S1) after two attempts are academically excluded unless they successfully appeal against exclusion. Similarly, if after two years on the extended programme, a student has not yet completed all the S1 modules, will have to appeal against exclusion.

10.1.1.6 Workplace Based Learning

The Diploma in Industrial Engineering has a formal Workplace Based Learning component of six months. This takes place at a Vaal University of Technology accredited employer (company). The student will be placed in the industry by VUT. Registration of this WBL is the responsibility of the student, and continuous progress will be monitored by VUT staff. In co-operation with an Industry mentor, the learner will be assessed by the mentor and VUT staff.

10.1.1.7 Progression and Pathway

Upon completion of this Diploma in Engineering in Industrial Engineering, which is at NQF Level 6 (with a minimum of 360 Credits), the graduate meets the minimum entry requirement for admission to Advanced Diploma in Industrial Engineering at NQF Level 7 (with a minimum of 120 credits and ECSA 140 Credits) designed to support articulation to satisfy an Industrial Engineering Technologist education benchmark. This Diploma provides the base for the graduate to enter training and experience toward independent practice as a candidate Industrial Engineering Technician and, once qualified, undergo registration as a Professional Industrial Engineering Technician by the Engineering Council of South Africa (ECSA). This qualification lies in a HEQSF Vocational Pathway.

10.1.2 Advanced Diploma in Industrial Engineering (AD0830)

10.1.2.1 Admission Requirements

A Diploma in Industrial Engineering (NQF level 6, 360 credits) or equivalent. All other equivalent qualifications will be treated on an ad hoc basis.

10.1.2.2 Programme Duration

The Advanced Diploma in Industrial Engineering is a minimum of a one-year full-time course.

10.1.2.3 Programme Structure

Each semester consists of approximately 15 weeks of tuition, comprising lectures, tutorials and practical work done in laboratories for some modules. During this time, the student's progress is evaluated by means of written tests, assignments (individual or group), practical evaluations, continuous assessments, case-based studies, documented investigation/research, presentations, documented projects, computer-based assessments and simulations. At the end of each semester, final examinations are written on all the work done during the semester, over an approximately two weeks' period for those modules that were not assessed on a continuous assessment basis.

10.1.2.4 Curriculum: Advanced Diploma in Industrial Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1 (All 3 modules are compulsory)		
EBMPS4A	Manufacturing and Production Science	20
EBQIC4A	Quality Control and Improvement	20
EBRMI4A	Research Methods and Industrial Engineering Project	20
SEMESTER 2 (2 compulsory modules and 2 electives)		
	Compulsory modules:	
EBFPD4A	Facility Planning and Design	20
EBMOS4A	Modelling and Simulation	20
	Elective modules (choose one):	
EBHFE4A	Human Factors and Ergonomics	20
EBIEM4A	Industrial Engineering Management	20

EBFEE4A	Financial Engineering and Economics *	20
EBIKM4A	Information and Knowledge Management *	20

Please note: All modules must be done at VUT. This is an NQF Level 7 qualification with a minimum of 120 credits and 140 credits to meet ECSA requirements.

10.1.2.5 Progression and Pathway

Upon completion of the Advanced Diploma in Industrial Engineering (NQF Level 7, minimum 140 credits), the graduate meets the minimum entry requirement for admission to the Postgraduate Diploma in Industrial Engineering (NQF Level 8), designed to support articulation to satisfy a Professional Industrial Engineering Technologist education benchmark. This Advanced Diploma provides the base for the graduate to enter training and experience towards independent practice as a Professional Industrial Engineering Technologist and, once qualified, undergo registration as a Professional Industrial Engineering Technologist by ECSA. This qualification lies in a HEQSF Vocational Pathway.

10.1.3 Postgraduate Diploma in Industrial Engineering (PG0830)

10.1.3.1 Admission Requirements

A Bachelor's degree or Advanced Diploma in Industrial Engineering or relevant NQF level 7 qualification (120 credits). All other equivalent qualifications will be treated on an ad hoc basis.

10.1.3.2 Programme Duration

The Postgraduate Diploma in Industrial Engineering is a minimum one-year, full-time course.

10.1.3.3 Curriculum: Postgraduate Diploma in Industrial Engineering

MODULE CODE	NAME OF MODULE	CREDITS
YEAR MODULES (All compulsory)		
EBIPD5A	Industrial Engineering Project Planning and Design	30
EBIDI5A	Industrial Engineering Project Design and Implementation	30
SEMESTER 1 (All modules are Compulsory)		
EBADA5A	Advanced Decision Analysis	20

EBAMS5A	Advanced Modelling and Simulation	20
	SEMESTER 2 (1 Compulsory module and 1 Elective)	
	Compulsory module:	
EBMPE5A	Manufacturing and Production Engineering	20
	Elective modules (choose one):	
EBAFD5A	Advanced Facility Design*	20
EBFEN5A	Financial Engineering*	20
EBPRE5A	Project Engineering*	20

Please note: All modules must be done at VUT. This is an NQF level 8 qualification with 140 credits.

10.1.3.4 Programme Structure

Each semester consists of approximately 15 weeks of tuition, comprising lectures, tutorials and practical work done in laboratories for some modules. During this time, the student's progress is evaluated by means of written tests, assignments (individual or group), practical evaluations, continuous assessments, case-based studies, documented investigation/research, presentations, documented projects, computer-based assessments and simulations. At the end of each semester, final examinations are written on all the work done during the semester over an approximately two weeks' period for those modules that were not assessed on a continuous assessment basis.

10.1.3.5 Progression and Pathway

Upon completion of the Postgraduate Diploma in Industrial Engineering (NQF Level 8, 120 credits), the graduate meets the minimum entry requirement for admission to the Master of Engineering in Industrial Engineering (NQF Level 9), designed to support articulation to satisfy a Professional Industrial Engineer education benchmark. This Postgraduate Diploma provides the base for the graduate to enter training and experience towards independent practice as a Professional Industrial Engineer and once qualified, undergo registration as a Professional Industrial Engineer by ECSA. This qualification lies in a HEQSF Vocational Pathway.

10.1.4 Master of Engineering in Industrial Engineering (MEng (Industrial)) (MP0830)

10.1.4.1 Admission Requirements

A BEng Degree or Equivalent NQF level 8 qualification including the Postgraduate Diploma with a minimum of 60% average.

10.1.4.2 Duration of Programme

The equivalent of a minimum one-year full-time study.

10.1.4.3 Programme Structure

This instructional programme comprises of a thesis only.

WHAT IS INDUSTRIAL ENGINEERING?

The main objective of this discipline is to constantly improve methods, procedures and practices within an organisation in order to increase productivity and profits. Value is added if inputs like manpower, materials, machinery and money are converted more effectively into products and services by using sound management principles. An Industrial Engineer is continually engaged in core aspects such as communication, cooperation, quality, planning and scheduling, as well as the calculation of cycle time, capacity and utilisation. Industrial Engineers should also be competent in economic analysis, problem-solving, materials handling, facility layout etc. Industrial Engineering, therefore, requires persons who like working with people; who enjoy analysing and solving problems, developing solutions, gaining co-operation and motivating people. Industrial engineers always seek better, quicker and cheaper ways of doing things.

JOB OPPORTUNITIES

There is a great need for persons who are well trained in Industrial Engineering. Job opportunities as business advisors, industrial analysts, production personnel, planning personnel and line managers are available in all types of manufacturing companies as well as in service organisations. Experience has shown that people with a qualification in Industrial Engineering and a dynamic personality quickly progress to the management level or start their own businesses.

10.1.5 Diploma in Operations Management (DI0400)

A diploma will be issued on the completion of five semesters of theoretical learning and one semester of Operations Management Practice (Project-based).

10.1.5.1 Programme Structure

Each semester consists of approximately 15 weeks of tuition, comprising lectures, tutorials and practical work done in laboratories for some modules. During this time, the student's progress is evaluated by means of written tests, assignments (individual or group), practical evaluations, continuous assessments, case-based studies, documented investigation/research, presentations, documented projects, computer-based assessments and simulations. At the end of each semester, final examinations are written on all the work done during the semester over an approximately two weeks' period for those modules that were not assessed on a continuous assessment basis.

10.1.5.2 Purpose of the Diploma in Operations Management

If you are a person who likes working with people, who enjoys analysing and solving problems, developing solutions, gaining co-operation, motivating people and who always seeks better, quicker and cheaper ways of doing things – then this is the course for you!

Qualified persons in Operations Management are employed by manufacturing companies because this qualification is most suitable for careers in production and operations management.

In Operations Management, you will specialise in production scheduling, material movement, inventory control, quality management, work simplification, productivity improvement and will contribute to the design and implementation of integrated systems comprising capital, plant, manpower and raw materials. Your objective will be to constantly improve methods, procedures and practices within an organisation in order to increase productivity and profits.

10.1.5.3 Admission Requirements

NSC	Compulsory Subjects	Level	Notes
National Senior Certificate	English Mathematics Physical Science	4 4 3	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79%

	Any other subjects with a minimum level of 3, excluding Life Orientation **Total**	12 **23**	7 = 80 – 89% 8 = 90 – 100%

All other grade 12 or equivalent certificates will be treated on an ad hoc basis.

10.1.5.4 Progression and Pathway

Upon completion of the Advanced Diploma in Operations Management (NQF Level 7, minimum 140 credits), the graduate meets the minimum entry requirement for admission to the Postgraduate Diploma in Operations Management (NQF Level 8).

10.1.5.5 Career Opportunities

Operations Management offers a challenging and exciting career in the private sector. The expertise and skills that you will achieve find their optimum application and growth in the manufacturing industry, progressively, as Production Assistant / Production Planner, Production Scheduler / Head Planner, Production Superintendent, Production Manager and Operations Management.

People with Operations Management qualifications and experience are also well equipped to start their own business.

10.1.5.6 Curriculum: Diploma in Operations Management

MODULE CODE	NAME OF MODULE	CREDITS
	SEMESTER 1	
HKCOX1A	Applied Communication Skills 1.1	8
ASICT1A	ICT Skills 1	10
EBMFX1A	Manufacturing Technology 1.1	10
AMMAT1A	Mathematics 1	10
EBOPX1A	Operations Management 1.1	10
EBOGX1A	Organisational Effectiveness 1.1	10
EBWPX1A	Workplace Dynamics 1.1	10
	SEMESTER 2	

HKCOY1A	Applied Communication Skills 1.2	8
EBMFY1A	Manufacturing Technology 1.2	10
EBOPY1A	Operations Management 1.2	10
EBOGY1A	Organisational Effectiveness 1.2	10
EBQMA1A	Quality Management 1	10
EBWPY1A	Workplace Dynamics 1.2	10
SEMESTER 3		
HKCOX2A	Applied Communication Skills 2.1	8
BACEX1A	Costing and Estimating 1.1	10
EBMAX2A	Operations Management 2.1	10
EBOGX2A	Organisational Effectiveness 2.1	10
EBQAS2A	Quality Assurance 2	10
EBSTX1A	Statistics 1.1	10
	(Modules with * are electives) – choose one:	
AAECH1A	*Engineering Chemistry 1	10
HLAWX1A	*Labour Law 1.1	15
APHYS1A	*Physics 1	10
ASPRG1A	*Programming 1	10
SEMESTER 4		
HKCOY2A	Applied Communication Skills 2.2	8
BACEY1A	Costing and Estimating 1.2	10
EBMAY2A	Operations Management 2.2	10
EBMAT2A	Operations Management Techniques 2	10
EBOGY2A	Organisational Effectiveness 2.2	10
	(Modules with * are electives) – choose one:	
AAECH2A	*Engineering Chemistry 2	10
EMMAE2A	*Maintenance Engineering 2	10
EMMEN2A	*Manufacturing Engineering 2	10
APHYS2A	*Physics 2	10

ASPRG2A	*Programming 2	10
SEMESTER 5		
EBILE3A	Industrial Leadership 3	10
EBMAX3A	Operations Management 3.1	10
EBMAT3A	Operations Management Techniques 3	10
EBOMG3A	Operations Management Technology 3	10
EBOEG3A	Organisational Effectiveness 3	10
SEMESTER 6		
EBMAP1A	Operations Management Practice 1	60

Progression and Pathway:
To move to POS B, student should have obtained at least 18 credits in POS A;
To move to POS C, student should have obtained at least 18 credits in POS B;
To move to POS D, student should have obtained at least 18 credits in POS C.
To move to POS E, student should have obtained at least 10 credits in POS D.
Only modules for which the pre-requisite has been passed can be enrolled.

Upon completion of the Diploma in Operations Management (NQF Level 6, minimum 360 credits), the graduate meets the minimum entry requirement for admission to the Advanced Diploma in Operations Management (NQF Level 7).

10.1.6 Advanced Diploma in Operations Management (AD0400)

10.1.6.1 Admission Requirements

A Diploma in Operations Management (NQF level 6, 360 credits) or other engineering disciplines or equivalent (including National Diploma in Operations Management). With a pass in Mathematics 1. All other equivalent qualifications will be treated on an ad hoc basis.

10.1.6.2 Programme Duration

The Advanced Diploma in Operations Management is a minimum one-year full-time course.

10.1.6.3 Curriculum: Advanced Diploma in Operations Management

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1 (2 compulsory modules and 1 elective)		
EBQMA4A	Quality Management	20
EBRMO4A	Research Methodology for Operations Management	20
	Elective modules (choose one):	
EBWDE4A	Workplace Design	20
EBSCM4A	Supply Chain Management	20
SEMESTER 2 (3 compulsory modules)		
	Compulsory modules:	
EBFIM4A	Financial Management	20
EBMAS4A	Manufacturing Systems*	20
EBMOM4A	Modelling in Operations Management*	20

Please note: All modules must be done at VUT. This is an NQF Level 7 qualification with 120 credits.

10.1.6.4 Programme Structure

Each semester consists of approximately 15 weeks of tuition, comprising lectures, tutorials and practical work done in laboratories for some modules. During this time, the student's progress is evaluated by means of written tests, assignments (individual or group), practical evaluations, continuous assessments, case-based studies, documented investigation/research, presentations, documented projects, computer-based assessments and simulations. At the end of each semester, final examinations are written on all the work done during the semester over an approximately two weeks' period for those modules that were not assessed on a continuous assessment basis.

10.1.6.5 Progression and Pathway

Upon completion of the Advanced Diploma in Operations Management (NQF Level 7, minimum 140 credits), the graduate meets the minimum entry requirement for admission to the Postgraduate Diploma in Operations Management (NQF Level 8).

10.1.7 Postgraduate Diploma in Operations Management (PG0400)

10.1.7.1 Admission Requirements

Bachelor's degree or Advanced Diploma or relevant NQF level 7 qualification (120 credits). All other equivalent qualifications will be treated on an ad hoc basis.

10.1.7.2 Programme Duration

The Postgraduate Diploma in Operations Management is a minimum one-year, full-time course.

10.1.7.3 Programme Structure

Each semester consists of approximately 15 weeks of tuition, comprising lectures, tutorials and practical work done in laboratories for some modules. During this time, the student's progress is evaluated by means of written tests, assignments (individual or group), practical evaluations, continuous assessments, case-based studies, documented investigation/research, presentations, documented projects, computer-based assessments and simulations. At the end of each semester, final examinations are written on all the work done during the semester over an approximately two weeks' period for those modules that were not assessed on a continuous assessment basis.

10.1.7.4 Curriculum: Postgraduate Diploma in Operations Management

MODULE CODE	NAME OF MODULE	CREDITS
	YEAR MODULES (All compulsory)	
EBOPD5A	Operations Management Project Planning and Design	30
EBODI5A	Operations Management Project Design and Implementation	30
	SEMESTER 1 (All 2 modules are Compulsory)	
EBAMA4A	Advanced Modelling in Operations Management	20
EBQRM5A	Quality and Reliability Management	20
	SEMESTER 2 (1 Compulsory module and 1 Elective)	
	Compulsory module:	
EBOMS5A	Advanced Manufacturing Systems	20
	Elective modules (choose one):	

EBAIM5A	Advanced Industrial Management*	20
EBAFD5A	Business Finance*	20

Please note: All modules must be done at VUT. This is an NQF level 8 qualification with 140 credits.

WHAT IS OPERATIONS MANAGEMENT?

If you are a person who likes working with people, who enjoy analyzing and solving problems, developing solutions, gaining co-operation, motivating people and who always seeks better, quicker and cheaper ways of doing things, then this is the programme for you. Qualified persons in Operations Management are employed by both manufacturing companies as well as service organizations.
In Operations Management, you will specialize in production scheduling, material movement, inventory control, quality management, work simplification, productivity improvement and will contribute to the design and implementation of integrated systems comprising capital, plant, manpower and raw materials. Your objective will be to constantly improve methods, procedures and practices within an organization in order to increase productivity and profits.

JOB OPPORTUNITIES

Operations Management offers a challenging and exciting career in the private sector. The expertise and skills that you will achieve, find their optimum applications and growth in the manufacturing industry, progressively, as Production Assistant / Production Planner, Production Scheduler / Head Planner, Production Superintendent, Production Manager and Operations Manager. People with Operations Management qualifications and experience are also well equipped to be employed in many other industries to start their own businesses.

10.1.8 Assessment

The department follows the assessment strategy of formal written exams. The year mark is compiled from a series of no less than three assessments (tests, practical’s, assignments, presentations, case studies, etc.). The year mark for admittance to the formal examination is 50%. Weights for calculating the year mark as well as the final mark will be reflected in the Learning Guide.

All assessments done during a particular semester will help learners learn and understand the work.

Some modules follow the assessment strategies of Continuous Assessment (CASS). All marks obtained during the semester will make up the learner's final mark. Each module's Learning Guide will indicate which tests and activities will contribute according to a pre-determined weight to the final mark.

10.1.9 Enquiries

Enquiries may be addressed to:

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10.2 MECHANICAL ENGINEERING

Discipline Staff Details

Surname, Initials & Title	Designation	Highest Qualification
Alugongo, AA (Prof)	Discipline Coordinator	PhD
Nakedi, K (Ms)	Administrator	PGD
Altaki, K (Mr)	Lecturer	BTech
Andezai, AM (Mr)	Lecturer	B.Eng, Mech Eng
Aniki, AO (Mr)	Lecturer	M Eng
Inyang, EE (Mr)	Lecturer	MTech
Kibonge, T (Mr)	Lecturer	BEng
Koza, VS (Mr)	Lecturer	MEng
Matshaba, MI (Mr)	Lecturer	BTech Mech
Mbatha, AJ (Mr)	Lecturer	BTech Mech
Nkomo, NZ (Mr)	Lecturer	MSc MEng Mech
Nturanabo, F (Mr)	Lecturer	MSc Eng
Odiagbe, FO (Mr)	Lecturer	BEng, Mech Eng
Olivier, AA (Mr)	Lecturer	MTech
Onyango, LO (Mr)	Lecturer	MTech
Pieterse, DP (Mr)	Lecturer	BTech
Ramano, KL (Mr)	Lecturer	BTech Mech
Sob, PB (Dr)	Lecturer	DTech Mech
Sozinando, DF (Mr)	Lecturer	MEng
Tchomeni Kouejou, BX (Mr)	Lecturer	DEng
Teku, GN (Mr)	Lecturer	MSc Eng
Theron, HS (Mr)	Lecturer	BTech
Tshitshonu, EK (Mr)	Lecturer	BSc Hons
Yakeu, KH	Lecturer	BTech Mech

Mhlongo, O (Ms)	Technician	BTech
Sigonde, CV (Ms)	Technician	BTech Mech
Vilakazi, LN (Ms)	Technician	MTech
De Wet, GCO (Mr)	Workshop Manager	Trade Certificate
Greyling, M (Mr)	Workshop Assistant	Grade 12
Ntshala, I (Mr)	Artisan	N3 Technical
Harris, HG (Mr)	Project Coordinator	M Dip Tech
Jacobs, JH	Project Coordinator	MTech Mech

10.2.1 Diploma in Mechanical Engineering (DI0840)

10.2.1.1 Programme Structure

Three-year full-time (six semesters S1 to S6) qualification.

The department is making provision to gradually release S6 completely of coursework to allow space for workplace based learning.

10.2.1.2 Purpose of the Diploma in Mechanical Engineering

The generic purpose of the qualification is spelled out in paragraph 4.1 and must be read in conjunction with the following:

The purpose of the qualification Diploma in Mechanical Engineering is to develop the necessary knowledge, understanding and skills required for the student's further learning towards becoming a competent practicing Mechanical Engineering Technician. It is intended to subsequently empower candidate Engineering Technicians to demonstrate that they are capable of applying their acquired knowledge, understanding, skills, attitudes and values in the work environments in South Africa. It is designed also to add value to the qualifying student in terms of enrichment of the person, status and recognition.

10.2.1.3 Admission Requirements: Diploma in Mechanical Engineering

NSC	Compulsory Subjects	Minimum for the Diploma programme	Notes
National Senior Certificate	Mathematics Physical Science English Language Any other subjects with a minimum level of 3, excluding Life Orientation **Total**	4 4 4 12 **24***	3 = 40 – 49% 4 = 50 – 59% 5 = 60 – 69% 6 = 70 – 79% 7 = 80 – 89% 8 = 90 – 100%

Please note:

- The prospective student's results must meet the statutory and programme admission requirement.
- Bonus points will only be used for selection purposes. In case of a tie and all other scores remaining the same use the actual percentages to differentiate.
- ***Admission requirements for any of the 3-year Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 28 and above APS points, with a minimum of 4 for Mathematics, Physical Science and English.
- ***Admission requirements for any of the 4-year extended Diploma programmes** in Engineering is a National Senior Certificate with a minimum of 24 – 27 maximum APS points, with a minimum of 4 for Mathematics, Physical Science and English. Students that need more information regarding Extended programmes should liaise with their respective HODs and/or the faculty manager. The main purpose of extended programmes is to widen access and reinforce/improve success.
- All other grade 12 or equivalent certificates will be evaluated against/according to statutory and programme requirements.
- International qualifications: All international qualifications will be evaluated by the International Office based on the Swedish scale and SAQA equivalence.
- Transfers: Applications from students to transfer from other institutions will be dealt with in terms of the Recognition of Prior Learning and CAT policies of VUT.

10.2.1.4 Career Opportunities

A Mechanical Technician is a person in possession of at least a Diploma in Mechanical Engineering. The task of the Technician in the design field is to assist the Engineer / Technologist with the design of new products or equipment for use in industry or society.

A Technician in the maintenance field must see to it that preventive or scheduled maintenance is done on all machines in order to prevent interruptions in production.

The activities in Mechanical Engineering can therefore be grouped into design, maintenance, electromechanical and project work where the latter includes aspects such as planning of projects, cost control, evaluation of tenders, negotiations with contractors, control over the progress of the project, co-ordination of all the interested departments and commissioning of the completed project.

In any heavy or light manufacturing industry, e.g. the chemical industry, iron and steel manufacturing industry, mining industry, power stations, transport services, provisional and government services, etc. Technicians are much sought after and a career in this field is lucrative and rewarding.

10.2.1.5 Curriculum: Diploma in Mechanical Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
HKCOX1A	Applied Communication Skills 1.1	8
AAECH1A	Engineering Chemistry 1	10
EEESK1A	Engineering Skills 1	5
ASICT1A	ICT Skills 1	10
AMMAT1A	Mathematics 1	10
APHYS1A	Physics 1	10
EESIN1A	Social Intelligence 1	3
SEMESTER 2		
HKCOY1A	Applied Communication Skills 1.2	8
EMCOA2A	Computing Applications 2	7
AAECH2A	Engineering Chemistry 2	10
EMEDR1A	Engineering Drawing 1	10
AMMAT2A	Mathematics 2	10
APHYT2A	Physics 2 (Theory)	5
APHYP2A	Physics 2 (Practical)	5

EMSPA1A	Safety Principles and Law 1	5
SEMESTER 3		
EMMEC1A	Mechanics 1	10
EMPRJ1A	Project 1 (WIL Mechanical)	7
EPEEN1A	Electrical Engineering 1	10
AMMAT3A	Mathematics 3	10
HKCOX2A	Applied Communication Skills 2.1	8
EMMEN1A	Mechanical Manufacturing Engineering 1	10
EMEDR2A	Engineering Drawing 2	10
SEMESTER 4		
EMMED2A	Mechanical Engineering Design 2	10
EMMOM2A	Mechanics of Machines 2	10
EMSOM2A	Strength of Materials 2	10
EMFMM2A	Fluid Mechanics 2 (Mechanics)	10
EMTHE2A	Thermodynamics 2	10
EMPRJ2A	Project 2 (WIL Mechanical)	8
HKCOY2A	Applied Communication Skills 2.2	8
EMCAI1A	Computer-Aided Draughting 1	10
SEMESTER 5		
EMMOM3A	Mechanics of Machines 3	10
EMSOM3A	Strength of Materials 3	10
EMFME3A	Fluid Mechanics 3	10
EMTHE3A	Thermodynamics 3	10
EMMED3A	Mechanical Engineering Design 3	10
EMMEN2A	Manufacturing Engineering 2	10
EMMAE1A	Maintenance Engineering 1	10
EMPRJ3A	Project 3 (WIL Mechanical)	15
SEMESTER 6		
EMTOM3A	Theory of Machines 3	10
EMAOM3A	Applied Strength of Materials 3	10
EMHYM3A	Hydraulic Machines 3	10

EMSPL3A	Steam Plant 3	10
EMMDE3A	Machine Design 3	10
EMMAE2A	Maintenance Engineering 2	10
EMMEC2A	Modelling and Engineering Computation 2	10
EMEXM1A	Workplace Based Learning 1 (Mechanical)	30

Curriculum: Diploma in Mechanical Engineering (4 year Extended programme) – DE0841

The purpose of the Extended Diploma programme is to assist students who enter the University with APS score of 24 – 27 by giving them more time to reach the level of competency similar to those who enter with higher APS scores. The programme extends the 3-year programme into 4 years by spreading the first year of study over 2 years with the inclusion of foundational modules as well as mainstream programme modules. The foundation modules in the first year of study will help students to improve their competency in Maths, Physics, Chemistry and Drawing. In the second year of study, the students will augment their foundation knowledge of Maths, Physics, Chemistry and Drawing to reach the level of the mainstream programme. Students are required to pass all modules in both years of the foundation phase to be able to proceed to the next year of study.

MODULE CODE	NAME OF MODULE	TYPE	CREDITS	
			Regular	Found
YEAR 1 - SEMESTER 1				
AAXCH1A	Foundation Chemistry 1	Foundation		10
AMXMA1A	Foundation Mathematics 1	Foundation		10
APXPH1A	Foundation Physics 1	Foundation		10
ASICT1A	ICT Skills 1	Regular	10	
EEESK1A	Engineering Skills 1	Regular	5	
EESIN1A	Social Intelligence 1	Regular	3	
HKCOX1A	Applied Communication Skills 1.1	Regular	8	
YEAR 1 - SEMESTER 2				
AAXCH2A	Foundation Chemistry 2	Foundation		10
AMXMA2A	Foundation Mathematics 2	Foundation		10

APXPH2A	Foundation Physics 2	Foundation		10
EMXDR1A	Foundation Drawing 1	Foundation		10
EMCOA2A	Computing Applications 2	Regular	7	
EMSPA1A	Safety Principles and Law 1	Regular	5	
HKCOY1A	Applied Communication Skills 1.2	Regular	8	
YEAR 2 - SEMESTER 1				
AAECH1B	Engineering Chemistry 1	Regular (Augm)	10	
AMMAT1B	Mathematics 1	Regular (Augm)	10	
APHYS1B	Physics 1	Regular (Augm)	10	
EMMEC1B	Mechanics 1	Regular (Augm)	10	
YEAR 2 - SEMESTER 2				
AAECH2A	Engineering Chemistry 2	Regular	10	
AMMAT2A	Mathematics 2	Regular	10	
APHYP2A	Physics 2 – Practical	Regular	5	
APHYT2A	Physics 2 - Theory	Regular	5	
EPEEN1A	Electrical Engineering 1	Regular	10	
EMEDR1B	Engineering Drawing 1	Regular (Augm)	10	

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10.2.2 Advanced Diploma in Mechanical Engineering (AD0840)

10.2.2.1 Programme Structure

One-year full-time qualification.

10.2.2.2 Purpose of the Advanced Diploma in Mechanical Engineering

The main purpose of this educational programme design is to build the necessary knowledge, understanding, abilities and skills required for further learning towards becoming a competent practicing engineering technologist. This qualification provides:

- Preparation for careers in Mechanical Engineering at NQF level 7 (Technologist status), for achieving technical proficiency and to make a contribution to the economy and national development;
- The educational base required for registration as a Professional Engineering Technologist with ECSA.
- Entry to NQF level 8 programmes e.g. bachelor's Honours and Postgraduate Diploma programmes and then to proceed to Masters and Doctorate programmes.

10.2.2.3 Admission Requirements: Advanced Diploma in Mechanical Engineering

A Diploma in Mechanical Engineering (NQF level 6, 360 credits) or National Diploma in Mechanical Engineering. All other equivalent qualifications will be treated on an ad hoc basis.

10.2.2.4 Curriculum: Advanced Diploma in Mechanical Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
EMEPR4A	Engineering Professionalism	10
EMECN4A	Engineering Economics	10
EMAEM4A	Applied Engineering Mathematics	15
EMMTS4A	Material Science	15
SEMESTER 2		
EMTFM4A	Thermo-Fluids and Turbo Machinery	15
EMHMT4A	Heat and Mass Transfer	15
EMSMS4A	Solid Mechanics and Stress Analysis	15
EMVCE4A	Vibration and Control Engineering	15
YEAR MODULE		
EMRMD4A	Research Methods and Engineering Design Project	30

10.2.3 Postgraduate Diploma in Mechanical Engineering (PG0840)

10.2.3.1 Programme Structure

One-year, full-time qualification.

10.2.3.2 Purpose of the Programme

This qualification is primarily industry oriented. The knowledge emphasises general principles, application, and technology transfer. The qualification provides students with a sound knowledge base in Mechanical Engineering and the ability to apply their knowledge and skills to this particular career in professional contexts, while equipping them to undertake more specialised and intensive learning. Programmes leading to this qualification tend to have 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 educational programmes designed to meet this qualification are to build the necessary knowledge, understanding, abilities and skills required for further learning towards becoming a competent practicing engineering technologist with research and innovation abilities. This qualification provides:

1. Preparation for careers in Mechanical engineering, for achieving technical proficiency and to make a contribution to the economy and national development;
2. The educational base required for proceeding towards a Masters in Engineering Programme at NQF level 9 Programme.
3 An avenue to those who wish to pursue registration with ECSA in the category 'Candidate Engineer' upon acquiring additional 20 Credits, which need not be at NQF 8.

10.2.3.3 Curriculum: Postgraduate Diploma in Mechanical Engineering

MODULE CODE	NAME OF MODULE	CREDITS
SEMESTER 1		
EMEAM5A	Advanced Engineering Mathematics	15
EMEMS5A	Engineering Modelling and Simulations Module 1	15
EMEIC5A	Internal Combustion Engine Analysis	8*

EMEMM5A	Maintenance Management	7*
SEMESTER 2		
EMECM5A	Continuum Mechanics	15
EMEES5A	Energy Systems	15
EMEMS5B	Engineering Modelling and Simulations Module 2	15
EMEPM5A	Production and Manufacturing	8*
EMERE5A	Refrigeration and Air-conditioning	7*
YEAR MODULE		
EMEAR5A	Applied Research Methodology in Mechanical Engineering	30

*** Elective: total credit 15 required**

10.2.4 Master of Engineering in Mechanical Engineering (MP0840)

This qualification is offered at the Vanderbijlpark campus only.

10.2.4.1 Programme Structure

At least one-year full-time research, concluded with a master's dissertation.

10.2.4.2 Purpose of the MEng (Mechanical Engineering)

The purpose of this qualification is to develop a student into a researcher, able to conduct independent research with minimum guidance in a chosen field of Mechanical Engineering. The outcomes of the research will contribute to knowledge production in the specialisation field. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.4.)

10.2.4.3 Admission Requirements

A BEng Degree or equivalent level 8 qualification including the Postgraduate Diploma. Ad hoc cases will be treated on merit.

10.2.5 Doctor of Engineering in Mechanical Engineering (DP0840)

This qualification is offered at the Vanderbijlpark campus only.

10.2.5.1 Programme Structure

At least two years full-time research, concluded with a Doctoral Thesis.

10.2.5.2 Purpose of the DEng in Mechanical Engineering

The purpose of the qualification is to develop a researcher who will make a significant and original contribution to knowledge in a specialised area of mechanical engineering and technology.

To develop a researcher in mechanical engineering with advanced abilities, to independently apply mechanical engineering design, synthesis, and related principles, to specific problems of society at large. One of the main objectives in this process is to develop an advanced capability to conduct engineering research of an original nature. It also promotes a lifelong learning approach and an aptitude for training other students in similar fields. (Also see paragraph 4.5.)

10.2.5.3 Admission Requirements

Master of Engineering in Mechanical Engineering or equivalent.

Proof of successful completion of a Vaal University of Technology approved course in Research Methodology. Ad hoc cases will be treated on merit.

10.2.6 Assessment

The department follows the assessment strategy of formal written exams. The year mark is compiled from a series of not less than three tests and / or a practical mark. The year mark for admittance to the formal examination is 50%. Weights for calculating the year mark as well as the final mark will be reflected in the Learning Guide. All tests, assignments and practical work done during a particular semester, will help learners learn and understand the work.

Some modules follow the assessment strategies of Continuous Assessment (CASS). All marks obtained during the semester will make up the learner's final mark. Each module's Learning Guide will indicate which tests and activities will contribute according to a pre-determined weight, to the final mark.

10.2.7 Workplace Based Learning (WBL)

The Diploma in Mechanical Engineering has a formal six months Workplace Based Learning Component that is coordinated by the Department of Mechanical Engineering.

10.2.8 Enquiries

Enquiries may be addressed to:

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11. SYLLABI

11.1 CHEMICAL ENGINEERING

Syllabi: DIPLOMA: CHEMICAL ENGINEERING (3 year programme) (Course code: DI0800)	
Module Code	**Module Description**
SEMESTER 1	
HKCOX1A	**Applied Communication Skills 1.1** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
EEESK1A	**Engineering Skills 1** The Engineering Profession: Different types of engineering. Mechanical, electrical, civil, chemical, computer etc. The engineering team; artisans, technicians, technologists and engineers. Engineering Teamwork: Engineering design. Teamwork versus group work. Basic principles of; engineering project management (plan, organise, lead and control), project costing, budgeting and resource management. What is a business plan? Engineering and the Environment: social responsibility, environmental impact, natural resources, sustainability of the engineering activity. Legal and safety considerations. Ethics in Engineering: professional ethics, responsibility, engineering norms, ECSA and their function.
AAECH1A	**Engineering Chemistry 1** Matter and measurement; Atoms; Molecules and ions; Formulas, Equations and moles; Chemical reactions in aqueous solution; Periodicity and atomic structure; Ionic bonds; Covalent bonds and molecular structure; Chemical equilibrium; Acids and bases; Organic chemistry.
ASICT1A	**ICT Skills 1** Recognizing Computers; Using current versions of Microsoft Windows Professional; Common Elements; Microsoft Word;

	Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, getting connected and using the Internet.
AMMAT1A	**Engineering Mathematics 1** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves, Simpson's rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre's, Calculating roots.
APHYS1A	**Physics 1** Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton's Law of Motion, Work and Energy, Impulse and Momentum, Electric Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids, Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.
EESIN1A	**Social Intelligence 1** Leadership styles: Democratic, Autocratic, Consensus etc. Economic systems of governance: Capitalism, Socialism and Communism. Etiquette in society and the workplace. Soft skills, Cultural influences. Success in Engineering: Professionalism, Ethics, Responsibility, Discipline, Time management, Acquiring information and Independent learning.
SEMESTER 2	
HKCOY1A	**Applied Communication Skills 1.2** Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity:

	Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph, Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
AAECH2A	**Engineering Chemistry 2** Introduction to chemical bonding; Ionic bonds; Covalent bonding and molecular structure; Hydrogen; The Group IA and IIA metals; Boron and Aluminium; Chemical reactions in aqueous solutions; Carbon, Silicon, Germanium, Tin, and Lead; Acids, bases, and non-aqueous solvents; Nitrogen Phosphorus, Arsenic; Oxygen, Sulphur, Selenium, and Tellurium; Halogens.
EMEDR1A	**Engineering Drawing 1** Drawing instruments; Drawing skills; Object visualization and drawing; sketch and drawing of chemical engineering process equipment's using computer software.
EHITC1A	**Introduction to Chemical Engineering 1** Dimensions, Units and their Conversion; Moles density and concentration; Pressure and barometric measurements; Introduction to material balances; Closed and open systems; Batch and continuous processes; Solving material balance problems for single and multiple units without reactions; Chemical reaction equation and stoichiometry.
AMMAT2A	**Engineering Mathematics 2** Differentiation: Inverse trig functions, Hyperbolic functions, Inverse hyperbolic functions, Parametric equations, Maxima and minima, Partial differentiation, Small changes, Rate of change. Integration: Revision of integration, Use of formulae sheet, Inverse functions, Partial fractions, Partial fractions, Integration by parts, Trig. & hyperbolic substitutions, t-formulae, Mean and RMS values. Differential Equations: Differential equation, separation, Using the integrating factor, Applications, Homogeneous differential equations. Matrix Algebra: Operations with matrices, Inverse of a matrix, solve equations using inverse, Cramer's rule, Eigenvalues and –vectors. Probability and Statistics: Data representation, Data summaries, Normal distribution, Conf. intervals, error est. Conf. intervals, error est. Hypothesis testing.
APHYP2A	**Physics 2 Practical** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass

	spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
APHYT2A	**<u>Physics 2 Theory</u>** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising Radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational

	Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
EHSPA1A	**<u>Safety Principles and Law 1</u>** Importance of health and safety: What is safety and health concepts as indicated in the OHS Act, Fundamental safety concepts and terms: Fundamental safety terms, legal appointments as per the OHS Act, duties of the legal appointees as per the OHS Act, safety awareness and fire training, What is hazards and risk in the workplace: What is a hazard, what is a risk, what is the difference between a hazard and a risk, identification of main six hazards in the workplace, occupational hazards, difference between an accident and an incident: general principles of control and risk reduction, safe systems of work, permit-to-work systems, emergency procedures and first-aid, Principles of hazard and risk control: What is a risk assessment, why do a risk assessment, how to conduct a risk assessment, Risk assessment and risk management, Tools and Machinery: Tool and machine hazards, Principles of safeguarding powered and driven machines, point of operation safeguards, controls for hand toll hazards, portable power tool controls, Electrical safety: What do I need to know about electricity, what kind of injuries result from electrical current, electrical shock hazards, arc flash, control of electrical hazards, electrical safety-related work practices, Noise and vibration: Sound and noise, hearing, hazards of noise, exposure standard for noise, engineering controls for noise, noise measurement, vibrations of the human body or parts of the human body.
SEMESTER 3	
HKCOX2A	**<u>Applied Communication Skills 2.1</u>** Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in work-place, PowerPoint Presentations: Planning and preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a logically sound and well- reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
BHMAN1A	**<u>Management 1</u>**

	Organizational structure and design, Organizational change and learning, Motivating for performance, The dynamics of leadership, Groups and teams in organizations; Operating strategies; Forecasting; Process planning and designing; Trade-off analysis; Automated processes; Allocating resources with LP; Decision trees; Facility location; Aggregate planning; Master production schedules; Inventory systems; Material requirements planning and Lot-sizing for MRP and CRP.
EHCPI1A	**Chemical Process Industries 1** Industrial gases and heavy chemicals, Cryogenic air separation, Ammonia manufacture, Chlori-alkali industries; Inorganic acids, Sulphuric acid, Phosphoric acid, Nitric acid, Hydrochloric acid; Coal processing, Combustion, Destructive Distillation – By product coking, Gasification and Synthol processes; Petroleum refining, Petrol and its properties, Pre-treatment of crude oil, Separation of crude oil, Conversion processes; Industrial polymers, Synthetic Rubber, Plastics; Iron and steel making processes, Iron making, Steel making.
AAECH3A	**Engineering Chemistry 3** Introduction to chemical bonding; Covalent bonding and molecular structure; Chemical reactions in aqueous solutions; Acids, bases, and non-aqueous solvents; Groups; Reaction kinetics, titrations, pH studies.
EHMEB2A	**Material and Energy Balance 2** Basic material balances on single units and on multiple systems; Chemical reaction equation and stoichiometry; Material balances for processes involving chemical reactions; Recycle; Bypass and Purge; Recycle and purge for processes involving chemical reactions; Heat balances without chemical reactions and heat balances involving chemical reactions.
AMMAT3A	**Mathematics 3** Application of Integration: Volumes of solids of revolution, Length of Curves, Double Integrals: Iterated Integrals & Fubini's theorem, Double Integrals, Polar Coordinates. First Order Differentiation Equations: Exact DE, Homogeneous DE, Bernoulli DE, Applications (Excluding Newton's Law of Cooling), D-Operator Methods. Numerical Solutions of First Order Differential Equations: Euler's method, Runge-Kutta order 2, Runge-Kutta order 4. Operator D Methods/Undetermined coefficients: Complementary Solutions, D-operator & Inverse, binomial or long division method, Theorem 1, Theorem 2, Theorem 3, Special cases, General solution, Applications. Laplace Transforms, and Table of transforms.

	(Derivation from first principles not for examination purposes), First shifting property, Laplace transforms of derivatives, Inverse Laplace Transforms using tables, Laplace Transforms of discontinuous functions, Inverse Laplace Transforms of discontinuous functions, Solution of differential equations, Application to electric circuits, Application to beams. Fourier Series: Periodic functions and harmonics, sketching of graphs and determining Fourier Series, Series with period 2l, Even and Odd functions, Full range and Half range series, Numerical Harmonic Analysis.
EHMPO1A	**Mechanical Operation 1** Particulate solids; Screening; Transportation and storage of solids; Comminution (Size Reduction); Size reduction equipment; Separation based on properties; Mixing; Froth Flotation.
SEMESTER 4	
HKCOY2A	**Applied Communication Skills 2.2** Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business Plan: Introduction to the business plan, Marketing your new business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements; aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
EHCOA2A	**Computing Applications 2** Basic Microsoft Excel spreadsheet commands and functions; Advanced Microsoft Excel for Algebraic and Numerical computations; Data representation using tables and graphs; Introduction statistical analysis. Introduction to Computer Programming using Visual Basic for Applications in Microsoft Excel.
EHCEL1A	**Chemical Engineering Laboratory 1** Projects such as: Batch distillation; Gas absorption with determination off mass transfer coefficient; Thin film evaporator; Vapour liquid equilibrium; Filtration; Cooling tower; Boiling/condensation; Refrigeration/heat pump; Leaching.
EHCET2A	**Chemical Eng. Thermodynamics 1**

	Introduction to thermodynamics; The first law and other basic concepts; Second Law of Thermodynamics, Volumetric behaviour of pure fluids; Heat Effect; Thermodynamics properties of fluids.
EHHMT2A	**<u>Heat and Mass Transfer 1</u>** Different modes of heat transfer: conduction, convection radiation. Heat transfer by conduction- Fourier's law; Resistance of heat flow; derivation and application of equation for resistance in series and parallel. Heat transfer by convection-concept of the film; evaluation of individual film coefficients, derivation and application of the convection equation; definition and application of the overall heat transfer coefficient using mean area and mean temperature difference. Heat transfer by radiation-definition of the term blackbody absorptivity and emissivity; definition and application of the Stefan-Boltzmann law. Basic principle of mass transfer, molecular diffusion (mass diffusion in gas phase, mass diffusion in liquid phase, mass diffusion through solid).
EHPCO2A	**<u>Process Control 1</u>** Control of chemical processes: Incentive of chemical process control, Design aspects of a process control system, Control modes (P, PI, PD, PID). Analysis and Design of advanced control systems: Introduction to feedback control, Control systems with multiple loops, Split range control, feed forward control, Ration control, Adaptive control, Inferential control, Design of control systems for Multivariable processes. Introduction to plant control. Modelling the dynamic and static behaviour of chemical processes: Development of a mathematical model, Modelling considerations for control purpose. Instrumentation: P&ID (Piping and Instrumentation Diagrams), Temperature measurement, Pressure measurement, Flow measurement, Level measurement.
EHPFD2A	**<u>Process Fluid Dynamics 1</u>** Units and Dimensions, System of units, Dimensional analysis, Scale-up methods; Fluid Statics, Hydrostatics, Pressure and pressure measurement devices; General Conservation Laws, Mass, momentum and energy relationships; Fluid Dynamics (general principles in fluid flow), Laminar & turbulence flow, Newtonian & non-Newtonian fluids and viscosity, Friction in pipes, Piping and pumping, piping auxiliaries, valves and 3D sigma, Non-circular conduits, Flow measuring devices.
SEMESTER 5	
EHATH3A	**<u>Applied Thermodynamics 2</u>** Steam/Vapour; Steam Condensers; Boiler; Turbines and Steam Cycles; Refrigeration.
EHCPR3A	**<u>Chemical Process Design</u>**

	Computer simulation and financial assessment; Basic Cost Estimation and Economic Assessment; A simple flash calculation by hand and simulator; Material Streams: energy balances and flow sheeting on computer; Physical property data bases and predictive methods, Degrees of freedom in problem solution; Complex unit operations design; Design with recycles and application to improved design; Emphasis on operability & controllability of processes.
EHENE1A	**Environmental Engineering 1** Material & Energy balances and Separations; Reactors and Reactions; Water Quality & Water Treatment; Wastewater Treatment; Air Quality and Control; Solid Waste; Hazardous Waste; Types Pollution.
EHRTE3A	**Reactor Technology 1** Reactor Mole Balance and definitions, Batch Reactor, Continuous Stirred Tank Reactor (CSTR), Plug Flow Reactor (PFR), Packed Bad Reactor, Semi-batch Reactor; Reaction Kinetics, Order of reactions, Type of reactions; Elementary and non-Elementary reactions, Reaction stoichiometry: development of stoichiometry table; Reactor design, Application to Batch reactor, Application to CSTR, Application to PFR; Data analysis, Application of integral method of analysis.
EHSEP3A	**Separation Processes 1** Introduction to processes separations; Distillation (binary system); Absorption; Evaporation; Drying; Crystallization.
EHCEL2A	**Chemical Engineering Laboratory 2** Projects such as: Continuous distillation; Gas absorption with determination off mass transfer coefficient; Thin film evaporator; Vapour liquid equilibrium; Filtration; Cooling tower; Boiling/condensation; Refrigeration/heat pump; Leaching.
	SEMESTER 6
EHEXL1A	**Workplace Based Learning 1**

	Syllabi: **DIPLOMA: CHEMICAL ENGINEERING (Extended 4 year programme)** **(Course code: DE0801)**
Module Code	**Module Description**
	SEMESTER 1
AAXCH1A	**Foundation Chemistry 1** Atoms, molecules & ions; Stoichiometry; Reactions in aqueous solution; Rate and extent of reactions; Chemical equilibrium; Acids, bases and salts; Electrochemistry.

AMXMA1A	**Foundation Mathematics 1** Intro to Algebra, Expressions & equations, Linear & simultaneous equations, Polynomial equations, Matrix algebra, Hyperbolic functions.
APXPH1A	**Foundation Physics 1** Mechanics: Force and Newton's laws; Momentum and impulse; Vertical projectile motion in one dimension; Work, energy & power; Doppler effect.
SEMESTER 2	
AAXCH2A	**Foundation Chemistry 2** Organic molecules; The chemical industry.
AMXMA2A	**Foundation Mathematics 2** Polynomial equations, Partial fractions, Trigonometry (radian measure), Binomial series, Functions, Intro to differentiation, Intro to integration.
APXPH2A	**Foundation Physics 2** Electrostatics; Electric circuits; Electrodynamics; Optical phenomena; Properties of materials; Emission and absorption spectra.
EMXDR1A	**Foundation Drawing 1** Letter and number notation; Line notation; Handling of apparatus; Measurement notation; Geometrical construction; Orthographic projections; Arcs of penetration and developments; Detailed works drawing; Composite drawings.

Syllabi: ADVANCED DIPLOMA: CHEMICAL ENGINEERING (Course code: AD0800)	
Module Code	**Module Description**
YEAR MODULES	
EHAPD4A	**Advanced Process Design** Equipment Design: Design and sizing of most common equipment used in chemical plants: shell & tube exchangers, cooling towers, multicomponent flash drums, distillation columns, absorption columns, catalytic reactors, etc. Chemical Plant Design Aspects: Code of Professional Practice; Process design principles and design objectives; Design Guidelines: Conceptual design, detailed design process, detailed design layout, Operation and

	Maintenance, Documentation; Safety. Process Flow diagrams (PFD), Process Piping and Instrumentation Diagrams (P&ID's) Hazard and Operability Analysis (HAZOP); Environmental and Sustainability Aspects of Plant Design and Operations: Chemical Plant Emissions (Air Emission. Solid waste, liquid effluent), Environmental Impact Assessment (EIA). Chemical Process Economics: Plant capital costs estimates (detailed factorial method); Operating costs estimates; Economic evaluation: NPV, IRR, etc. Design Project: Literature survey – evaluation of process and engineering alternatives; Material and Energy balances; Process Flow sheeting – PFD and P&I diagrams; Simulation of a continuous flow process using rigorous simulation packages e.g. CHEMCAD / ASPEN / HYSIM. Etc.; Equipment design and specifications; Hazards and Operability Study; Environmental considerations, legislation and pollution control; Process economics.
EHRMP4A	**Research Methodology and Project** Identify, describe, and delimit an industrial process problem/research problem, Motivate the need for the project, State specific objectives, Estimate resource requirements, Establish various tasks in project and time frame for each task, Survey relevant sources on the research problem, Write a properly referenced literature survey, Identify and justify relevant theoretical framework and justify choice, Describe and defend methodology, Design and conduct experiments and trials to study the effects of process variables on process operations, analyse, interpret and report results of experiments and trials, write technical reports.
SEMESTER 1	
EHAEM4A	**Advanced Engineering Mathematics** Least Square method and curve fitting of data, cubic spline problems, approximation of functions interpolation and extrapolation of techniques; forward, backward and central difference, error approximation; derivatives from difference tables; Numerical integration – Newton Cotes Integration technique, Simpson's 1/3 rd and 3/8th rule, trapezoidal rule, Gaussian quadrature; Multiple Integral solution of Non-linear equation, bisection methods, regular-falsi method, Newton-Raphson methods, Euler's method, Euler's modified iteration technique, Picaed method, Runge-Kutta 4th order technique, Taylor series method; Solutions of ordinary differential equation (initial and boundary value problem).
EHARE4A	**Advanced Reaction Engineering**

	Basic principles, rate controlling steps, Thermodynamic aspects of chemical equilibrium calculations, Intrinsic and Global rates. Heterogeneous reactor design. Non-catalytic and catalytic heterogeneous reaction and reactor design, axial mixing phenomenon, Fluidized bed reactors, Analysis of real reactors. Multiphase flow reactors, Stirred vessel reactors, miscellaneous reactors, Multiphase flow regimes, Gas-liquid, Solid-gas, Gas-solid, liquid-solid reactors, Isothermal and adiabatic fixed bed reactors, Non-isothermal and non-adiabatic fixed bed reactors, fixable bed reactors. Classification, characterization, preparation and application of catalysts, activation & deactivation catalysts, Specific design aspects and the typical industrial reactors with their performance, Reactor stability and optimization, Scale up of reactors.
EHFLM4A	**Advanced Fluid Mechanics** Similitude and scale-up applications, Advanced Equations of Fluid Flow (Energy Mass and momentum conservation), Incompressible Flow in Pipes and Channels, Flow of incompressible non-Newtonian fluids in pipes, Flow of Compressible Fluids, Flow of multiphase mixtures, Flow Past Immersed Bodies, Transportation and Metering of Fluids, Agitation and Mixing of Liquids, Introduction to unsteady state flow (laminar flow).
EHHMX4A	**Advanced Heat, Mass Transfer and Separation: Mod 1** Heat Transfer to Fluid without Phase Change, Heat transfer to fluid with a phase change, Radiative heat transfer, Heat-Exchange Equipment, Mass Transfer, Multicomponent distillation, multiple effect evaporation, liquid-liquid extraction, crystallization, drying, adsorption Solid-liquid extraction (leaching), membrane separations and absorption.
SEMESTER 2	
EHHMY4A	**Advanced Heat, Mass Transfer and Separation: Mod 2** Heat Transfer to Fluid without Phase Change, Heat transfer to fluid with a phase change, Radiative heat transfer, Heat-Exchange Equipment, Mass Transfer, Multicomponent distillation, multiple effect evaporation, liquid-liquid extraction, crystallization, drying, adsorption Solid-liquid extraction (leaching), membrane separations and absorption.
EHMAN4A	**Engineering Management** Using Operations to Complete. Managing Effective Projects. Developing a Process Strategy. Analysing Processes. Managing Quality. Planning Capacity. Managing Process Constraints. Maintenance and Reliability. Linear Programming Model. Engineering Economics Analysis.

EHCEL4A	**Chemical Engineering Laboratory** Continuous Distillation: Conduct an energy and material balance around the column, determine the number of theoretical plates using the McCabe-Thiele method, determine the feed location stage. Refrigeration: Observe the effects of high ambient temperature, to observe the effects of a shortage of refrigerant, observe the effects of severely restricted air flow through the condenser, observe the effects of a stopped condenser fan, To observe the effects of hot air over the condenser. Batch Stirred Tank Reactor: determine the reaction order with respect to NaOH, determine the reaction rate constant with respect to NaOH, determine the rate of the chemical reaction. Evaporator: evaluate the mass and energy balances, determine the amount of heat transferred by the steam, determine the steam required (kg/s), determine the overall heat transfer coefficient (U), determine the efficiency (%).
EHAPC4A	**Advanced Process Control** Introduction to Process Control, Control System Hardware, Control and Modelling Philosophies, and Economic Justification of Process Control. Theoretical Models of Chemical Processes or Mathematical Modeling of Chemical Processes. Dynamic Behavior of Chemical Processes. Analysis and Design of Feedback Control Systems (Closed-loop Control Systems). Analysis and Design of Feed Forward (FF) Control Systems.

Syllabi: POSTGRADUATE DIPLOMA: CHEMICAL ENGINEERING (Course code: PG0800)	
Module Code	**Module Description**
EHPRM5A	**Research Project (Chemical Engineering)** Perform critical review of the published literature in areas appropriate to the area of the research and identify and apply relevant theories to the problem. Record and analyse experimental data. Draw appropriate conclusions from the results. Discuss the purpose of a research project and its significance in relation to relevant previous work reported in literature. Communicate/Convey the work and its outcomes in a variety of formats – report, poster and academic paper. Carry out/Do literature search using library and IT facilities to identify knowledge gaps.
EHPEEX5A	**Environmental Engineering I (Chemical Eng)**

	Conventional and advanced water treatment techniques; Local and international environmental regulations for a chemical industry; environmental impact assessment of a chemical process; environmental economics; design of sampling and assessment tools; indicators of ecological integrity; environmental risk assessment and management; policy decision-making; impact assessment and environmental audit; national and international air pollution regulations; Source and propagation of water, air and land pollutants; modelling of diurnal and seasonal pollution dispersion; quantification methods for pollutants; Conventional and advanced treatment techniques for industrial wastewater from petrochemical, mining and energy industries; Air pollution control in petrochemical, mining and energy industries; Causes of land pollution such as agricultural chemicals, industrialisation, mining, landfills, human sewage; Effects of land pollution and prevention and mitigation strategies.
EHPPDX5A	**Chemical Process Design I (Chemical Eng)** Process synthesis philosophy of integrated process synthesis; Integrated process synthesis with process mass and energy balance targets; Process based flow sheet synthesis; Application of transport processes: mass, heat and momentum transfer; Application of reacting systems; Introduction to renewable resources and integration of renewable energy with industrial processes; Heat and mass integration - designing for maximum energy recovery and wastewater minimization.
EHPEEY5A	**Environmental Engineering II (Chemical Eng)** Primary, secondary and advanced wastewater treatment and other methods such as activated carbon adsorption; membrane separation; ozonalysis, photodegradation; enhanced coagulation; heavy metal removal, chemical precipitation; neutralization; oxidation-reduction; desalination processes; ion exchange. Composition and characterization of sewage; Basic design principles of sewage treatment systems; Sludge handling and treatment; simulation software for wastewater treatment processes; Simulation and modelling tool to design and optimized the performance of wastewater treatment systems
EHPPDY5A	**Chemical Process Design II (Chemical Eng)** Introduction to Computational Modelling; Discrete modelling of process systems; Solution methods for discrete optimization problems: Process synthesis using implicit enumeration; Algorithmic approaches to synthesis of sustainable systems: heat exchanger networks; Process synthesis under uncertainty; Flexibility analysis; Computer based modelling, simulation and

	optimisation of integrated processes using ChemCad; Advanced process economics; Process engineering in the green economy.
EHPBEX5A	**Bioprocess Engineering I** Introduction to bioprocess engineering; Calculations, Presentation and Analysis of Data; Material and Energy Balances, hydrodynamics and mixing; Structure and Biology of Cells: Prokaryotic, Eukaryotic; Cell types: Bacteria, Yeasts, Molds, Algae, Protozoa, Animal & Plant Cells; Structure and function of bio-molecules: lipids, proteins, carbohydrates (sugars & polysaccharides), nucleic acids, hybrid bio-chemicals; Kinetics of Enzyme-Catalysed reactions and Applied Enzyme Catalysis: Mechanistic models, Michaelis-Menten Equation to determine rate parameters; Immobilised systems.
EHPBEY5A	**Bioprocess Engineering II** Fermentation (Process Design and Optimisation) – Foods and beverages, Amino Acids, Organic feed-stocks, Organic acids, Vitamins, Antibiotics, Single-cell proteins; Design and Analysis of Bioreactors: Batch, Continuous and Plug-Flow Reactors, Dynamic models, stability, Non-ideal processes, Sterilisation, Immobilised Biocatalysts and Multiphase systems, Bioreactor scale-up, Instrumentation and Control, Bio-process economics.
EHPPEX5A	**Petrochemical Engineering I** Origin, Formation and Composition of Petroleum: Overview of Petroleum Refinery, Petroleum Refinery Processes and operations, Petroleum Refinery flow schemes, Definitions of Refining terms, Types of refineries such as simple intermediate and complex, preflashing, Major petroleum products and their specifications, Blending of various petroleum fractions to meet required specification, Methane, natural gas, compressed natural gas (CNG), rebuilding of hydrocarbons.
EHPPEY5A	**Petrochemical Engineering II** Petrochemical Industry; Petrochemical Industry Integration and Value Chain; Petrochemical Industry By-processes: Ammonia Synthesis, Methanol Synthesis, Polymers and Associated Chemicals; Synthetic Fuels , Solvents and Chemicals.

11.2 METALLURGICAL ENGINEERING

Syllabi:
DIPLOMA IN METALLURGICAL ENGINEERING (3 year programme)
(Course code: DI0850)

Module Code	Module Description
	SEMESTER 1
HKCOX1A	**Applied Communication Skills 1.1** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
EEESK1A	**Engineering Skills 1** The Engineering Profession: Different types of engineering. Mechanical, electrical, civil, chemical, computer etc. The engineering team; artisans, technicians, technologists and engineers. Engineering Teamwork: Engineering design. Teamwork versus group work. Basic principles of; engineering project management (plan, organise, lead and control), project costing, budgeting and resource management. What is a business plan? Engineering and the Environment: social responsibility, environmental impact, natural resources, sustainability of the engineering activity. Legal and safety considerations. Ethics in Engineering: professional ethics, responsibility, engineering norms, ECSA and their function.
AAECH1A	**Engineering Chemistry 1** Matter and measurement; Atoms; Molecules and ions; Formulas, Equations and moles; Chemical reactions in aqueous solution; Periodicity and atomic structure; Ionic bonds; Covalent bonds and molecular structure; Chemical equilibrium; Acids and bases; Organic chemistry.
ASICT1A	**ICT Skills 1** Recognizing Computers; Using current versions of Microsoft Windows Professional; Common Elements; Microsoft Word; Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, getting connected and using the Internet.
AMMAT1A	**Mathematics 1** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves,

	Simpson's rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre's, Calculating roots.
APHYS1A	**Physics 1** Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton's Law of Motion, Work and Energy, Impulse and Momentum, Electric Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids, Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.
EESIN1A	**Social Intelligence 1** Leadership styles: Democratic, Autocratic, Consensus etc. Economic systems of governance: Capitalism, Socialism and Communism. Etiquette in society and the workplace. Soft skills, Cultural influences. Success in Engineering: Professionalism, Ethics, Responsibility, Discipline, Time management, Acquiring information and Independent learning.
SEMESTER 2	
AMMAT2A	**Mathematics 2** Differentiation: Inverse trig functions, Hyperbolic functions, Inverse hyperbolic functions, Parametric equations, Maxima and minima, Partial differentiation, Small changes, Rate of change. Integration: Revision of integration, Use of formulae sheet, Inverse functions, Partial fractions, Partial fractions, Integration by parts, Trig. & hyperbolic substitutions, t-formulae, Mean and RMS values. Differential Equations: Differential eq., separation, Using the integrating factor, Applications, Homogeneous differential equations. Matrix Algebra: Operations with matrices, Inverse of a matrix, solve equations using inverse, Cramer's rule, Eigenvalues and –vectors. Probability and Statistics: Data representation, Data summaries, Normal distribution, Conf. intervals, error est. Conf. intervals, error est. Hypothesis testing.
EMEDR1A	**Engineering Drawing 1** Drawing instruments; Drawing skills; Object visualization and drawing; sketch and drawing of chemical engineering process equipment's using computer software.
APHYS2A	**Physics 2** Projectile motion; rotational motion; simple harmonic motion and elasticity; fluids; gas behaviour; thermodynamics; current and capacitors; magnetism; nuclear physics, radioactivity and ionising radiation; Calculus.

AAECH2A	**<u>Engineering Chemistry 2</u>** Introduction to chemical bonding; Ionic bonds; Covalent bonding and molecular structure; Hydrogen; The Group IA and IIA metals; Boron and Aluminium; Chemical reactions in aqueous solutions; Carbon, Silicon, Germanium, Tin, and Lead; Acids, bases, and non-aqueous solvents; Nitrogen Phosphorus, Arsenic; Oxygen, Sulphur, Selenium, and Tellurium; Halogens.
EYSPA1A	**<u>Safety Principles and Law 1</u>** Importance of health and safety: What is safety and health concepts as indicated in the OHS Act, Fundamental safety concepts and terms: Fundamental safety terms, legal appointments as per the OHS Act, duties of the legal appointees as per the OHS Act, safety awareness and fire training, What is hazards and risk in the workplace: What is a hazard, what is a risk, what is the difference between a hazard and a risk, identification of main six hazards in the workplace, occupational hazards, difference between an accident and an incident: general principles of control and risk reduction, safe systems of work, permit-to-work systems, emergency procedures and first-aid, Principles of hazard and risk control: What is a risk assessment, why do a risk assessment, how to conduct a risk assessment, Risk assessment and risk management, Tools and Machinery: Tool and machine hazards, Principles of safeguarding powered and driven machines, point of operation safeguards, controls for hand toll hazards, portable power tool controls, Electrical safety: What do I need to know about electricity, what kind of injuries result from electrical current, electrical shock hazards, arc flash, control of electrical hazards, electrical safety-related work practices, Noise and vibration: Sound and noise, hearing, hazards of noise, exposure standard for noise, engineering controls for noise, noise measurement, vibrations of the human body or parts of the human body.
EYCOA2A	**<u>Computing Applications 2</u>** Navigating EECOA2A on VUTela, Laboratory rules & guidelines. Microsoft Excel 2016: Working principles, creating engineering spreadsheets, navigating excel to solve engineering problems, using operations for engineering application. Introduction to VB programming.
HKCOY1A	**<u>Applied Communication Skills 1.2</u>** Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity: Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph,

	Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
SEMESTER 3	
EYPTH1A	**Process Thermodynamics 1** Enthalpy; Entropy: processes – spontaneous, reversible and irreversible; Free energy; Ellingham diagram for oxides and sulphides; Chemical equilibrium; Behaviour of gases; Principles of phase equilibrium; Construction of phase diagrams: binary, free energy. Phase equilibria: the Clausius- Clapeyron equations; Fugacity, activity and equilibrium constant; Construction binary phase diagrams and application of Gibbs phase rule.
EYEME1A	**Extractive Metallurgy 1** Physical and Chemical Characteristics of Ore Minerals; Production of non-ferrous metals; Production of iron and steel; Pollution and pollution control; Refractories; The concept of distribution functions.
EYPME1A	**Physical Metallurgy 1** Electron configuration in metals; Crystallography; Solidification of metals; Introduction to plastic deformation; Constitution of alloys; Phases and phase diagrams; Heat treatment; Alloy specification.
EYMPR1A	**Mineral Processing 1** Ore deposits; Mining and mining methods; Ore handling; Ore preparation; Principles of comminution; Economic considerations.
EYMAM1A	**Manufacturing Metallurgy 1** Solidification of metals; casting technologies; design of Runners and gating systems; Casting construction and pattern design; Moulding materials; Moulding boxes; Cores and core making; Production techniques; Calculations of: solidification rates. Defects in castings; Dye-penetrant testing; Magnetic particle testing; Eddy current testing; Internal defects: Ultrasonic testing; Radiographic inspection; Introduction to Simulation of Casting Processes; Introduction to Additive Manufacturing.
EYEGE1A	**Engineering Geology 1** Earth: surface, structure and age; Mineralogy; Petrology; Structural geology; Surface processes; Stratigraphy; Ore deposits; Industrial minerals; Practical work.
HKCOX2A	**Applied Communication Skills 2.1** Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in workplace, PowerPoint Presentations: Planning and preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal

	Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a logically sound and well-reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
SEMESTER 4	
EYHYD2A	**Hydrometallurgy 2** Solution chemistry and process thermodynamics; leaching reagents and processes; influence of pH and potential; leaching methods; application in leaching of oxide, sulphide and native minerals; design of a leaching plant; quantitative analysis (calculations); laboratory work.
EYPYR2A	**Pyrometallurgy 2** Mining and iron ore preparation. Iron blast furnace process and alternative iron making processes. Principles of direct reduction processes and comparisons of different processes. Corex process for iron making. Classification of refractory materials and testing methods. Types of refractory materials and identification of different basic, acid and neutral materials for manufacturing. Design- and installation methods in the refractory industry. Differentiation between different industries applying refractory material with special reference to the iron and steel and ferro-alloy production processes.
EYPME2A	**Physical Metallurgy 2** Mechanical metallurgy; Strengthening mechanisms; Phase transformations; Diffusion; The tension test; The torsion test; Hardness; Fatigue; Creep and stress rupture; Brittle fracture and Impact testing. Fracture and fracture mechanics, residual stress concentrations, Failure analysis.
EYMPR2A	**Mineral Processing 2** Application of distribution functions to selection; Sampling and material balance; Mineral separation methods based on physical properties; Dewatering.
EYMAM2A	**Manufacturing Metallurgy 2** Welding processes; Manual and automated welding processes; Physics of welding; Defects in welding; Welding and weldability tests; Weld distortion; Welding procedures; Welding specifications, codes, symbols. Additive Manufacturing in Welding Processes. Automation in Welding Processes.
EBQCO2A	**Quality Control 2** Fundamentals of statistics; Statistical process control; Product acceptance (sampling); Quality engineering; Quality and economy and Computers and quality.
HKCOY2A	**Applied Communication Skills 2.2**

	Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business Plan: Introduction to the business plan, Marketing your new business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements; aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
SEMESTER 5	
EYHYD3A	**Hydrometallurgy 3** Winning and recovery processes: adsorption on activated coal; Ion exchange processes; Solvent extraction; Applications in gold, PGM and uranium leaching and treatment of the leach solution.
EYPYR3A	**Pyrometallurgy 3** Desulphurization of hot metal. Basic oxygen process for steel making. Production of Ferro-silicon; Production of Ferro-manganese; Production of Ferro chrome; Production of special Ferro-alloys; Pollution and pollution control. Pyrometallurgy of copper ores roasting and smelting. Pyrometallurgy of zinc smelting. Pyrometallurgy for lead ore roasting, and smelting.
EYPME3A	**Physical Metallurgy 3** Corrosion processes and corrosion testing; Electrochemistry of corrosion; Passivity; Corrosion of iron and steel; Protection against corrosion; Alloying against corrosion; Non-ferrous alloys and polymers. Ternary phase diagrams Ultra low carbon steels; Low carbon steels; High strength low alloy steels; Ultra high strength steels; High alloy and heat resistant steels; Cast irons; Titanium and Titanium alloys, Aluminium and Aluminium alloys or Copper and copper alloys.
EYMPR3A	**Mineral Processing 3** Principles of mineral processing plant design; Material balances on complex flow diagrams; Mathematical models and their applications in mineral processing; Principles, theory and practice of industrial process control in mineral processing plants; Mineral processing plant commissioning practice; Principles and practice of cost estimating.
EYMAM3A	**Manufacturing Metallurgy 3** Fundamentals of metal working; Forging processes; Rolling of metals; Extrusion; Drawing of rod and wire; Sheet metal forming including the theoretical aspects. Additive Manufacturing and Simulation

	(MagmaSoft). Manufacturing processes of other Materials; Ceramics; Polymers; Composites.
BHMAN1A	**Management 1** Organizational structure and design, Organizational change and learning, Motivating for performance, The dynamics of leadership, Groups and teams in organizations; Operating strategies; Forecasting; Process planning and designing; Trade-off analysis; Automated processes; Allocating resources with LP; Decision trees; Facility location; Aggregate planning; Master production schedules; Inventory systems; Material requirements planning and Lot-sizing for MRP and CRP.
EYENC1A	**Environmental Geochemistry 1** Review of chemical principles, reactions at the solid-water interface, soil chemistry, contaminants in soils and sediments, medical geochemistry of Earth materials, hydro-geochemistry and hydrologic cycle, water chemistry and contamination, groundwater geochemistry and contamination, atmospheric chemistry and pollution, waste dumps, acid mine drainage.
SEMESTER 6	
EYWIL1A	**Workplace Based Learning 1** The Diploma in Metallurgical Engineering has a formal six months Workplace Based Learning Component that is coordinated by the Department of Metallurgical Engineering. Companies accredited by the University will provide Workplace Based Learning. Students will spend a full six months at the work place following an approved programme under an approved company-based mentor. The programme will include work-based exposure and activities that will cover those sub-disciples of the qualification that provide specialisation suitable for the company providing the Workplace Based Learning. The students will be required to submit regular progress reports as indicated in the programme as well as a final report that will include suitable work-based project reports, which will be assessed by the University.

Syllabi: DIPLOMA: METALLURGICAL ENGINEERING (Extended 4 year programme) (Course code: DE0851)	
Module Code	**Module Description**
SEMESTER 1	
AAXCH1A	**Foundation Chemistry 1**

	Atoms, molecules & ions; Stoichiometry; Reactions in aqueous solution; Rate and extent of reactions; Chemical equilibrium; Acids, bases and salts; Electrochemistry.
AMXMA1A	**Foundation Mathematics 1** Intro to Algebra, Expressions & equations, Linear & simultaneous equations, Polynomial equations, Matrix algebra, Hyperbolic functions.
APXPH1A	**Foundation Physics 1** Mechanics: Force and Newton's laws; Momentum and impulse; Vertical projectile motion in one dimension; Work, energy & power; Doppler effect.
SEMESTER 2	
AAXCH2A	**Foundation Chemistry 2** Organic molecules; The chemical industry.
AMXMA2A	**Foundation Mathematics 2** Polynomial equations, Partial fractions, Trigonometry (radian measure), Binomial series, Functions, Intro to differentiation, Intro to integration.
APXPH2A	**Foundation Physics 2** Electrostatics; Electric circuits; Electrodynamics; Optical phenomena; Properties of materials; Emission and absorption spectra.
EMXDR1A	**Foundation Drawing 1** Letter and number notation; Line notation; Handling of apparatus; Measurement notation; Geometrical construction; Orthographic projections; Arcs of penetration and developments; Detailed works drawing; Composite drawings.

Syllabi:
ADVANCED DIPLOMA: METALLURGICAL ENGINEERING
(Course code: AD0850)

Module Code	Module Description
SEMESTER 1	
AMMAT3A	**Engineering Mathematics 3** Application of Integration: Volumes of solids of revolution, Length of Curves, Double Integrals: Iterated Integrals & Fubini's theorem, Double Integrals, Polar Coordinates. First Order Differentiation Equations: Exact DE, Homogeneous DE, Bernoulli DE, Applications (Excluding Newton's Law of Cooling), D-Operator Methods. Numerical Solutions of First Order Differential Equations: Euler's method, Runge-Kutta order 2, Runge-Kutta order 4. Operator D Methods/Undetermined

	coefficients: Complementary Solutions, D-operator & Inverse, binomial or long division method, Theorem 1, Theorem 2, Theorem 3, Special cases, General solution, Applications. Laplace Transforms, and Table of transforms. (Derivation from first principles not for examination purposes), First shifting property, Laplace transforms of derivatives, Inverse Laplace Transforms using tables, Laplace Transforms of discontinuous functions, Inverse Laplace Transforms of discontinuous functions, Solution of differential equations, Application to electric circuits, Application to beams. Fourier Series: Periodic functions and harmonics, sketching of graphs and determining Fourier Series, Series with period 2l, Even and Odd functions, Full range and Half range series, Numerical Harmonic Analysis.
SEMESTER 2	
EBQCO3A	**Quality Control 3** Introduction; Different philosophies; Quality cost; Quality control and Quality improvement. Acceptance quality control: Inspection and testing; Measurement and acceptance sampling and Special quality experiments.
SEMESTER 1 & 2 (Year Modules)	
EYHYD4A	**Hydrometallurgy** Revision of background process thermodynamics; leaching rates; winning and recovery processes - ion exchange, solvent extraction, cementation, electrowinning; applications in extraction of copper, gold, platinum group metals, titanium, lead, zinc and uranium (primary minerals, occurrences, leaching chemistry, flowsheet, existing plants); quantitative analyses.
EYPYR4A	**Pyrometallurgy** Electric arc steel making. Conventional and continuous casting of steel. Monolithic refractory materials. Manufacturing techniques and properties expected from plastic-, castable- and all relevant monolithic refractories. Mass balances, thermodynamics and basic electro refining calculations over typical plants. The pyrometallurgy of vanadium, titanium and platinum.
EYPME4A	**Physical Metallurgy** Production Metallurgy and applications of cast irons, non-ferrous alloys (Al,Ti,Mg,Cu,Ni). The physical metallurgy of light alloys (e.g. Al, Ti, Mg alloys), superalloys (Ni and PGMs), smart alloys (NiTi alloys), hard materials (WC-Co, hard steels), Ceramic materials (structural, electrical, energy storage) and their processing technology. Advanced physical metallurgy of low alloy C steels and stainless steels.
EYMIP4A	**Mineral Processing** Principles of mineral processing plant design. Material balances on complex flow diagrams. Mathematical models and their applications in

	mineral processing. Principles, theory and practice of industrial process control in mineral processing plants. Mineral processing plant commissioning practice. Principles and practice of cost estimating.
EYMAM4A	**Manufacturing Metallurgy** Manufacturing Processes. Additive manufacturing (e.g 3-D printing). Computer Integrated Manufacturing and Automation (e.g. in welding processes). Nanomanufacturing. Sustainable Manufacturing. Case studies.
EYPRO2A	**Metallurgical Research Methods and Project** Introduction to research methodology in Metallurgical Engineering. Laboratory safety. Generation of empirical data. Reporting of data. Interpretation of data. Report writing. Oral presentations.

Syllabi: POSTGRADUATE DIPLOMA: METALLURGICAL ENGINEERING (Course code: PG0850)	
Module Code	**PHYSICAL METALLURGY OPTION**
SEMESTER 1	
EYPTH2A	**Process Thermodynamics** Reaction spontaneities ΔG and equilibrium constant k. Phase equilibrium. Binary- and multiple solutions. Electrochemical cells. Activation energy. Solubility. Order of reactions. Reaction kinetics.
EYMKR5A	**Corrosion Engineering** Corrosion Principles. Corrosion Electrochemistry. Thermodynamics and Kinetics of Corrosion Processes. Corrosion Processes (Atmospheric, Crevice and Pitting, EAC, Galvanic, Corrosion in water systems, Concrete Corrosion and High temperature Oxidation). Corrosion Control (Inhibitors, Protective Coatings, Materials Selection, CP and Anodic Protection). Corrosion Management, Modelling, Life Prediction, Computer Applications and Monitoring. Corrosion Failure Analysis. Corrosion Monitoring and Measurement techniques.
SEMESTER 2	
EYHMT5A	**Heat and Mass Transfer** Distinguish between the mechanisms of heat transfer modes, derive suitable heat loss equations for different situations. Determine temperature distributions, heat losses, analyse heat flow resistances and discuss heat source systems. Compare flow patterns between objects at different angles, explain advantages of insulation layers and calculate the thickness. Interpret mechanisms of radiation, types of bodies, emissivity and apply these principles in solving typical problems. Apply Heissler charts as a method to determine energy losses and temperature distributions in different objects and at different

	depths. Discuss the kinetics of diffusion and calculate reaction mass flow rates, and evaporation processes. Compare flow types of liquids and gases and calculate volumetric flow rates. Illustrate different types of heat exchangers, calculate flow rates and temperature exchange.
SEMESTER 1 & 2 (Year Modules)	
EYMAS5A	**Advanced Modelling and Simulation** Introduction to discrete event simulation - Applications, advantages, and limitations. Simulation project methodology, event calendar and implications. Advanced statistic distributions, familiarisation with Arena and Simio. Making decisions with simulation. Buffer zone modelling. Introduction to advanced modelling techniques. Modelling material handling devices. Conveyor modelling. Continuous systems: classification of systems, system's abstraction and modelling, types of systems and examples, system variables, input-output system description, system response and analysis of system behaviour. System simulation (computer-aided: Simio software), real-world system examples. Discrete systems: difference equations, numerical simulation of continuous-time dynamics, discrete-event systems, and real-world system examples.
EYPRO5A	**Physical Metallurgy Research Project** The theory of characterization tools. Research Methodology in Science and Engineering. The use of research tools and databases (literature search databases, zetero, origin, published articles, presentation of scientific data, presentation skills, conferences, networking in science and engineering, publishing etc.).
EYPME5A	**Physical Metallurgy** Thermodynamics and kinetics of Solidification. Diffusional transformation in solids. Diffusionless transformation in solids. Heat treatment process. Coarsening of particles. Discontinuous phase transformations. Thermomechanical treatment of metals and alloys.
EYMAM5A	**Manufacturing Metallurgy** Science and selection of Engineering Materials and Alloys. Basic Metallurgical Manufacturing Processes: Casting, Forming, Powder Processing, Machining, welding. Advanced Materials Manufacturing: Metal-Matrix Composites, Ceramic Matrix Composites and Polymer-Based composites, Additive manufacturing, Functionally graded Materials. Introduction to Materials Modelling and process simulation. Computer Automated Design, Manufacturing and Automation. Manufacturing Costs.
EYMAE5A	**Materials Engineering** Introduction to Materials science and Engineering. Structure-Property relationships of Materials and Materials design. An introduction to Properties and Applications of Materials: (Ceramics, Polymers,

	Composites and non-ferrous alloys). Specialty Materials Applications: Functional Materials/Compositionally graded Materials (e.g. electronic, magnetic, superconducting, high temperature alloys, biomaterials, thermoelectric, smart materials). Manufacturing Methods (Casting & Powder Metallurgy). Additive Manufacturing. Materials Selection and Economics. Introduction to Computational Material Science: Modelling and Simulation.

Syllabi: POSTGRADUATE DIPLOMA: METALLURGICAL ENGINEERING (Course code: PG0850)	
Module Code	**EXTRACTIVE METALLURGY OPTION**
SEMESTER 1	
EYPTH2A	**Process Thermodynamics** Reaction spontaneities ΔG and equilibrium constant k. Phase equilibrium. Binary- and multiple solutions. Electrochemical cells. Activation energy. Solubility. Order of reactions. Reaction kinetics.
EYMKR5A	**Corrosion Engineering** Corrosion Principles. Corrosion Electrochemistry. Thermodynamics and Kinetics of Corrosion Processes. Corrosion Processes (Atmospheric, Crevice and Pitting, EAC, Galvanic, Corrosion in water systems, Concrete Corrosion and High temperature Oxidation). Corrosion Control (Inhibitors, Protective Coatings, Materials Selection, CP and Anodic Protection). Corrosion Management, Modelling, Life Prediction, Computer Applications and Monitoring. Corrosion Failure Analysis. Corrosion Monitoring and Measurement techniques.
SEMESTER 2	
EYHMT5A	**Heat and Mass Transfer** Distinguish between the mechanisms of heat transfer modes, derive suitable heat loss equations for different situations. Determine temperature distributions, heat losses, analyse heat flow resistances and discuss heat source systems. Compare flow patterns between objects at different angles, explain advantages of insulation layers and calculate the thickness. Interpret mechanisms of radiation, types of bodies, emissivity and apply these principles in solving typical problems. Apply Heissler charts as a method to determine energy losses and temperature distributions in different objects and at different depths. Discuss the kinetics of diffusion and calculate reaction mass flow rates, and evaporation processes. Compare flow types of liquids and gases and calculate volumetric flow rates. Illustrate different types of heat exchangers, calculate flow rates and temperature exchange.
SEMESTER 1 & 2 (Year Modules)	

EYMAS5A	**Advanced Modelling and Simulation** Introduction to discrete event simulation - Applications, advantages, and limitations. Simulation project methodology, event calendar and implications. Advanced statistic distributions, familiarisation with Arena and Simio. Making decisions with simulation. Buffer zone modelling Introduction to advanced modelling techniques. Modelling material handling devices. Conveyor modelling. Continuous systems: classification of systems, system's abstraction and modelling, types of systems and examples, system variables, input-output system description, system response and analysis of system behaviour. System simulation (computer-aided: Simio software), real-world system examples. Discrete systems: difference equations, numerical simulation of continuous-time dynamics, discrete-event systems, and real-world system examples.
EYPRO5A	**Extractive Metallurgy Research Project** The theory of characterization tools. Research Methodology in Science and Engineering. The use of research tools and databases (literature search databases, zotero, origin, published articles, presentation of scientific data, presentation skills, conferences, networking in science and engineering, publishing etc.). Laboratory-based empirical research project.
EYMIP5A	**Mineral Processing** Introduction to mineral processing principles and terminology. Ore characteristics and mineral separation methods. Application of mineral separation methods in the concentration of coal, precious metals (Au and PGM's) and base metals (Cu, N, Zn, Pb). Material balance on complex mineral processing flow diagrams. Equipment selection and sizing. Principles of mineral processing plant design. Principles of mineral processing plant cost estimation. Application of mathematical models for mineral processing units.
EYHYD5A	**Hydrometallurgy** Hydrometallurgy processes and plants design: review of hydrometallurgy basics; hydrometallurgical plants; general plant design considerations; process design; flowsheets development; drawing; plant design economics; secondary resources processing; South African core commodities; Case studies of recent trends in application to specific commodities; laboratory work.
EYPYR5A	**Pyrometallurgy** Define thermodynamic laws; Discuss and determine spontaneity of processes; Discuss influence of various parameters on processes in steel industry; Calculate flame temperatures and blast air volumes in blast furnaces; Calculate mass stoichiometric mass balances in blast furnaces; Calculate tap temperatures, tap times, compositions etc in

	steel production processes, continuous casting processes, electric arc furnaces and degassing processes; Define different slag theories and compare and discuss the role of slag; Discuss principles of solid-, liquid- and gas reactions and calculate parameters; Derive mathematical models for smelting and metal-slag systems; Calculate reaction rates for pyro systems.

11.3 CIVIL ENGINEERING

Syllabi: DIPLOMA: CIVIL ENGINEERING (3 year programme) (Course code: DI0810)	
Module Code	**Module Description**
SEMESTER 1	
HKCOX1A	**Applied Communication Skills 1.1** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
EEESK1A	**Engineering Skills 1** The Engineering Profession: Different types of engineering. Mechanical, electrical, civil, chemical, computer etc. The engineering team; artisans, technicians, technologists and engineers. Engineering Teamwork: Engineering design. Teamwork versus group work. Basic principles of; engineering project management (plan, organise, lead and control), project costing, budgeting and resource management. What is a business plan? Engineering and the Environment: social responsibility, environmental impact, natural resources, sustainability of the engineering activity. Legal and safety considerations. Ethics in Engineering: professional ethics, responsibility, engineering norms, ECSA and their function.
AAECH1A	**Engineering Chemistry 1** Matter and measurement; Atoms; Molecules and ions; Formulas, Equations and moles; Chemical reactions in aqueous solution; Periodicity and atomic structure; Ionic bonds; Covalent bonds and molecular structure; Chemical equilibrium; Acids and bases; Organic chemistry.
ASICT1A	**ICT Skills 1** Recognizing Computers; Using current versions of Microsoft Windows Professional; Common Elements; Microsoft Word;

	Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, getting connected and using the Internet.
AMMAT1A	**<u>Mathematics 1</u>** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves, Simpson's rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre's, Calculating roots.
APHYS1A	**<u>Physics 1</u>** Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton's Law of Motion, Work and Energy, Impulse and Momentum, Electric Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids, Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.
EESIN1A	**<u>Social Intelligence 1</u>** Leadership styles: Democratic, Autocratic, Consensus etc. Economic systems of governance: Capitalism, Socialism and Communism. Etiquette in society and the workplace. Soft skills, Cultural influences. Success in Engineering: Professionalism, Ethics, Responsibility, Discipline, Time management, Acquiring information and Independent learning.
SEMESTER 2	
HKCOY1A	**<u>Applied Communication Skills 1.2</u>** Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity:

	Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph, Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
ECAME1A	**Applied Mechanics 1** Measurement, Statics, mechanics, basics of structural engineering, mass, vectors, forces, properties of sections, friction. Laboratory work.
ECCOA2A	**Computing Applications 2** Navigating EECOA2A on VUTela, Laboratory rules & guidelines. SIMetrix Software: Working principles, Interfaces, creating electronic circuits, simulation, graphs, measurements. Microsoft Word 2016: Working principles, creating engineering documents, navigating word, using operations. Microsoft Excel 2016: Working principles, creating engineering spreadsheets, navigating excel to solve engineering problems, using operations for engineering applications.
AAECH2A	**Engineering Chemistry 2** Introduction to chemical bonding; Ionic bonds; Covalent bonding and molecular structure; Hydrogen; The Group IA and IIA metals; Boron and Aluminium; Chemical reactions in aqueous solutions; Carbon, Silicon, Germanium, Tin, and Lead; Acids, bases, and non-aqueous solvents; Nitrogen Phosphorus, Arsenic; Oxygen, Sulphur, Selenium, and Tellurium; Halogens.
ECEDR1A	**Engineering Drawing 1** Basic Drawing Principles; Design Components; Identify and use drawing equipment; Draw common objects using standardized rules; Represent given data on graph.
AMMAT2A	**Mathematics 2** Differentiation: Inverse trig functions, Hyperbolic functions, Inverse hyperbolic functions, Parametric equations, Maxima and minima, Partial differentiation, Small changes, Rate of change. Integration: Revision of integration, Use of formulae sheet, Inverse functions, Partial fractions, Partial fractions, Integration by parts, Trig. & hyperbolic substitutions, t-formulae, Mean and RMS values. Differential Equations: Differential eq., separation, Using the integrating factor, Applications, Homogeneous differential equations. Matrix Algebra: Operations with matrices, Inverse of a matrix, solve equations using inverse, Cramer’s rule, Eigenvalues and –vectors. Probability and Statistics: Data

	representation, Data summaries, Normal distribution, Conf. intervals, error est. Conf. intervals, error est. Hypothesis testing.
APHYP2A	**<u>Physics 2 Practical</u>** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
APHYT2A	**<u>Physics 2 Theory</u>** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising Radiation, Nuclear Energy and

	Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
ECSPA1A	**Safety Principles and Law 1** Importance of health and safety: What is safety and health concepts as indicated in the OHS Act, Fundamental safety concepts and terms: Fundamental safety terms, legal appointments as per the OHS Act, duties of the legal appointees as per the OHS Act, safety awareness and fire training, What is hazards and risk in the workplace: What is a hazard, what is a risk, what is the difference between a hazard and a risk, identification of main six hazards in the workplace, occupational hazards, difference between an accident and an incident: general principles of control and risk reduction, safe systems of work, permit-to-work systems, emergency procedures and first-aid, Principles of hazard and risk control: What is a risk assessment, why do a risk assessment, how to conduct a risk assessment, Risk assessment and risk management, Tools and Machinery: Tool and machine hazards, Principles of safeguarding powered and driven machines, point of operation safeguards, controls for hand toll hazards, portable power tool controls, Electrical safety: What do I need to know about electricity, what kind of injuries result from electrical current, electrical shock hazards, arc flash, control of electrical hazards, electrical safety-related work practices, Noise and vibration: Sound and noise, hearing, hazards of noise, exposure standard for noise, engineering controls for noise, noise measurement, vibrations of the human body or parts of the human body.
SEMESTER 3	
HKCOX2A	**Applied Communication Skills 2.1** Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in workplace, PowerPoint Presentations: Planning and preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a

	logically sound and well- reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
ECCOS1A	**Construction Methods 1** Construction plant; Safety; Construction methods: Foundations, structures; Major civil engineering structures: Roads, bridges, tunnels, dams; Drainage; Infrastructures: Harbours, airport, railways; Labour-Enhanced Construction (LEC).
ECCOM1A	**Construction Materials 1** Over view of construction materials; Aggregates; Concrete, Structural steel, Plastics, Clay products, Timber; Laboratory work.
ECEDR2A	**Engineering Drawing 2** Elements of engineering design presentation: Buildings; plans, elevations, sections. Roads; layout plan, longitudinal sections, cross sections. Hydraulic structures; pipelines, water reticulation, sewer lines and treatment plants.
EYEGE1A	**Engineering Geology 1** Earth: surface, structure and age; Mineralogy; Petrology; Structural geology; Surface processes; Stratigraphy; Ore deposits; Industrial minerals; Practical work.
ECESU1A	**Engineering Surveying 1** Basic principles; Coordinates (Traversing); Levelling; Tacheometry; Areas and volumes; Map projections; Practical.
ECSME1A	**Soil Mechanics 1** Engineering soils; Soil composition; Soil classification; Classification system for soils; Compactions; Laboratory work.
ECST2A	**Theory of Structures 2** Sectional properties; Stresses and strain: Direct stress-strain; Theory of elastic bending; Torsional stress, Stress due to impact loading; Simply supported beams and cantilevers with point loads; Uniformly distributed and uniformly varying loads; Analysis of statically determinate pin-jointed frames; Laboratory work.
SEMESTER 4	
HKCOY2A	**Applied Communication Skills 2.2** Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business Plan: Introduction to the business plan, Marketing your new business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements;

	aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
ECCEM1A	**Civil Engineering Management 1** Overview of civil engineering works; Contracts; Tendering; Office and site administration; Work study; Quality control and assurance.
ECCOM2A	**Construction Materials 2** Overview of highway construction materials: Bitumen, Lime, Binders and Asphalt, Quality control of construction materials; Laboratory work.
ECEOS2A	**Elements of Structural Steel and Timber Design 2** Reinforced concrete: Limit state theory, Design of structural elements (Standard connections, Rectangular beams, T-beams and L-beams, slabs, staircases, flat slabs, Columns, foundations); Unreinforced masonry: Design basis; Laboratory work.
ECESU2A	**Engineering Surveying 2** Leveling; Traversing; Tacheometry; Setting out of Civil structures; Triangulation, Geographic information system; Practical work.
ECSAN3A	**Structural Analysis 3** Shear stress; Momentary area theorems; Influence lines for statically determinant beams and frames; Struts; Combined stresses; Laboratory work.
ECTEN1A	**Transportation Engineering 1** Transport planning; Transport engineering; Geometric design; Railway design.
ECWEN1A	**Water Engineering 1** Hydrology: Hydrological cycle, Meteorology, Infiltration, Runoff, Ground water, Stormwater; Water and wastewater treatment: Water treatment, Sewerage and wastewater treatment.
SEMESTER 5	
ECCEM2A	**Civil Engineering Management 2** Project management; Contract planning; Planning techniques; Financial planning techniques; Labour law; Pricing and cost planning; Basic computer software application.
ECDOC1A	**Documentation 1** Quantities of civil works; specifications; Types of contracts; Conditions of contract; Compilation of tender documents; Law of contracts.
ECEOR3A	**Elements of Reinforced Concrete Masonry Design 3** Reinforced concrete: Design Basis, Limit –State Theory, Design of structural elements, Standard connections (SABS 0144),

	Rectangular beams, T-beams and L-beams, Slabs, Staircases, Flat slabs (introduction only), Columns, Cantilever type retaining walls, Foundations; Unreinforced Masonry: Design Basis, Introduction to the design of a simple wall column using empirical rules; Laboratory work and computer applications.
ECFMC2A	**Fluid Mechanics 2 (Civil)** Fluid properties; Fluid statics; Fluid flow; Flow in pipes; Flow measurement; Open channel flow; Introduction to pumps.
ECSME2A	**Soil Mechanics 2** Water in soils; Measurement of shear strength: shear strength of soil, soil pressure on retaining walls, Stability of slopes, Bearing capacities of foundations, Deep foundations, Consolidation settlement; Site investigation.
ECSAN4A	**Structural Analysis 4** Slope deflection; Clapeyron's three moment theorem; Bending moment distribution; Plastic collapse mechanisms; Strain energy (Virtual work); Laboratory work and computer applications.
ECTEN2A	**Transportation Engineering 2** Earthworks design; Pavement materials, Asphalt and Bitumen, pavement materials; Pavement design and management; Surfacing; Drainage.
SEMESTER 6	
ECEXL1A	**Workplace Based Learning 1** Giving the students work based learning experience in as many aspects related to Civil Engineering as possible. This would imply exposure to most of the topics listed below. The minimum requirement is that a student must acquire an acceptable level of proficiency in at least four (4) of the following major seven (7) categories: Administration; Drawing; Surveying; Design; Contracts; Construction supervision; Materials testing.

Syllabi: DIPLOMA: CIVIL ENGINEERING (Extended 4 year programme) (Course code: DE0811)	
Module Code	**Module Description**
SEMESTER 1	
AAXCH1A	**Foundation Chemistry 1** Atoms, molecules & ions; Stoichiometry; Reactions in aqueous solution; Rate and extent of reactions; Chemical equilibrium; Acids, bases and salts; Electrochemistry.
AMXMA1A	**Foundation Mathematics 1**

	Intro to Algebra, Expressions & equations, Linear & simultaneous equations, Polynomial equations, Matrix algebra, Hyperbolic functions.
APXPH1A	**Foundation Physics 1** Mechanics: Force and Newton's laws; Momentum and impulse; Vertical projectile motion in one dimension; Work, energy & power; Doppler effect.
SEMESTER 2	
AAXCH2A	**Foundation Chemistry 2** Organic molecules; The chemical industry.
AMXMA2A	**Foundation Mathematics 2** Polynomial equations, Partial fractions, Trigonometry (radian measure), Binomial series, Functions, Intro to differentiation, Intro to integration.
APXPH2A	**Foundation Physics 2** Electrostatics; Electric circuits; Electrodynamics; Optical phenomena; Properties of materials; Emission and absorption spectra.
EMXDR1A	**Foundation Drawing 1** Letter and number notation; Line notation; Handling of apparatus; Measurement notation; Geometrical construction; Orthographic projections; Arcs of penetration and developments; Detailed works drawing; Composite drawings.

Syllabi: ADVANCED DIPLOMA: CIVIL ENGINEERING (Course code: AD0810)	
Module Code	**Module Description**
SEMESTER 1	
ECMAT4A	**Civil Engineering Materials** Concrete technology; Asphalt technology; Bitumen technology; Steel technology; Timber technology.
ECHTE4A	**Highway and Traffic Engineering** Traffic surveys; Traffic characteristics and flow theory; Traffic design; Traffic management and urban works; Traffic safety; Statistical methods; Parking studies; Systems and structures; TSM; TDM traffic impact studies; Traffic control and forms of signing; Signals and ATC systems; Interchange and intersection capacity and Project.
	Structural Analysis

ECSTR4A	Virtual work; Arches- 3-pinned, 2-pinned and fixed: Rectangular; Portals; Segmental and Parabolic; Influence lines: Frames; Arches and Portals; Space frames; Suspension bridges; Cables and Stiffening girders; Computer applications.
ECWWE4A	**Water and Wastewater Engineering** Water and Wastewater Properties; Treatment Processes; Treatment Plant Design; Water Recycling and Reuse; Recovery and Conservation; Environmental Aspects; Plant- Operation and Management.
ECENS4A	**Environmental Studies** To understand the planning and design of a civil engineering project in order to identify potential fatal flaws such as unavailability of technical and scientific information; To demonstrate the knowledge on understanding the Interested and Affected parties (I&APs) of a proposed civil engineering development, during the scoping phase of the EIA; To be able to identify the environmental specialists (geologist, botanist, economist, etc.) needed for a particular civil engineering project or development; To be able to integrate the findings of the environmental specialist with other available information and synthesized into an Environmental Impact Report (EIR); To be able to understand the Authority review and decision making process.
ECREM4A	**Civil Engineering Research Methodology** Introduction to Research and the Research Process; Research Ethics and Integrity; Introduction to Quantitative Research, Study Designs and Methods; Analysis and Interpretation of Quantitative Data; Introduction to Qualitative Research; Study Designs and Methods; Analysis and Interpretation of Qualitative Data; Literature survey.
SEMESTER 2	
ECEDE4A	**Earthworks Design** Materials selection; Design and construction of embankments; Design and construction of cuttings; Environmental impact control; Problem soils: Collapsible soils and expansive soils; Compaction equipment and techniques; Other soil improvement techniques.
	Steel and Reinforced Concrete Design To design structural steel connections in accordance with SABS 0162-1; To design thin, cold-formed steel structural elements to SANS 10162-2; To design a complete heavy industrial building that incorporates crane gantry girders and composite steel-concrete elements with reference to relevant design codes; To analyse to

ECSRD4A	reinforced concrete elements and structures to determine forces, reactions, stresses and bending moments; To design reinforced concrete slabs (flat, waffle, ribbed and hollow), corbels, deep beams and shear walls; To design silos and water retaining structures; To utilise computer software packages (PROKON and AUTOCAD) for analysis, design and detailing of a design project.
ECRWE4A	**Railway Engineering** Introduction to railways; Functions of railway track components (Signalling, Switches and Crossings; Rail Joints and Welding); Components of Track Structure; Manual and Mechanised Maintenance; Geometric Design of Railways; Railway Safety and Derailment Investigation.
ECRED4A	**Reticulation Design** Hydraulic principles; Design parameters; Ancillary works; Pumping installations; System operation; Water management; Waste management; Environmental aspects and design project.
ECBDC4A	**Business Development in the Civil Engineering Environment** Structure of the South African Economy; Business opportunities in the build environment; SMME and enterprise development; Role of government and programmes in business development; Government and private sector budgeting and funding processes; BBBEE requirements; PPP; business (organisation) models, Ownership, shareholding, etc., Legal requirements, registration; Company taxes; Financial statements and interpretation; Project and company funding methods; Planning and control; Project and company viability / feasibility; Company risks; Insurance.
ECMTT4A	**Management Tools and Techniques** Management Tools and Techniques For: Project Integration Management, Project Scope Management, Project Time Management, Project Cost Management, Project Quality Management, Project Human Resource Management, Project Communication Management, Project Risk Management, Project Procurement Management and Project Stakeholder Management.
ECREP4A	**Civil Engineering Research Project** Data collection according to prescribed specifications; Validation of results, discussion and conclusions; and Dissemination of research findings by means of a research report and presentation.

Syllabi:
POSTGRADUATE DIPLOMA: CIVIL ENGINEERING

(Course code: PG0810)	
Module Code	**Module Description**
SEMESTER 1	
ECEEN5A	**Environmental Engineering** Water Resources management; Climate Change; Environmental Engineering Problems, their Causes and sustainability; Engineered Environmental systems; Renewable and Non-Renewable Energy; Green Engineering.
ECGTE5A	**Geotechnical Engineering** Soil mechanics relating to foundations; Types of foundations and their applications; Shallow foundations; Mat foundations; Pile foundations; Drilled-piers and caisson foundations; Foundations on problem soils; Lateral earth support; Kinematics and Strain; Stress in soils; Governing Equations of Continua; Infinitesimal Elasticity Constitutive Theory; Poro-elastic Theory; Introduction to Finite Element Methods; Strong form, weak form of governing equations; element formulations; Iso-parametric Elements and Gauss Integration;
ECPMC5A	**Project and Construction Management** Project management theory and requirements. The project and construction stages; Types of contracts, contract documentation and conditions of contract; Procurement processes and requirements; government development and social objectives (requirements); Estimating and tendering; Site inspection, site overheads; pre-constructing planning – site layout and organization, construction programme, etc.; Plan and keeping within time and budget, managing delays, disputes and on-site problems; Manage quality control, complying with health and safety; communication with stakeholders; managing material and equipment; payments and claims; handover and closing out.
ECRPX5A	**Research Project in Civil Engineering (Module 1)** The concept and philosophy of research; Research topic; Identify and define a project title; Objectives, Research problem and problem statement, Hypothesis statement and Research proposal; Data bases; Categories of journals; Impact factor; Hirsch Index; Proposal writing (detailed analysis); Relevance of research to society; Time management; Effective technical communication; Research proposal for project funding; Plagiarism.
SEMESTER 2	
ECSTE5A	**Structural Engineering** Analysis of plates and simple shells; Introduction to structural dynamic; Plastic analysis of beams and frames; Yield line analysis

	of slabs; Properties of fresh (rheology) and hardened (mechanical and durability) concrete; Sustainable concrete (concrete and environment); laboratory practicals; Investigational project.
ECTEN5A	**Transportation Engineering** Transport models; Travel demand analysis and Transport policy; Traffic Design; Geometric Design & Safety and Pavement Design & Maintenance.
ECWEN5A	**Water Engineering** Hydrodynamic principles to solve complex problems on static and moving fluids; Operating principles of hydraulic machinery in the design of pumping stations, structures for surge protection and hydropower plants; Complex problems on varied flow in channels; Hydraulic structures design such as culverts, stilling basins and drop structures; Groundwater and surface water resources for resources planning; Water demand through reservoir design and operation; Integrated water resources management.
ECRPY5A	**Research Project in Civil Engineering (Module 2)** Experimental design, Thesis writing, Data interpretation and analysis: Data capture and validation; Copyright and plagiarism; Fundamentals of research project management; Presentation.

11.4 ELECTRICAL ENGINEERING: ELECTRONIC

Syllabi: DIPLOMA IN ELECTRICAL ENGINEERING: ELECTRONIC (3 year programme) (Course code: DI0823)	
Module Code	**Module Description**
	SEMESTER 1
HKCOX1A	**Applied Communication Skills 1.1** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
EEESK1A	**Engineering Skills 1** The Engineering Profession: Different types of engineering. Mechanical, electrical, civil, chemical, computer etc. The engineering team; artisans, technicians, technologists and engineers. Engineering Teamwork: Engineering design. Teamwork versus group work. Basic principles of; engineering project management (plan, organise, lead and control), project costing, budgeting and resource management. What is a business plan? Engineering and the Environment: social responsibility, environmental impact, natural resources, sustainability of the engineering activity. Legal and safety considerations. Ethics in Engineering: professional ethics, responsibility, engineering norms, ECSA and their function.
EPEEN1A	**Electrical Engineering 1** Electrical Principles: The electron theory, Heat, Magnetism, Friction, Pressure, Light, Chemical Action, Batteries, International system of measurement. Basic Electrical Concepts: The electrical circuit, Electrical current flow, Electrical current, Electromotive force and voltage, Definitions of electric, magnetic and other SI units, Resistance, Resistors. Network Theorems in Direct Current Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion,

	Delta-Star conversion, Star-delta conversion. Electro Magnetism: The magnetic field, Electromagnetic Force on a current-carrying conductor, Electromagnetic induction, Lenz's law, Faraday's law. Inductance in Direct Current Circuits: Inductive circuits, Inductance, Current growth in an inductive circuit, Current decay in an inductive circuit, Energy stored in an inductor, Types of inductors. Capacitance in Direct Current Circuits: Capacitors, Capacitance, Series capacitor circuit, Parallel capacitor circuits. Parallel Magnetic Cores: Parallel magnetic circuits, electrical analogy, series and parallel in magnetic circuits.
ASICT1A	**ICT Skills 1** Recognizing Computers; Using current versions of Microsoft Windows Professional; Common Elements; Microsoft Word; Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, getting connected and using the Internet.
AMMAT1A	**Mathematics 1** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves, Simpson's rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre's, Calculating roots.
APHYS1A	**Physics 1** Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton's Law of Motion, Work and Energy, Impulse and Momentum, Electric Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids, Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.
EESIN1A	**Social Intelligence 1**

	Leadership styles: Democratic, Autocratic, Consensus etc. Economic systems of governance: Capitalism, Socialism and Communism. Etiquette in society and the workplace. Soft skills, Cultural influences. Success in Engineering: Professionalism, Ethics, Responsibility, Discipline, Time management, Acquiring information and independent learning.
AAECH1A	**Engineering Chemistry 1** Matter and measurement; Atoms; Molecules and ions; Formulas, Equations and moles; Chemical reactions in aqueous solution; Periodicity and atomic structure; Ionic bonds; Covalent bonds and molecular structure; Chemical equilibrium; Acids and bases; Organic chemistry.
SEMESTER 2	
HKCOY1A	**Applied Communication Skills 1.2** Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity: Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph, Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
EECOA2A	**Computing Applications 2** Navigating EECOA2A on VUTela, Laboratory rules & guidelines. SIMetrix Software: Working principles, Interfaces, creating electronic circuits, simulation, graphs, measurements. Microsoft Word 2016: Working principles, creating engineering documents, navigating word, using operations. Microsoft Excel 2016: Working principles, creating engineering spreadsheets, navigating excel to solve engineering problems, using operations for engineering applications.
EIDSY1A	**Digital Systems 1** Digital and Analogue Quantities: Binary Digits, Logic Levels, Digital Waveforms Basic Logic Functions. Number Systems, Operations and Codes: Decimal Numbers, Binary Numbers, Decimal-to-Binary Conversion, Binary Arithmetic, Compliments of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed Numbers, Hexadecimal Numbers, Octal Numbers, Binary Coded Decimal (BCD), Digital Codes, Error Codes. Logic Gates: The inverter, The AND gate, The OR gate, The NAND gate, The NOR gate and the

	Exclusive-OR and Exclusive-NOR gate, Fixed-Function Logic Gates. Boolean Algebra and Logic Simplifications: Boolean Operations and Expressions, Laws and Rules of Boolean Algebra, DeMorgan's Theorems, Boolean Analysis of Logic Circuits, Logic Simplifications using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, The Karnaugh Map, Karnaugh Map SOP Minimization, Karnaugh Map POS Minimization. Combinational Logic Analysis: Basic Combinational Logic Circuits, Implementing Combinational Logic, The Universal Property of NAND and NOR gates, Combinational Logic using NAND and NOR gates, Pulse Waveform Operation. Functions of Combinational Logic: Half and Full Adders, Parallel Binary Adders, Ripple Carry and Look-Ahead Carry Adders, Comparators, Decoders, Encoders, Code Converters, Multiplexers (Data Selectors), De-multiplexers, Parity Generators/Checkers.
EPEEN2A	**Electrical Engineering 2** Single Phase AC Circuits: Series Impedance Circuits, AC Voltage Diver, Components of current, Admittance, Parallel impedance circuits, Current divider. Power and Power Factor Correction: Active (Real) power, Power in a resistive ac circuit, Power in an active ac circuit, Power in a capacitive ac circuit, Peak and average power, the complex power triangle, Complex power, Reactive power, Power factor, Disadvantage of a low power factor, causes of low power, Power factor correction, Equipment used for power factor improvement, Importance of power factor improvement, Calculations on power factor improvement. Network Theorems in AC Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion, Maximum power transfer theorem. Resonance: Effect of varying frequency in series ac circuits, Frequency effect on the circuit impedance, Current at resonance, Resonance rise in voltage, Energy transfer between the inductor and capacitor, Resonant frequency in series ac circuits, Tuning for resonance, Q-factor of a series resonant circuit, Practical parallel resonant circuit. Complex Waves and Harmonics: Integration of waveforms, Production of harmonics, Effect of reactance in complex circuits, Composition of complex waves, Power and power factor of non-sinusoidal waves, Resonance as a result of non-sinusoidal waves, Addition and subtraction of non-sinusoidal waveforms.
AMMAT2A	**Mathematics 2** Differentiation: Inverse trig functions, Hyperbolic functions, Inverse hyperbolic functions, Parametric equations, Maxima and

	minima, Partial differentiation, Small changes, Rate of change. Integration: Revision of integration, Use of formulae sheet, Inverse functions, Partial fractions, Partial fractions, Integration by parts, Trig. & hyperbolic substitutions, t-formulae, Mean and RMS values. Differential Equations: Differential eq., separation, Using the integrating factor, Applications, Homogeneous differential equations. Matrix Algebra: Operations with matrices, Inverse of a matrix, solve equations using inverse, Cramer's rule, Eigenvalues and –vectors. Probability and Statistics: Data representation, Data summaries, Normal distribution, Conf. intervals, error est. Conf. intervals, error est. Hypothesis testing.
EEELE1A	**<u>Electronics 1</u>** Introduction to Electronics: The Atom, Materials Used in Electronics, Current in Semiconductors, N-Type and P-Type Semiconductors, the PN Junction. Diodes and Applications: Diode Operation, Voltage-Current (V-I) Characteristics of a diode, Diode Models, Half-Wave Rectifiers, Full-Wave Rectifiers, Power Supply Filters and Regulators, Diode Limiters and Clampers, Voltage Multipliers, The Diode Datasheet, Troubleshooting. Special-Purpose Diodes: The Zener Diode, Zener Diode Applications, The Varactor Diode, Optical Diodes, Other Types of Diodes, Troubleshooting. Bipolar Junction Transistors: BJT Structure, Basic BJT Operation, BJT Characteristics and Parameters, The BJT as an Amplifier, The BJT as a Switch, The Phototransistor, Transistor Categories and Packaging, Troubleshooting. Transistor Bias Circuits: The DC Operating Point, Voltage-Divider Bias, Other Bias Methods, Troubleshooting.
EEWPR1A	**<u>Project 1 (WIL - Electronics)</u>** Rules and safety principles that apply in laboratories, including relevance and adherence to the OHS act. General theory on soldering including wetting, flux, solder chemistry, soldering iron types and usage and soldering technique. Preparing, drilling, de-burring and cleaning of pre-set solder course PCB. Insert and solder components too specification. Use of high-speed drilling machines, pliers, cutters, strippers, de-soldering equipment to produce quality workmanship on own project. Design and plan circuit layout on strip-board for given circuits. Plan the cutting, linking and layout for neatness, efficiency and reliable use. Build, test, and resolve problems for this project before presentation. Use laser toner transfer method to reproduce CAD designed image onto PCB copper. Etch using Ferric Chloride and clean surface features. Drill holes. Bend and place components before soldering. Test and calibrate circuit including resolution of faults.

	Install electrical board into product enclosure with heatsink attached and finalise for use and presentation.
EESPA1A	**<u>Safety Principles and Law 1</u>** Importance of health and safety: What is safety and health concepts as indicated in the OHS Act, Fundamental safety concepts and terms: Fundamental safety terms, legal appointments as per the OHS Act, duties of the legal appointees as per the OHS Act, safety awareness and fire training, What is hazards and risk in the workplace: What is a hazard, what is a risk, what is the difference between a hazard and a risk, identification of main six hazards in the workplace, occupational hazards, difference between an accident and an incident: general principles of control and risk reduction, safe systems of work, permit-to-work systems, emergency procedures and first-aid, Principles of hazard and risk control: What is a risk assessment, why do a risk assessment, how to conduct a risk assessment, Risk assessment and risk management, Tools and Machinery: Tool and machine hazards, Principles of safeguarding powered and driven machines, point of operation safeguards, controls for hand toll hazards, portable power tool controls, Electrical safety: What do I need to know about electricity, what kind of injuries result from electrical current, electrical shock hazards, arc flash, control of electrical hazards, electrical safety-related work practices, Noise and vibration: Sound and noise, hearing, hazards of noise, exposure standard for noise, engineering controls for noise, noise measurement, vibrations of the human body or parts of the human body.
EIPRI1A	**<u>Process Instrumentation 1</u>** Introduction: Measurement Standards, Functional elements of Instruments, Static characteristics of instruments, Instrument errors, Industrial instrumentation schematics. Pressure Measurement: Introduction and definitions, Pressure in a Liquid, Pressure measurement with manometers, measuring pressure with elastic structures, measuring pressure with force balance gauges, Measuring pressure with DP-cell, Strain gauges. Flow Measurement: Introduction, Derivation of the flow equation, Differential pressure method of measuring flow, Other flow meters. Level Measurement: Direct methods, indirect methods. Temperature Measurement: Introduction, Expansion and pressure thermometers, Resistance thermometers, Thermocouple thermometers, Thermistor thermometers. Process Control: Introduction, Control schemas, PID controllers, Pneumatic control valves.

APHYP2A	**Physics 2 Practical** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
APHYT2A	**Physics 2 Theory** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising Radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors,

	Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
SEMESTER 3	
HKCOX2A	**Applied Communication Skills 2.1** Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in workplace, PowerPoint Presentations: Planning and preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a logically sound and well- reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
EIDSY2A	**Digital Systems 2** Latches Flip-Flops and Timers: Latches, Flip-Flops, Flip-Flop Operating Characteristics, Flip-Flop Applications, One-Shots, the a-stable multi-vibrator. Shift Registers: Shift Register Operation, Types of Shift Register, Bidirectional Shift Registers, Shift Register Counters, Shift Register Applications. Counters: Finite State Machines, Asynchronous Counter Operation, Synchronous Counter Operation, Up/Down Synchronous Counters, Design of Synchronous Counters, Cascaded Counters, Counter Decoding, Counter Applications. Data Storage: Semiconductor Memory Basics, The Random-Access Memory (RAM), Read-Only Memory (ROM), Programmable Rom, The Flash Memory, Memory Expansion, Special Types of Memories, Magnetic and Optical Storage, Memory Hierarchy, Cloud Storage. Signal Conversion and Processing: Analogue-to-Digital Conversion, Methods of analogue-to-Digital Conversion, Methods of Digital -to- analogue Conversion, Digital Signal Processing, The Digital Signal Processor (DSP).
EEELE2A	**Electronics 2** BJT Amplifiers: Amplifier Operation, Transistor Models, the Common-Emitter Amplifier, the Common-Collector Amplifier, the Common-Base Amplifier, Multistage Amplifiers, the Differential Amplifier. Power Amplifiers: The Class A Power Amplifier, The Class B and Class AB Push-Pull Amplifiers, The Class C Power

	Amplifier. Field Effect Transistors: The JFET, JFET Characteristics and Parameters, JFET Biasing, The Ohmic Region, The MOSFET, MOSFET Characteristics and Parameters, MOSFET Biasing, The IGBT. FET Amplifiers and Switching Circuits: The Common-Source Amplifier, The Common-Drain Amplifier, The Common-Gate Amplifier, The Class D Amplifier, MOSFET Analog Switching, MOSFET Digital Switching. Amplifier Frequency Response: Basic Concepts, The Decibel, Low-Frequency Amplifier Response, High-Frequency Amplifier Response, Total Amplifier Frequency Response. Thyristors: The Four-Layer Diode, The Silicon-Controlled Rectifier (SCR), SCR, Applications, The Diac and Triac , The Silicon-Controlled Switch (SCS), Programmable Uni-junction Transistor (PUT).
EEWPR2A	**<u>Project 2 (WIL - Electronic</u>)** Introduction to microcontrollers (uC) in general and their pervasive use in industry and commercial environments. Introduction to uC Assembler, the C programming language and the high-level Flowcode programming language. Revisit of binary principles and number systems. Introduction to the Arduino development board. Programming interface. Pin layout. On-board peripherals. Possible usage scenarios using examples from hobbyists, experimenters and professional applications. Introduction to using flowcharts principle to define the logic for instructing a controller to execute sequenced instructions. Definition of logical blocks, inputs, outputs, decisions, macros, loops, variables, interrupts and their use in the Flowcode 8 environment. Indicate direct linkage of Flowcode 8 blocks to C-code. Schematic connection diagrams generated using ‘Fritzing’ (freeware Arduino application). Multiple projects to program simulate and execute on hardware given with time constraint. Marks awarded for Program Structure, Simulation, Connection Diagrams and Hardware Functioning after program download (this covers all aspects of semesters learning and application thereof).
EECAD1A	**<u>Electrical CAD 1</u>** Introduction to Computer-Aided Design (CAD) concepts, EAGLE origins and current environment, project structure, file locations, creation of industry standard schematic diagrams, PCB creation, component placement and routing. The use custom libraries, output file generation for manufacture. Fusion 360. Creating new project linked and 3D parts for each EAGLE component used. The upload “push” of these updates to Fusion. Using Fusion to visualize the PCB layout as well as other parts of design.

AMMAT3A	**Mathematics 3** Application of Integration: Volumes of solids of revolution, Length of Curves, Double Integrals: Iterated Integrals & Fubini's theorem, Double Integrals, Polar Coordinates. First Order Differentiation Equations: Exact DE, Homogeneous DE, Bernoulli DE, Applications (Excluding Newton's Law of Cooling), D-Operator Methods. Numerical Solutions of First Order Differential Equations: Euler's method, Runge-Kutta order 2, Runge-Kutta order 4. Operator D Methods/Undetermined coefficients: Complementary Solutions, D-operator & Inverse, binomial or long division method, Theorem 1, Theorem 2, Theorem 3, Special cases, General solution, Applications. Laplace Transform, and Table of transforms. (Derivation from first principles not for examination purposes), First shifting property, Laplace transforms of derivatives, Inverse Laplace Transforms using tables, Laplace Transforms of discontinuous functions, Inverse Laplace Transforms of discontinuous functions, Solution of differential equations, Application to electric circuits, Application to beams. Fourier Series: Periodic functions and harmonics, sketching of graphs and determining Fourier Series, Series with period 2l, Even and Odd functions, Full range and Half range series, Numerical Harmonic Analysis.
EEECO2A	**Electronic Communication 2** Introduction to radio frequency communication; Radio frequency components; Resonance; Modulation AM FM and phase; Radio wave propagation; Basic antenna theory and dB's.
EIENP1A	**Engineering Programming 1** Introduction to programming: different languages, first program, integer variables, numbers and operators, characters, flow control, input and output. Advanced Flow Control and Data Aggregates: if and else, more types, loops, Boolean algebra, vectors, initiators: simple arrays, multidimensional arrays, structures and why we need them. Extending Expressive Power: pointers, functions and memory. Accessing Different kinds of Data: arrays of pointers, conversions, strings, and namespaces. Object Programming Essentials: basic concepts, a class, static components, and objects vs pointers inside objects. Inheritance: class hierarchy, inheritance and type compatibility, polymorphism and virtual methods, objects as parameters and dynamic casting, various supplements, constant keyword. Exceptions: to errors in human, throw statement, categorizing exceptions, catching exceptions. Operators and Enumerated types: overloading operators, enumerated types.

BHMAN1A	**Management 1** Organizational structure and design, Organizational change and learning, Motivating for performance, The dynamics of leadership, Groups and teams in organizations; Operating strategies; Forecasting; Process planning and designing; Trade-off analysis; Automated processes; Allocating resources with LP; Decision trees; Facility location; Aggregate planning; Master production schedules; Inventory systems; Material requirements planning and Lot-sizing for MRP and CRP.
EINET1A	**Networks 1** Introduction – Exploring the Network: Global Connectivity, Networking Today, LANs, WANs, and the Internet, Components of a Network, The Network as a data communications platform, The changing Network Environment. Configuring a Network Operating System: The IOS, Basic Configurations, Network Addressing Schemes. Network Protocols and Communications: The Rules of Communications, Protocols and Standards, How Data moves in a Network. Network Access: Physical layer Protocols, Network Media, Data Link Layer Protocols, Media Access Control. Ethernet: Ethernet Protocol, Address Resolution Protocol, LAN Switches Network Layer: Network Layer Protocols, Routing Principles, what is a Router, Configuring Routers. IP Addressing: IPV4 and IPV6 Addressing, Connectivity, ICMP. Sub netting IP Networks: Sub netting of IPV4 Networks, Addressing Schemes, Structured Design, Design Considerations for IPV6. Transport Layer: Transport layer Protocols, TCP and UDP Characteristics and Operation. Application layer: Application layer Protocols, Well-known Application Layer Protocols and Services, HTTP, DHCP, DNS, SMTP etc. Build a Small Network: Network Design, Network Security, Network performance, Troubleshooting.
SEMESTER 4	
HKCOY2A	**Applied Communication Skills 2.2** Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business Plan: Introduction to the business plan, Marketing your new business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements; aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a

	cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
EEELE3A	**Electronics 3** Advanced voltage regulators; Amplification theory and applications; Oscillators; Power amplifiers; Passive filter design and Noise.
EEWPR3A	**Project 3 (WIL - Electronic)** General-purpose sensors used in commercial and industrial processes (light, temperature, humidity, pressure, flow, speed, distance…). Storing calibration parameters and set points. Storage of time-logged data sets. Real Time Clocks & Calendar (Time Control) Hardware RTCC (Real Time Clock & Calendar) either as on-board peripheral or external device. Software defined RTCC and use. Using uC for the control of 1) DC motors 2) Servo motors 3) Stepper motors 4) AC motors.
EEDCO2A	**Digital Communication 2** Differentiation between analogue and digital signals, spread spectrum systems, digital modulation, noise and interference, compression and error detection and communication networks and protocols.
EECAD2A	**Electrical CAD 2** Develop project using EAGLE and Fusion. Translating multiple boards from EAGLE to Fusion part blocks. Stacking and linking connected boards in Fusion. Connecting peripheral boards using cables and connectors. Layout of individual's development boards and peripherals. Fusion CAMUse CAM processing to 3D print designed supports, brackets and mountings for idealized design.
EEMET3A	**Measurement Technology 3** Definitions Measurement; Units Standards and Concepts Data analysis; Instrument selection; DC measurements; AC measurement; Signal sources; Oscilloscopes; Frequency measurement; Frequency domain instruments; Logic analyzers; Null balanced instruments.
EEPEL3A	**Power Electronics 3** Industrial Control Elements: The Elements of Logic Control, switches as Input Devices, Relays as Logic Devices, Solid State Logic Gates. Designing Logic Control Systems Using Relays and Solid state devices: Classification Control System. Programmable Logic Controllers: Introducing the PLC, Input-Output Section, Input Cards, Output Cards, Input-Output Racks, Addressing Method, the processor, Input Image File (IIF), Output Image File

	(OIF), The User Program Memory, The Variable Data Memory, The Central Processing Unit (CPU). Programmable Logic Controllers (PLC) Instructions I: Examine-On/Off Instruction, Output-Energize instruction, Rung Definition, Decision Logic of the CPU. Programmable Logic Controllers (PLC) Instructions II: Counters, Up-Down Counters, Timers, Timer-On-Delay (TON) operation, Timer-Off-Delay (TOF) operation. Programmable Logic Controllers (PLC) Instructions III: Latch and Unlatch Instructions, Immediate Input and Output instructions, Immediate Input Instruction, Immediate Input Instruction, Master Control Reset Instruction. Programmable Logic Controllers (PLC) Analog Data: Analog Data handling, Analog Input Card, Analog Input Card Operation, Analog Output Card, Analog Output Card Construction. Network Considerations: Supervisory Control and Data Acquisition (SCADA), Requirements of SCADA systems. Input Devices for Analog Data: Displacement, Pressure, Temperature, Measurements using a strain gauge, Tachometers, Moisture Content (Humidity), Light, Flow rate, Power, Shaft position measurement. Complete system design: One complete project design solution.
EICSY2A	**Control Systems 2** Mathematical Foundation: Basic control system concepts, open-loop and closed-loop system, Block Diagrams: Block diagram terminologies, Block diagram reduction rules, Modelling: Derive the differential equation of RLC circuits, Stability: Define the stability criteria of control systems, Time Domain Analysis: Define Test signals and their transfer functions, Derive the steady state error for unity feedback system, Frequency Domain Analysis: Define frequency domain analysis of linear control systems.
EIENP2A	**Engineering Programming 2** The Analysis Model of a system: selection of an appropriate model. Iterative System Build: Select and Prepare a use case for design and/or code; Use Case Design; Perform Class Design; Code and Unit Test a use case using the build tools as defined in the Architecture document; Integrate and test: the use case with all other use cases in the build. Principles of Database Design: The Logical Data model is transformed into a physical Data Base.
EIPRI2A	**Process Instrumentation 2** High and medium vacuum measurement, Introduction, Ionization gauges, Hot- filament ionization vacuum gauge, Undesirable feature, Cold cathode ionization vacuum gauge Electronic pressure detectors and transmitters, Introduction, Resistance strain gauge, Theory, Gauge factor “S”, Construction of strain

	gauges, Fine wire gauge cemented on a paper backing Flow measurement, Introduction, Types of flow, Streamlined flow, Turbulent flow, Helical-turbulent flow, Pulsating flow, Planning a flow installation, The flow equation, Modification of the flow formula level measurement, Introduction, Selection of a measurement system, Capacitive level measurement system, Operation of capacitive system, Factors which determine the di-electric constant, Installation requirements and practical consideration, temperature measure, Temperature measurement: Introduction, Resistance thermometer measuring method, Measurement circuits, Application notes, Potentiometer circuits, Operating principles, programmable controllers, Introduction to programmable controllers, Definition of a programmable controllers, Components of a programmable controller, Power supply, Control unit, Read-only memory (ROM), Random access memory, Central processing unit, Internal operation of the control unit, Input modules, controllers and control elements Introduction to Practical controllers and elements, Control stations, Remote-set stations, Cascade stations, Ratio-stations, Computer-set stations, Integral saturation, Control valves.
EIDCS1A	**Digital Control Systems 1** Introduction to Networks: Introduction, Analogue Communication Systems, Instrumentation and Control Systems, Digital Communication Systems, Serial and Parallel Communication, Classifying Communication. Communication Mediums: Optical Fibers for Data Transmission, Radio/Wireless Communication, and Wireless Ethernet. Communication Protocols: Introduction, Packet-Switching vs Circuit-Switching, Data transfer path - ISO/OSI 7-layer model, Ethernet, Ethernet & the 7-layer ISO/OSI model, and transmission control protocol/internet protocol (TCP/IP). Industrial Networks or Field busses: Introduction, Industrial applications, Predecessors of the modern Fieldbus, Digital Communication Plus 4 - 20 mA, Highway Addressable Remote Transmitter (HART), Operation of HART, Modbus for Factory Automation, Current Fieldbus Standards, Fieldbus. Profinet: Introduction, Redundant Profibus/Ethernet, and Profisafe. Foundation Fieldbus: Introduction, H1 Level, Foundation Fieldbus H1 Level Topology, Foundation Fieldbus Model, Producer/Consumer Model (Publish/Subscribe), Standard Function Blocks in FF Devices. Devicenet & Controlnet: History and development of Devicenet, Topology and Connectors, Connections, Installation rules, Power Supplies, Potential Power

	Supply Problems, Bus Operation, Data Structure. Interbus & AS-I Bus: Interbus Protocol Efficiency, Interbus Shift Registers, Interbus System Performance, Interbus Sub-Buses, Redundancy with Interbus, The Actuator-Sensor Interface (AS-I BUS), AS-I Physical Layer.
SEMESTER 5	
EEOEL3A	**Opto-Electronics 3** Principals, Advantages, Disadvantages, Simple Calculations, Practical Applications, Future of Optoelectronics. Reflection, Refraction, Snell's Law, Numerical Aperture, Calculations, Structure of Fiber, Losses, Optical Power and Calculations, Dispersion, Semiconductors, Transmission Systems, Modulation , Demodulation, SNR, Mixers and Multiplexing, Single Mode Fiber, Multimode Fiber, Manufacturing Processes and Techniques, Plastic Optic Fiber cables, Types, Construction and Characteristics of Cables, Types of Ducted Cables, Installation Possibilities, Light Sources, Conversions, LEDs, Laser Diodes, Gain-guided and Index-guided, Conversions, Optical Receiver, Fiber Amplifiers, Connectors, Couplers, Fiber Joining, Techniques, Splicing, Local and Long-Distance Networks, Telephone Networks, Data Networks, Design Optic Fiber Cable System, Optical Path Loss Budget, Installation Techniques, Testing Optic Fiber, Test Equipment, OTDR Calculations, Markets, Development Trends, Lasers and Amplifiers, Fiber Cables, Transmission Systems, Industry, Military, Government, Medicine.
EEWPR4A	**Project 4 (WIL - Electronic)** Peculiarities of a project management; Preparing yourself for doing a project; Project Planning; Project Goals; Project Schedule; Project Deliverables; Properties of a good project report; Human Resource Plan; Communications Plan; Risk Management Plan.
EEMIC3A	**Microwave Communication 3** Microwave fundamentals; Microwave transmission lines; Impedance matching using the Smith chart; Microwave components; Microwave generations and Microwave applications.
EERAD3A	**Radio Engineering 3** Angle Modulation: Introduction to Angle Modulation; Frequency Modulation; Phase Modulation; The Angle Modulation Spectrum; FM and Noise; FM Stereo; FM Measurements. Receivers: Introduction to Receivers; Receiver Topologies; Receiver Characteristics; Demodulators; Communication Receivers; Transceivers; Receiver Measurements. Antennas: Introduction to

	Antennas; Simple Antennas; Antenna Characteristics; Other Simple Antennas; Antenna Matching; Antenna Arrays; Reflectors; Cellular and PCS (Personal Communication System) Antennas; Antenna Test Equipment. Cellular Radio: Introduction to Cellular Radio; Advanced Mobile Phones; AMPS Control Systems; Security and Privacy; Cellular Phones; Cell Site Equipment.
EETXR3A	**Transmission 3 (Radio Frequency)** Radio Frequency Circuits: Introduction to Radio Frequency Circuits; High-Frequency Effects; Tuned Radio-Frequency Amplifiers; Single-Tuned Class A (Transformer Coupled with Tuned Primary) Amplifiers; Single-Tuned Class A (Transformer Coupled with Tuned Secondary) Amplifiers; Double-Tuned Transformer-Coupled Amplifiers; Neutralization. Transmitters: Introduction to Transmitters; Transmitter Requirements; Transmitter Topologies; FM Transmitters; Transmitter Power Measurements. Transmission Lines: Introduction to Transmission Lines; Characteristic Impedance; Velocity Factor; Reflections; EM Propagation on Transmission Lines; Standing Waves; Variation of Impedance Along a Transmission Line; Characteristics of Open and Shorted Transmission Lines; Transmission Line Losses. Satellites & Radio Frequency Propagation: Electromagnetic waves; Free-space propagation; Mobile / portable communication; Repeaters & Cellular systems; Introduction to Satellites; Satellite Orbits; Geostationary Satellites; Application of Geostationary Satellites; Satellites in Low- and Medium Earth Orbits.
EEPEL4A	**Power Electronics 4** AC drivers; DC drives; Inverters; Multilevel inverters; FACTS; Power conversion applications and Resonant conversion techniques.
EIENP3A	**Engineering Programming 3** A Senior Level Certified Object Orientated Programming Course selected out of the mainstream Object Orientated Courses such as CPS - C++ Certified Senior Programmer or The Equivalent Certified Java Course or the equivalent C Programming course such as CLS - C Certified Senior Programmer Certificate or an appropriate level web-based development course, depending on the programming demands of Software Engineering Project. Sample Curriculum for CPS - C++ Certified Senior Programmer.
SEMESTER 6	
EEEXL1A	**Experiential Learning 1** Safety, company procedures, tools, components.
EEEXL2A	**Experiential Learning 2**

	Measurement procedures, calibration methods and procedures, installation and commissioning procedures and methods.
EEPRJ4A	**Engineering Project 4** Industrial problem solving and documentation.

Syllabi: DIPLOMA IN ELECTRICAL ENGINEERING: ELECTRONIC (Extended 4 year programme) (Course code: DE0863)	
Module Code	**Module Description**
	SEMESTER 1
AAXCH1A	**Foundation Chemistry 1** Atoms, molecules & ions; Stoichiometry; Reactions in aqueous solution; Rate and extent of reactions; Chemical equilibrium; Acids, bases and salts; Electrochemistry.
AMXMA1A	**Foundation Mathematics 1** Intro to Algebra, Expressions & equations, Linear & simultaneous equations, Polynomial equations, Matrix algebra, Hyperbolic functions.
APXPH1A	**Foundation Physics 1** Mechanics: Force and Newton's laws; Momentum and impulse; Vertical projectile motion in one dimension; Work, energy & power; Doppler effect.
	SEMESTER 2
AAXCH2A	**Foundation Chemistry 2** Organic molecules; The chemical industry.
AMXMA2A	**Foundation Mathematics 2** Polynomial equations, Partial fractions, Trigonometry (radian measure), Binomial series, Functions, Intro to differentiation, Intro to integration.
APXPH2A	**Foundation Physics 2** Electrostatics; Electric circuits; Electrodynamics; Optical phenomena; Properties of materials; Emission and absorption spectra.

Syllabi: ADVANCED DIPLOMA IN ELECTRICAL ENGINEERING: ELECTRONIC ENGINEERING (Course code: AD0823)	
Module Code	**Module Description**

SEMESTER 1	
EEPRO4A	**Electrical Engineering Project (Electronic)** Research Methodology: Introduction to Research methodology, Research topics, Different types of research, All research concepts and outputs, Referencing. Project Proposal: Discussion of the project proposal, Introduction: (Background, Purpose, Problem), Problem statement, Sub problems, Hypothesis, Assumptions, Delimitations, Definition of terms, Importance of the project, Overview of the project and summary. Literature Review: Introduction to literature study, Background of the topic being researched, Relevance of literature used for the study, Evidence of researched literature to address the components of the project, Citations and referenced used with research literature with reference to the VUT referring documentation. Sub-Problem 1 chapter: Introduction relevant to identified sub problem 1, Restatement of what the sub problem 1 is that need to be solved, Restatement of the hypothesis associated with the stated sub problem 1, Theory, relevant laws, fundamentals applicable to the stated sub problem 1, Methods, methodology used as well as what resources used to solve the sub problem1, Results obtained through tests, analysis and interpretation of the obtained data, Discussion of the results (explanations and evaluation of the data obtained), Testing of the hypothesis, Summary of what was discussed in the chapter. Sub-Problem 2 chapter: Introduction relevant to identified sub problem 2, Restatement of what the sub problem 2 is that need to be solved, Restatement of the hypothesis associated with the stated sub problem 2, Theory, relevant laws, fundamentals applicable to the stated sub problem 2, Methods, methodology used as well as what resources used to solve the sub problem2, Results obtained through tests, analysis and interpretation of the obtained data, Discussion of the results (explanations and evaluation of the data obtained), Testing of the hypothesis, Summary of what was discussed in the chapter. Final chapter: Summary of the identified problem statement and sub problems, Findings and deductions, Meaning and implications of the research that was conducted, Re-assessment of the original identified problems, Recommendations, Fields for further studies. Final project demonstration: Presentation of the identified problem and sub problems, technologies used and how was the final solution obtained, Final project hardware layout, Demonstration of the solution, Questions and answers (Moderator/Examiners).
EIREM4A	**Engineering Research Methods (Electronic)**

	Aspects of research: Introduction, importance of research, elements of research, defining research, dimensions of research, what research is not, nature of research and ethical requirements for researchers. Types of Research: Introduction, basic and applied research and research as per discipline or technical group. Sources of topics for scientific research: Introduction, starting point for research, sources of research topics or problems, when a topic is not a research problem and determining the suitability of a research problem. Demarcating of the research problem: Introduction, selecting a subject for research, posing a research problem as statement and steps in problem demarcation and formulation. Formulating a hypothesis: Introduction, defining a hypothesis, inductive and deductive hypothesis, variables and examples of formulated hypothesis. Writing a research proposal: Introduction, defining a research proposal, value of a research proposal, types of research proposals and components of the research proposal. Basic reading techniques for the literature review: Introduction, what to include in a review of the relevant research topic literature and the steps in doing literature review. Methods for collecting data: Introduction, research instruments, primary and secondary data and research methodology used to manage collected data. Literature review (Chapter 2): Introduction, provide evidence of a research for information and referencing techniques, inclusion of recent literature, relevance of collected information, how to interpret the collected information and relevant information associated with each identified sub problem.
EEAEL4A	**Electronics** Advanced biasing; Universal preamplifier; Three stage semi-power amplifier signal sources and Signal processing; Power amplifier; Power supply; RF coil; Differential amplifier; Dual-gate MOSFET and Power MOSFET
EERAD4A	**Radio Engineering** Theory and design of radio frequency amplifiers (all classes); Radio frequency transmission and systems; Measurements; Theory and design of antennas and Utilisation of CAD.
EIDSP4A	**Digital Signal Processing** Understand linear discrete-time systems. Sampling of analogue signals. Differential equations. Convolution summation. Z-Transform manipulation. Frequency response. Digital Fourier transform techniques. Design active filter circuits for application in digital circuits. Solve broadly defined digital signal analysis

	problems. Apply scientific engineering knowledge to solve digital signal processing design problems. Design signal processing circuits for use in control systems found in industry.
EISPC4A	**<u>Signal Processing</u>** Signal Spectra: Determine the frequency spectrum of a signal using the trigonometric Fourier expansion, determine the frequency spectrum of a signal, using the complex Fourier series. Filter Transmission: Determine the frequency response and transfer functions of networks, define the frequency response of low pass filters, high pass filters, band pass filters and band reject filters. Network Analysis: Determine the transfer functions of passive networks, determine the transfer functions of active networks. Butterworth Filters: Determine the order requirement from the filter design specifications, determine the transfer function from the filter design specifications, realize the designed filter in hardware. Chebychev Filters: Determine the order requirement from the filter design specifications, determine the transfer function from the filter design specifications, realize the designed filter in hardware. Project: Low Pass Butterworth Filter designs: The student need to design two low pass Butterworth filters. The first design is for a 4th order and the second design must be for a 5th order filter Butterworth filter.
SEMESTER 2	
AMAEM4A	**<u>Advanced Engineering Mathematics</u>** Mathematical skills using: Applications of integration; Laplace transform; First order differential equations and D-operators and Two dimensional Laplace equations.
BHEMN4A	**<u>Engineering Management</u>** Contracts, Tenders, Planning techniques, Financial planning and control, Labor, Plant and materials, Scheduling, Budgets Cash flow and cost control, Labor law.
EEAMI4A	**<u>Microwave Engineering</u>** Design of microwave amplifiers and circuits using S parameters; Micro-strip design; Design of microwave antennae; Microwave measurements; Industrial applications and Utilisation of CAD.
EEAOE4A	**<u>Opto-Electronics</u>** History of Opto-electronics; Transmitting and receiving devices; Manufacturing of cables and connectors; Opto-electronic communication system and Test equipment.
EESAT4A	**<u>Satellite Communication</u>** History of satellite communication; Orbital parameters; Link design; Platform and payload; Space environment and Launches and deployment.

EICIA4A	**<u>Circuit Analysis</u>** First order circuits: Determine the zero input response of first order circuits, determine the zero state response of first order circuits, find the total response of first order circuits in terms of the natural response and the steady state response. Second order circuits: Determine the zero input response of second order circuits and determine the complete response of second order circuits with initial conditions and non-zero inputs. Sinusoidal analysis: Determine steady state response in the time domain and determine steady state response in the frequency domain. Resonance: Analyse series resonant circuits, analyze parallel resonant circuits and perform calculations involving practical resonant circuits. Laplace Network Analysis: Calculate the Laplace transform of common time functions and perform Laplace network analysis. Project: Second and third order step response: Students will be required to construct a second and third order circuit and determine its step response.
EIDCS4A	**<u>Digital Control Systems</u>** Sampled Data Systems: Describe the basic elements of a digital control system and the fundamental process of sampling a continuous signal, express the input output relationship of digital systems in terms of difference equations, define the impulse function and step function, determine the z transform of important time functions and use z-transform techniques to solve difference equations. Transfer Functions: Visualize the sampling process to be composed of an ideal sampling action followed by a hold action, determine the transfer function of discrete cascaded systems and feedback systems, and obtain the transfer function of a plant preceded by a zero-order hold device. Time Domain Analysis: Analyse the transient behavior of a prototype second order continuous system, map between values in the s plane and the z plane, judge the response of discrete systems by relating the essential discrete characteristics to the properties of a similar and more familiar continuous system, view the transient response of discrete systems in terms of the position of the roots of the characteristic equation in the z plane and determine the steady state behaviour of digital control systems. Stability Analysis: Use the Jury test to judge the stability of discrete control systems and prescribe the set of conditions that will guarantee stable operation of a digital control system. Root Locus Techniques: Construct the root locus from the characteristic equation of a system and analyse transient and stability behaviour of systems by means of the root locus. Digital Controller Design: Improve

	system response with controller design based on root locus methods, determine digital forms of the PID control algorithm and realize PID controllers. Project: Level Control: To complete this project, students will be required to construct a circuit representing a water level control system with various parameters to simulate PID control.

Syllabi: POSTGRADUATE DIPLOMA IN ELECTRICAL ENGINEERING: ELECTRONIC ENGINEERING (Course code: PG0823)	
Module Code	**Module Description**
COMPULSORY MODULES	
	Engineering Research Project Project Identification, Project proposal, Literature study, Conceptual design, Functional design, Implementation, Testing and data analysis, Oral presentation and Documentation.
	Research Statistics This module develops the student's knowledge and skill in the application of basic mathematics; Statistics in management; Exploratory data analysis; Statistical models for forecasting and planning. How to perform basic mathematical calculations; Setting the statistical scene; Exploratory data analysis & application on Excel; Statistical models for forecasting and planning; Basic probability concepts & Probability distributions and Inferential statistics.
ELECTIVES	
	Advanced Measurement Technology Intelligent metering systems, Propagation losses, Load management, Data acquisition, Energy consumption patterns, Global positioning system, Harmonic distortion in electrical systems.
	Alternative Energy Feasibility
	Energy Management Safety and Legislation of Alternative Energy Installations, Commissioning of Installations.
	Microwave Design Design of microwave amplifiers and circuits using S parameters; Micro-strip design; Design of microwave antennae; Microwave measurements; Industrial applications and Utilisation of CAD.

	Energy Efficiency Management Conduct an energy audit, Energy audit instrumentation, Energy codes, Energy standards and protocols, Electric and energy rate structure, Economic analysis and life cycle cost, Lighting improvement and Industrial systems.

11.5 ELECTRICAL ENGINEERING: POWER

Syllabi: DIPLOMA IN ELECTRICAL ENGINEERING: POWER (3 year programme) (Course code: DI0824)	
Module Code	**Module Description**
SEMESTER 1	
HKCOX1A	**Applied Communication Skills 1.1** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
EEESK1A	**Engineering Skills 1** The Engineering Profession: Different types of engineering. Mechanical, electrical, civil, chemical, computer etc. The engineering team; artisans, technicians, technologists and engineers. Engineering Teamwork: Engineering design. Teamwork versus group work. Basic principles of; engineering project management (plan, organise, lead and control), project costing, budgeting and resource management. What is a business plan? Engineering and the Environment: social responsibility, environmental impact, natural resources, sustainability of the engineering activity. Legal and safety considerations. Ethics in Engineering: professional ethics, responsibility, engineering norms, ECSA and their function.
EPEEN1A	**Electrical Engineering 1** Electrical Principles: The electron theory, Heat, Magnetism, Friction, Pressure, Light, Chemical Action, Batteries, International system of measurement. Basic Electrical Concepts: The electrical circuit, Electrical current flow, Electrical current, Electromotive

	force and voltage, Definitions of electric, magnetic and other SI units, Resistance, Resistors. Network Theorems in Direct Current Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion. Electro Magnetism: The magnetic field, Electromagnetic Force on a current-carrying conductor, Electromagnetic induction, Lenz's law, Faraday's law. Inductance in Direct Current Circuits: Inductive circuits, Inductance, Current growth in an inductive circuit, Current decay in an inductive circuit, Energy stored in an inductor, Types of inductors. Capacitance in Direct Current Circuits: Capacitors, Capacitance, Series capacitor circuit, Parallel capacitor circuits. Parallel Magnetic Cores: Parallel magnetic circuits, electrical analogy, series and parallel in magnetic circuits.
ASICT1A	**ICT Skills 1** Recognizing Computers; Using current versions of Microsoft Windows Professional; Common Elements; Microsoft Word; Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, getting connected and using the Internet.
AMMAT1A	**Mathematics 1** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves, Simpson's rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre's, Calculating roots.
APHYS1A	**Physics 1** Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton's Law of Motion, Work and Energy, Impulse and Momentum, Electric

	Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids, Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.
EESIN1A	**Social Intelligence 1** Leadership styles: Democratic, Autocratic, Consensus etc. Economic systems of governance: Capitalism, Socialism and Communism. Etiquette in society and the workplace. Soft skills, Cultural influences. Success in Engineering: Professionalism, Ethics, Responsibility, Discipline, Time management, Acquiring information and Independent learning.
SEMESTER 2	
HKCOY1A	**Applied Communication Skills 1.2** Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity: Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph, Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
EPCOA2A	**Computing Applications 2** Navigating EPCOA2A on VUTela, Laboratory rules & guidelines. SIMetrix Software: Working principles, Interfaces, creating electronic circuits, simulation, graphs, measurements. Microsoft Word 2016: Working principles, creating engineering documents, navigating word, using operations. Microsoft Excel 2016: Working principles, creating engineering spreadsheets, navigating excel to solve engineering problems, using operations for engineering applications.
EIDSY1A	**Digital Systems 1** Digital and Analogue Quantities: Binary Digits, Logic Levels, Digital Waveforms Basic Logic Functions. Number Systems, Operations and Codes: Decimal Numbers, Binary Numbers, Decimal-to-Binary Conversion, Binary Arithmetic, Compliments of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed Numbers, Hexadecimal Numbers, Octal Numbers, Binary Coded Decimal (BCD), Digital Codes, Error Codes. Logic Gates: The inverter, The AND gate, The OR gate, The NAND gate, The NOR gate and the Exclusive-OR and Exclusive-NOR gate, Fixed-Function Logic Gates. Boolean Algebra and Logic Simplifications: Boolean Operations

	and Expressions, Laws and Rules of Boolean Algebra, DeMorgan's Theorems, Boolean Analysis of Logic Circuits, Logic Simplifications using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, The Karnaugh Map, Karnaugh Map SOP Minimization, Karnaugh Map POS Minimization. Combinational Logic Analysis: Basic Combinational Logic Circuits, Implementing Combinational Logic, The Universal Property of NAND and NOR gates, Combinational Logic using NAND and NOR gates, Pulse Waveform Operation. Functions of Combinational Logic: Half and Full Adders, Parallel Binary Adders, Ripple Carry and Look-Ahead Carry Adders, Comparators, Decoders, Encoders, Code Converters, Multiplexers (Data Selectors), De-multiplexers, Parity Generators/Checkers.
EPEEN2A	**Electrical Engineering 2** Single Phase AC Circuits: Series Impedance Circuits, AC Voltage Diver, Components of current, Admittance, Parallel impedance circuits, Current divider. Power and Power Factor Correction: Active (Real) power, Power in a resistive ac circuit, Power in an active ac circuit, Power in a capacitive ac circuit, Peak and average power, the complex power triangle, Complex power, Reactive power, Power factor, Disadvantage of a low power factor, causes of low power, Power factor correction, Equipment used for power factor improvement, Importance of power factor improvement, Calculations on power factor improvement. Network Theorems in AC Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion, Maximum power transfer theorem. Resonance: Effect of varying frequency in series ac circuits, Frequency effect on the circuit impedance, Current at resonance, Resonance rise in voltage, Energy transfer between the inductor and capacitor, Resonant frequency in series ac circuits, Tuning for resonance, Q-factor of a series resonant circuit, Practical parallel resonant circuit. Complex Waves and Harmonics: Integration of waveforms, Production of harmonics, Effect of reactance in complex circuits, Composition of complex waves, Power and power factor of non-sinusoidal waves, Resonance as a result of non-sinusoidal waves, Addition and subtraction of non-sinusoidal waveforms.
EEELE1A	**Electronics 1** Introduction to Electronics: The Atom, Materials Used in Electronics, Current in Semiconductors, N-Type and P-Type Semiconductors, the PN Junction. Diodes and Applications: Diode Operation, Voltage-Current (V-I) Characteristics of a diode, Diode

	Models, Half-Wave Rectifiers, Full-Wave Rectifiers, Power Supply Filters and Regulators, Diode Limiters and Clampers, Voltage Multipliers, The Diode Datasheet, Troubleshooting. Special-Purpose Diodes: The Zener Diode, Zener Diode Applications, The Varactor Diode, Optical Diodes, Other Types of Diodes, Troubleshooting. Bipolar Junction Transistors: BJT Structure, Basic BJT Operation, BJT Characteristics and Parameters, The BJT as an Amplifier, The BJT as a Switch, The Phototransistor, Transistor Categories and Packaging, Troubleshooting. Transistor Bias Circuits: The DC Operating Point, Voltage-Divider Bias, Other Bias Methods, Troubleshooting.
AMMAT2A	**Mathematics 2** Differentiation: Inverse trig functions, Hyperbolic functions, Inverse hyperbolic functions, Parametric equations, Maxima and minima, Partial differentiation, Small changes, Rate of change. Integration: Revision of integration, Use of formulae sheet, Inverse functions, Partial fractions, Partial fractions, Integration by parts, Trig. & hyperbolic substitutions, t-formulae, Mean and RMS values. Differential Equations: Differential eq., separation, Using the integrating factor, Applications, Homogeneous differential equations. Matrix Algebra: Operations with matrices, Inverse of a matrix, solve equations using inverse, Cramer's rule, Eigenvalues and –vectors. Probability and Statistics: Data representation, Data summaries, Normal distribution, Conf. intervals, error est. Conf. intervals, error est. Hypothesis testing.
EESPA1A	**Safety Principles and Law 1** Importance of health and safety: What is safety and health concepts as indicated in the OHS Act, Fundamental safety concepts and terms: Fundamental safety terms, legal appointments as per the OHS Act, duties of the legal appointees as per the OHS Act, safety awareness and fire training, What is hazards and risk in the workplace: What is a hazard, what is a risk, what is the difference between a hazard and a risk, identification of main six hazards in the workplace, occupational hazards, difference between an accident and an incident: general principles of control and risk reduction, safe systems of work, permit-to-work systems, emergency procedures and first-aid, Principles of hazard and risk control: What is a risk assessment, why do a risk assessment, how to conduct a risk assessment, Risk assessment and risk management, Tools and Machinery: Tool and machine hazards, Principles of safeguarding powered and driven machines, point of operation safeguards, controls for hand toll hazards, portable power tool controls, Electrical safety: What do I

	need to know about electricity, what kind of injuries result from electrical current, electrical shock hazards, arc flash, control of electrical hazards, electrical safety-related work practices, Noise and vibration: Sound and noise, hearing, hazards of noise, exposure standard for noise, engineering controls for noise, noise measurement, vibrations of the human body or parts of the human body.
	CHOICE MODULES
EMEDR1A	**Engineering Drawing 1** Drawing instruments; Drawing skills; Object visualization and drawing; sketch and drawing of chemical engineering process equipment's using computer software.
APHYP2A	**Physics 2 Practical** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
APHYT2A	**Physics 2 Theory** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF,

	Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising Radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
SEMESTER 3	
HKCOX2A	**Applied Communication Skills 2.1** Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in workplace, PowerPoint Presentations: Planning and preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a logically sound and well- reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
EPEEN3A	**Electrical Engineering 3** Advanced Three Phase circuits, Inter Connectors, Components, Basics of Illumination.
EPEMA2A	**Electrical Machines 2** Direct Current Machines.
EPSYS2A	**Power Systems 2** Generation of Electricity – Power Stations
AMMAT3A	**Mathematics 3** Application of Integration: Volumes of solids of revolution, Length of Curves, Double Integrals: Iterated Integrals & Fubini's theorem, Double Integrals, Polar Coordinates. First Order Differentiation Equations: Exact DE, Homogeneous DE, Bernoulli DE, Applications

	(Excluding Newton's Law of Cooling), D-Operator Methods. Numerical Solutions of First Order Differential Equations: Euler's method, Runge-Kutta order 2, Runge-Kutta order 4. Operator D Methods/Undetermined coefficients: Complementary Solutions, D-operator & Inverse, binomial or long division method, Theorem 1, Theorem 2, Theorem 3, Special cases, General solution, Applications. Laplace Transforms, and Table of transforms. (Derivation from first principles not for examination purposes), First shifting property, Laplace transforms of derivatives, Inverse Laplace Transforms using tables, Laplace Transforms of discontinuous functions, Inverse Laplace Transforms of discontinuous functions, Solution of differential equations, Application to electric circuits, Application to beams. Fourier Series: Periodic functions and harmonics, sketching of graphs and determining Fourier Series, Series with period 2l, Even and Odd functions, Full range and Half range series, Numerical Harmonic Analysis.
EEELE2A	**Electronics 2** BJT Amplifiers: Amplifier Operation, Transistor Models, the Common-Emitter Amplifier, the Common-Collector Amplifier, the Common-Base Amplifier, Multistage Amplifiers, the Differential Amplifier. Power Amplifiers: The Class A Power Amplifier, The Class B and Class AB Push-Pull Amplifiers, The Class C Power Amplifier. Field Effect Transistors: The JFET, JFET Characteristics and Parameters, JFET Biasing, The Ohmic Region, The MOSFET, MOSFET Characteristics and Parameters, MOSFET Biasing, The IGBT. FET Amplifiers and Switching Circuits: The Common-Source Amplifier, The Common-Drain Amplifier, The Common-Gate Amplifier, The Class D Amplifier, MOSFET Analog Switching, MOSFET Digital Switching. Amplifier Frequency Response: Basic Concepts, The Decibel, Low-Frequency Amplifier Response, High-Frequency Amplifier Response, Total Amplifier Frequency Response. Thyristors: The Four-Layer Diode, The Silicon-Controlled Rectifier (SCR), SCR, Applications, The Diac and Triac , The Silicon-Controlled Switch (SCS), Programmable Uni-junction Transistor (PUT).
	CHOICE MODULE (Choose 1)
EIDSY2A	**Digital Systems 2** Latches Flip-Flops and Timers: Latches, Flip-Flops, Flip-Flop Operating Characteristics, Flip-Flop Applications, One-Shots, the a-stable multi-vibrator. Shift Registers: Shift Register Operation, Types of Shift Register, Bidirectional Shift Registers, Shift Register Counters, Shift Register Applications. Counters: Finite State

	Machines, Asynchronous Counter Operation, Synchronous Counter Operation, Up/Down Synchronous Counters, Design of Synchronous Counters, Cascaded Counters, Counter Decoding, Counter Applications. Data Storage: Semiconductor Memory Basics, The Random-Access Memory (RAM), Read-Only Memory (ROM), Programmable Rom, The Flash Memory, Memory Expansion, Special Types of Memories, Magnetic and Optical Storage, Memory Hierarchy, Cloud Storage. Signal Conversion and Processing: Analogue-to-Digital Conversion, Methods of analogue-to-Digital Conversion, Methods of Digital -to- analogue Conversion, Digital Signal Processing, The Digital Signal Processor (DSP).
BHMAN1A	**Management 1** Organizational structure and design, Organizational change and learning, Motivating for performance, The dynamics of leadership, Groups and teams in organizations; Operating strategies; Forecasting; Process planning and designing; Trade-off analysis; Automated processes; Allocating resources with LP; Decision trees; Facility location; Aggregate planning; Master production schedules; Inventory systems; Material requirements planning and Lot-sizing for MRP and CRP.
EIPRI1A	**Process Instrumentation 1** Introduction: Measurement Standards, Functional elements of Instruments, Static characteristics of instruments, Instrument errors, Industrial instrumentation schematics. Pressure Measurement: Introduction and definitions, Pressure in a Liquid, Pressure measurement with manometers, measuring pressure

	Linear and angular motion; Momentum and impulse; Work energy and power and Radial acceleration.
SEMESTER 4	
HKCOY2A	**Applied Communication Skills 2.2** Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business Plan: Introduction to the business plan, Marketing your new business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements; aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
EPSYS3A	**Power Systems 3** Calculation and Theory of Transmission Systems.
EEPEL3A	**Power Electronics 3** Industrial Control Elements: The Elements of Logic Control, switches as Input Devices, Relays as Logic Devices, Solid State Logic Gates. Designing Logic Control Systems Using Relays and Solid state devices: Classification Control System. Programmable Logic Controllers: Introducing the PLC, Input-Output Section, Input Cards, Output Cards, Input-Output Racks, Addressing Method, the processor, Input Image File (IIF), Output Image File (OIF), The User Program Memory, The Variable Data Memory, The Central Processing Unit (CPU). Programmable Logic Controllers (PLC) Instructions I: Examine-On/Off Instruction, Output-Energize instruction, Rung Definition, Decision Logic of the CPU. Programmable Logic Controllers (PLC) Instructions II: Counters, Up-Down Counters, Timers, Timer-On-Delay (TON) operation, Timer-Off-Delay (TOF) operation. Programmable Logic Controllers (PLC) Instructions III: Latch and Unlatch Instructions, Immediate Input and Output instructions, Immediate Input Instruction, Immediate Input Instruction, Master Control Reset Instruction. Programmable Logic Controllers (PLC) Analog Data: Analog Data handling, Analog Input Card, Analog Input Card Operation, Analog Output Card, Analog Output Card Construction. Network Considerations: Supervisory Control and Data Acquisition (SCADA), Requirements of SCADA systems. Input Devices for Analog Data: Displacement, Pressure, Temperature,

	Measurements using a strain gauge, Tachometers, Moisture Content (Humidity), Light, Flow rate, Power, Shaft position measurement. Complete system design: One complete project design solution.
EPAEN2A	**Alternative Energy 2 (Power)** Principles of Solar, Wind, Geothermal, Hydro, Bio energy, Micro Generation.
EPEMA3A	**Electrical Machines 3** Single-phase transformers, Three phase Induction Machines.
	CHOICE MODULE
EICSY2A	**Control Systems 2** Mathematical Foundation: Basic control system concepts, open-loop and closed-loop system, Block Diagrams: Block diagram terminologies, Block diagram reduction rules, Modelling: Derive the differential equation of RLC circuits, Stability: Define the stability criteria of control systems, Time Domain Analysis: Define Test signals and their transfer functions, Derive the steady state error for unity feedback system, Frequency Domain Analysis: Define frequency domain analysis of linear control systems.
SEMESTER 5	
EPEPR3A	**Electrical Protection 3** Introduction to basic Theory, Fuses, Fuse Protection.
EPAEN3A	**Alternative Energy 3 (Power)** Interconnection of renewable energy on the grid.
EPEMA4A	**Electrical Machines 4** Three Phase Transformers, Three Phase Induction Machines.
EPTXP3A	**Transmission 3 (Power)** Principles of Transmission, Calculations, Mechanical Design.
EEPEL4A	**Power Electronics 4** AC drivers; DC drives; Inverters; Multilevel inverters; FACTS; Power conversion applications and Resonant conversion techniques.
EPEMN2A	**Energy Management 2** Tariffs, Economic of Power Distribution.
	CHOICE MODULE
EEELE3A	**Electronics 3** Advanced voltage regulators; Amplification theory and applications; Oscillators; Power amplifiers; Passive filter design and Noise.
SEMESTER 6	
EPEXL1A	**Experiential Learning 1** Measurement.
EPEXL2A	**Experiential Learning 2**

	Testing.
EPPRJ4A	**Engineering Project 4** Project done in industry.

Syllabi: DIPLOMA IN ELECTRICAL ENGINEERING: POWER (Extended 4 year programme) (Course code: DE0864)	
Module Code	**Module Description**
SEMESTER 1	
AAXCH1A	**Foundation Chemistry 1** Atoms, molecules & ions; Stoichiometry; Reactions in aqueous solution; Rate and extent of reactions; Chemical equilibrium; Acids, bases and salts; Electrochemistry.
AMXMA1A	**Foundation Mathematics 1** Intro to Algebra, Expressions & equations, Linear & simultaneous equations, Polynomial equations, Matrix algebra, Hyperbolic functions.
APXPH1A	**Foundation Physics 1** Mechanics: Force and Newton's laws; Momentum and impulse; Vertical projectile motion in one dimension; Work, energy & power; Doppler effect.
SEMESTER 2	
AAXCH2A	**Foundation Chemistry 2** Organic molecules; The chemical industry.
AMXMA2A	**Foundation Mathematics 2** Polynomial equations, Partial fractions, Trigonometry (radian measure), Binomial series, Functions, Intro to differentiation, Intro to integration.
APXPH2A	**Foundation Physics 2** Electrostatics; Electric circuits; Electrodynamics; Optical phenomena; Properties of materials; Emission and absorption spectra.

Syllabi: ADVANCED DIPLOMA IN ELECTRICAL ENGINEERING: POWER ENGINEERING (Course code: AD0824)	
Module Code	**Module Description**
SEMESTER 1	
EPPRO4A	**Electrical Engineering Project**

	Research Methodology: Introduction to Research methodology, Research topics, Different types of research, All research concepts and outputs, Referencing. Project Proposal: Discussion of the project proposal, Introduction: (Background, Purpose, Problem), Problem statement, Sub problems, Hypothesis, Assumptions, Delimitations, Definition of terms, Importance of the project, Overview of the project and summary. Literature Review: Introduction to literature study, Background of the topic being researched, Relevance of literature used for the study, Evidence of researched literature to address the components of the project, Citations and referenced used with research literature with reference to the VUT referring documentation. Sub-Problem 1 chapter: Introduction relevant to identified sub problem 1, Restatement of what the sub problem 1 is that need to be solved, Restatement of the hypothesis associated with the stated sub problem 1, Theory, relevant laws, fundamentals applicable to the stated sub problem 1, Methods, methodology used as well as what resources used to solve the sub problem1, Results obtained through tests, analysis and interpretation of the obtained data, Discussion of the results (explanations and evaluation of the data obtained), Testing of the hypothesis, Summary of what was discussed in the chapter. Sub-Problem 2 chapter: Introduction relevant to identified sub problem 2, Restatement of what the sub problem 2 is that need to be solved, Restatement of the hypothesis associated with the stated sub problem 2, Theory, relevant laws, fundamentals applicable to the stated sub problem 2, Methods, methodology used as well as what resources used to solve the sub problem2, Results obtained through tests, analysis and interpretation of the obtained data, Discussion of the results (explanations and evaluation of the data obtained), Testing of the hypothesis, Summary of what was discussed in the chapter. Final chapter: Summary of the identified problem statement and sub problems, Findings and deductions, Meaning and implications of the research that was conducted, Re-assessment of the original identified problems, Recommendations, Fields for further studies Final project demonstration: Presentation of the identified problem and sub problems, technologies used and how was the final solution obtained, Final project hardware layout, Demonstration of the solution, Questions and answers (Moderator/Examiners).
EPREM4A	**Engineering Research Methods** Aspects of research: Introduction, importance of research, elements of research, defining research, dimensions of research,

	what research is not, nature of research and ethical requirements for researchers. Types of Research: Introduction, basic and applied research and research as per discipline or technical group. Sources of topics for scientific research: Introduction, starting point for research, sources of research topics or problems, when a topic is not a research problem and determining the suitability of a research problem. Demarcating of the research problem: Introduction, selecting a subject for research, posing a research problem as statement and steps in problem demarcation and formulation. Formulating a hypothesis: Introduction, defining a hypothesis, inductive and deductive hypothesis, variables and examples of formulated hypothesis. Writing a research proposal: Introduction, defining a research proposal, value of a research proposal, types of research proposals and components of the research proposal.
EPHVE4A	**High Voltage Engineering** Breakdown mechanisms of gasses, liquids and solids, generation of high AC and DC voltages, Generation of Impulse voltages and currents, Measurement of High voltages and currents, High Voltage Testing of electrical equipment, Non-destructive Insulation test techniques.
EPELP4A	**Electrical Protection** Z-bus and symmetrical faults, Symmetrical components and sequence networks, Unsymmetrical faults.
EPELM4A	**Electrical Machines** Synchronous Alternators, Synchronous machines, Induction motors, Design.
SEMESTER 2	
AMAEM4A	**Advanced Engineering Mathematics** Mathematical skills using: Applications of integration; Laplace transform; First order differential equations and D-operators and Two dimensional Laplace equations.
BHEMN4A	**Engineering Management** Contracts, Tenders, Planning techniques, Financial planning and control, Labor, Plant and materials, Scheduling, Budgets Cash flow and cost control, Labor law.
EPEPS4A	**Electrical Power Systems** Basic concepts, Three-phase Transformers, Synchronous machines: Real and Reactive Power, Series impedance of Transmission Lines, Capacitance of Transmission lines, Current and Voltage regulations on Transmission Lines, Power flow studies, Economic operation of Power Systems.
EEPOW4A	**Power Electronics**

	AC drivers; DC drives; Inverters; Multilevel inverters; FACTS; Power conversion applications and Resonant conversion techniques.

Syllabi: POSTGRADUATE DIPLOMA IN ELECTRICAL ENGINEERING: POWER ENGINEERING (Course code: PG0824)	
Module Code	**Module Description**
COMPULSORY	
	Engineering Research Project Project Identification, Project proposal, Literature study, Conceptual design, Functional design, Implementation, Testing and data analysis, Oral presentation and Documentation.
	Research Statistics This module develops the student's knowledge and skill in the application of basic mathematics; Statistics in management; Exploratory data analysis; Statistical models for forecasting and planning. How to perform basic mathematical calculations; Setting the statistical scene; Exploratory data analysis & application on Excel; Statistical models for forecasting and planning; Basic probability concepts & Probability distributions and Inferential statistics.
MINIMUM OF 3 ELECTIVES	
	Alternative Energy Feasibility Study understand: Climate change awareness, Conventional and Alternative Energy Source management, Energy efficiency.
	Electrical Protection Electrical protection of Switchgear, Transformer Protection, Feeder protection, Generator Protection, Motor Protection and Transmission line Protection.
	Energy Efficiency Management Conduct an energy audit, Energy audit instrumentation, Energy codes, Energy standards and protocols, Electric and energy rate structure, Economic analysis and life cycle cost, Lighting improvement and Industrial systems.
	Energy Management Safety and Legislation of Alternative Energy Installations, Commissioning of Installations.
	High Voltage Engineering

	Breakdown mechanism of Gases, Liquids and Solids, Generation of high AC and DC voltages, Generation of Impulse voltages and currents, Measurement of High Voltages and Currents, High Voltage Testing of Electrical Equipment, Non-destructive Insulation Test Techniques.
	Power Systems Three Phase Transformers, Phase shift Tap Changing, Synchronous machines, Real and Relative Power Control, Series impedance of Transmission Lines. Current and Voltage relations on Transmission Lines, Power flow solutions and Economic operation of power systems.

11.6 ELECTRICAL ENGINEERING: PROCESS CONTROL

Syllabi: DIPLOMA IN ELECTRICAL ENGINEERING: PROCESS CONTROL (3 year programme) (Course code: DI0825)	
Module Code	**Module Description**
SEMESTER 1	
HKCOX1A	**Applied Communication Skills 1.1** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
EEESK1A	**Engineering Skills 1** The Engineering Profession: Different types of engineering. Mechanical, electrical, civil, chemical, computer etc. The engineering team; artisans, technicians, technologists and engineers. Engineering Teamwork: Engineering design. Teamwork versus group work. Basic principles of; engineering project management (plan, organise, lead and control), project costing, budgeting and resource management. What is a business plan? Engineering and the Environment: social responsibility, environmental impact, natural resources, sustainability of the engineering activity. Legal and safety considerations. Ethics in Engineering: professional ethics, responsibility, engineering

	norms, ECSA and their function.
EPEEN1A	**Electrical Engineering 1** Electrical Principles: The electron theory, Heat, Magnetism, Friction, Pressure, Light, Chemical Action, Batteries, International system of measurement. Basic Electrical Concepts: The electrical circuit, Electrical current flow, Electrical current, Electromotive force and voltage, Definitions of electric, magnetic and other SI units, Resistance, Resistors. Network Theorems in Direct Current Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion. Electro Magnetism: The magnetic field, Electromagnetic Force on a current-carrying conductor, Electromagnetic induction, Lenz's law, Faraday's law. Inductance in Direct Current Circuits: Inductive circuits, Inductance, Current growth in an inductive circuit, Current decay in an inductive circuit, Energy stored in an inductor, Types of inductors. Capacitance in Direct Current Circuits: Capacitors, Capacitance, Series capacitor circuit, Parallel capacitor circuits. Parallel Magnetic Cores: Parallel magnetic circuits, electrical analogy, series and parallel in magnetic circuits.
ASICT1A	**ICT Skills 1** Recognizing Computers; Using current versions of Microsoft Windows Professional; Common Elements; Microsoft Word; Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, getting connected and using the Internet.
AMMAT1A	**Engineering Mathematics 1** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves, Simpson's rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre's, Calculating roots.
APHYS1A	**Physics 1**

	Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton's Law of Motion, Work and Energy, Impulse and Momentum, Electric Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids, Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.
EESIN1A	**Social Intelligence 1** Leadership styles: Democratic, Autocratic, Consensus etc. Economic systems of governance: Capitalism, Socialism and Communism. Etiquette in society and the workplace. Soft skills, Cultural influences. Success in Engineering: Professionalism, Ethics, Responsibility, Discipline, Time management, Acquiring information and Independent learning.
SEMESTER 2	
HKCOY1A	**Applied Communication Skills 1.2** Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity: Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph, Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
EICOA2A	**Computing Applications 2** Navigating EICOA2A on VUTela, Laboratory rules & guidelines. SIMetrix Software: Working principles, Interfaces, creating electronic circuits, simulation, graphs, measurements. Microsoft Word 2016: Working principles, creating engineering documents, navigating word, using operations. Microsoft Excel 2016: Working principles, creating engineering spreadsheets, navigating excel to solve engineering problems, using operations for engineering applications.
EIDSY1A	**Digital Systems 1** Digital and Analogue Quantities: Binary Digits, Logic Levels, Digital Waveforms Basic Logic Functions. Number Systems, Operations and Codes: Decimal Numbers, Binary Numbers, Decimal-to-Binary

	Conversion, Binary Arithmetic, Compliments of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed Numbers, Hexadecimal Numbers, Octal Numbers, Binary Coded Decimal (BCD), Digital Codes, Error Codes. Logic Gates: The inverter, The AND gate, The OR gate, The NAND gate, The NOR gate and the Exclusive-OR and Exclusive-NOR gate, Fixed-Function Logic Gates. Boolean Algebra and Logic Simplifications: Boolean Operations and Expressions, Laws and Rules of Boolean Algebra, DeMorgan's Theorems, Boolean Analysis of Logic Circuits, Logic Simplifications using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, The Karnaugh Map, Karnaugh Map SOP Minimization, Karnaugh Map POS Minimization. Combinational Logic Analysis: Basic Combinational Logic Circuits, Implementing Combinational Logic, The Universal Property of NAND and NOR gates, Combinational Logic using NAND and NOR gates, Pulse Waveform Operation. Functions of Combinational Logic: Half and Full Adders, Parallel Binary Adders, Ripple Carry and Look-Ahead Carry Adders, Comparators, Decoders, Encoders, Code Converters, Multiplexers (Data Selectors), De-multiplexers, Parity Generators/Checkers.
AMMAT2A	**Engineering Mathematics 2** Differentiation: Inverse trig functions, Hyperbolic functions, Inverse hyperbolic functions, Parametric equations, Maxima and minima, Partial differentiation, Small changes, Rate of change. Integration: Revision of integration, Use of formulae sheet, Inverse functions, Partial fractions, Partial fractions, Integration by parts, Trig. & hyperbolic substitutions, t-formulae, Mean and RMS values. Differential Equations: Differential eq., separation, Using the integrating factor, Applications, Homogeneous differential equations. Matrix Algebra: Operations with matrices, Inverse of a matrix, solve equations using inverse, Cramer's rule, Eigenvalues and –vectors. Probability and Statistics: Data representation, Data summaries, Normal distribution, Conf. intervals, error est. Conf. intervals, error est. Hypothesis testing.
EIPRI1A	**Process Instrumentation 1** Introduction: Measurement Standards, Functional elements of Instruments, Static characteristics of instruments, Instrument errors, Industrial instrumentation schematics. Pressure Measurement: Introduction and definitions, Pressure in a Liquid, Pressure measurement with manometers, measuring pressure with elastic structures, measuring pressure with force balance gauges, Measuring pressure with DP-cell, Strain gauges. Flow Measurement: Introduction, Derivation of the flow equation,

	Differential pressure method of measuring flow, Other flow meters. Level Measurement: Direct methods, indirect methods. Temperature Measurement: Introduction, Expansion and pressure thermometers, Resistance thermometers, Thermocouple thermometers, Thermistor thermometers. Process Control: Introduction, Control schemas, PID controllers, Pneumatic control valves.
APHYP2A	**<u>Physics 2 Practical</u>** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
APHYT2A	**<u>Physics 2 Theory</u>** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of

	gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising Radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
EESPA1A	**Safety Principles and Law 1** Importance of health and safety: What is safety and health concepts as indicated in the OHS Act, Fundamental safety concepts and terms: Fundamental safety terms, legal appointments as per the OHS Act, duties of the legal appointees as per the OHS Act, safety awareness and fire training, What is hazards and risk in the workplace: What is a hazard, what is a risk, what is the difference between a hazard and a risk, identification of main six hazards in the workplace, occupational hazards, difference between an accident and an incident: general principles of control and risk reduction, safe systems of work, permit-to-work systems, emergency procedures and first-aid, Principles of hazard and risk control: What is a risk assessment, why do a risk assessment, how to conduct a risk assessment, Risk assessment and risk management, Tools and Machinery: Tool and machine hazards, Principles of safeguarding powered and driven machines, point of operation safeguards, controls for hand toll hazards, portable power tool controls, Electrical safety: What do I need to know about electricity, what kind of injuries result from electrical current, electrical shock hazards, arc flash, control of electrical hazards, electrical safety-related work practices, Noise and vibration: Sound and noise, hearing, hazards of noise, exposure standard for noise, engineering controls for noise, noise measurement, vibrations of the human body or parts of the human body.
SEMESTER 3	
HKCOX2A	**Applied Communication Skills 2.1** Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in workplace, PowerPoint Presentations: Planning and

	preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a logically sound and well- reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
EPEEN2A	**<u>Electrical Engineering 2</u>** Single Phase AC Circuits: Series Impedance Circuits, AC Voltage Diver, Components of current, Admittance, Parallel impedance circuits, Current divider. Power and Power Factor Correction: Active (Real) power, Power in a resistive ac circuit, Power in an active ac circuit, Power in a capacitive ac circuit, Peak and average power, the complex power triangle, Complex power, Reactive power, Power factor, Disadvantage of a low power factor, causes of low power, Power factor correction, Equipment used for power factor improvement, Importance of power factor improvement, Calculations on power factor improvement. Network Theorems in AC Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion, Maximum power transfer theorem. Resonance: Effect of varying frequency in series ac circuits, Frequency effect on the circuit impedance, Current at resonance, Resonance rise in voltage, Energy transfer between the inductor and capacitor, Resonant frequency in series ac circuits, Tuning for resonance, Q-factor of a series resonant circuit, Practical parallel resonant circuit. Complex Waves and Harmonics: Integration of waveforms, Production of harmonics, Effect of reactance in complex circuits, Composition of complex waves, Power and power factor of non-sinusoidal waves, Resonance as a result of non-sinusoidal waves, Addition and subtraction of non-sinusoidal waveforms.
EEELE1A	**<u>Electronics 1</u>** Introduction to Electronics: The Atom, Materials Used in Electronics, Current in Semiconductors, N-Type and P-Type Semiconductors, the PN Junction. Diodes and Applications: Diode Operation, Voltage-Current (V-I) Characteristics of a diode, Diode Models, Half-Wave Rectifiers, Full-Wave Rectifiers, Power Supply Filters and Regulators, Diode Limiters and Clampers, Voltage Multipliers, The Diode Datasheet, Troubleshooting. Special-Purpose Diodes: The Zener Diode, Zener Diode Applications, The Varactor Diode, Optical Diodes, Other Types of Diodes,

	Troubleshooting. Bipolar Junction Transistors: BJT Structure, Basic BJT Operation, BJT Characteristics and Parameters, The BJT as an Amplifier, The BJT as a Switch, The Phototransistor, Transistor Categories and Packaging, Troubleshooting. Transistor Bias Circuits: The DC Operating Point, Voltage-Divider Bias, Other Bias Methods, Troubleshooting.
EIENP1A	**Engineering Programming 1** Introduction to programming: different languages, first program, integer variables, numbers and operators, characters, flow control, input and output. Advanced Flow Control and Data Aggregates: if and else, more types, loops, Boolean algebra, vectors, initiators: simple arrays, multidimensional arrays, structures and why we need them. Extending Expressive Power: pointers, functions and memory. Accessing Different kinds of Data: arrays of pointers, conversions, strings, and namespaces. Object Programming Essentials: basic concepts, a class, static components, and objects vs pointers inside objects. Inheritance: class hierarchy, inheritance and type compatibility, polymorphism and virtual methods, objects as parameters and dynamic casting, various supplements, constant keyword. Exceptions: to errors in human, throw statement, categorizing exceptions, catching exceptions. Operators and Enumerated types: overloading operators, enumerated types.
EINET1A	**Networks 1** Introduction – Exploring the Network: Global Connectivity, Networking Today, LANs, WANs, and the Internet, Components of a Network, The Network as a data communications platform, The changing Network Environment. Configuring a Network Operating System: The IOS, Basic Configurations, Network Addressing Schemes. Network Protocols and Communications: The Rules of Communications, Protocols and Standards, How Data moves in a Network. Network Access: Physical layer Protocols, Network Media, Data Link Layer Protocols, Media Access Control. Ethernet: Ethernet Protocol, Address Resolution Protocol, LAN Switches Network Layer: Network Layer Protocols, Routing Principles, what is a Router, Configuring Routers. IP Addressing: IPV4 and IPV6 Addressing, Connectivity, ICMP. Sub netting IP Networks: Sub netting of IPV4 Networks, Addressing Schemes, Structured Design, Design Considerations for IPV6. Transport Layer: Transport layer Protocols, TCP and UDP Characteristics and Operation. Application layer: Application layer Protocols, Well-known Application Layer Protocols and Services, HTTP, DHCP, DNS, SMTP etc. Build a Small Network:

	Network Design, Network Security, Network performance, Troubleshooting.
EIPRI2A	**<u>Process Instrumentation 2</u>** High and medium vacuum measurement, Introduction, Ionization gauges, Hot- filament ionization vacuum gauge, Undesirable feature, Cold cathode ionization vacuum gauge Electronic pressure detectors and transmitters, Introduction, Resistance strain gauge, Theory, Gauge factor "S", Construction of strain gauges, Fine wire gauge cemented on a paper backing Flow measurement, Introduction, Types of flow, Streamlined flow, Turbulent flow, Helical-turbulent flow, Pulsating flow, Planning a flow installation, The flow equation, Modification of the flow formula level measurement, Introduction, Selection of a measurement system, Capacitive level measurement system, Operation of capacitive system, Factors which determine the di-electric constant, Installation requirements and practical consideration, temperature measure, Temperature measurement: Introduction, Resistance thermometer measuring method, Measurement circuits, Application notes, Potentiometer circuits, Operating principles, programmable controllers, Introduction to programmable controllers, Definition of a programmable controllers, Components of a programmable controller, Power supply, Control unit, Read-only memory (ROM), Random access memory, Central processing unit, Internal operation of the control unit, Input modules, controllers and control elements Introduction to Practical controllers and elements, Control stations, Remote-set stations, Cascade stations, Ratio-stations, Computer-set stations, Integral saturation, Control valves.
AMMAT3A	**<u>Mathematics 3</u>** Application of Integration: Volumes of solids of revolution, Length of Curves, Double Integrals: Iterated Integrals & Fubini's theorem, Double Integrals, Polar Coordinates. First Order Differentiation Equations: Exact DE, Homogeneous DE, Bernoulli DE, Applications (Excluding Newton's Law of Cooling), D-Operator Methods. Numerical Solutions of First Order Differential Equations: Euler's method, Runge-Kutta order 2, Runge-Kutta order 4. Operator D Methods/Undetermined coefficients: Complementary Solutions, D-operator & Inverse, binomial or long division method, Theorem 1, Theorem 2, Theorem 3, Special cases, General solution, Applications. Laplace Transforms, and Table of transforms. (Derivation from first principles not for examination purposes), First shifting property, Laplace

	transforms of derivatives, Inverse Laplace Transforms using tables, Laplace Transforms of discontinuous functions, Inverse Laplace Transforms of discontinuous functions, Solution of differential equations, Application to electric circuits, Application to beams. Fourier Series: Periodic functions and harmonics, sketching of graphs and determining Fourier Series, Series with period 2l, Even and Odd functions, Full range and Half range series, Numerical Harmonic Analysis.
SEMESTER 4	
EIDCS1A	**Digital Control Systems 1** Introduction to Networks: Introduction, Analogue Communication Systems, Instrumentation and Control Systems, Digital Communication Systems, Serial and Parallel Communication, Classifying Communication. Communication Mediums: Optical Fibers for Data Transmission, Radio/Wireless Communication, and Wireless Ethernet. Communication Protocols: Introduction, Packet-Switching vs Circuit-Switching, Data transfer path - ISO/OSI 7-layer model, Ethernet, Ethernet & the 7-layer ISO/OSI model, and transmission control protocol/internet protocol (TCP/IP). Industrial Networks or Field busses: Introduction, Industrial applications, Predecessors of the modern Fieldbus, Digital Communication Plus 4 - 20 mA, Highway Addressable Remote Transmitter (HART), Operation of HART, Modbus for Factory Automation, Current Fieldbus Standards, Fieldbus. Profinet: Introduction, Redundant Profibus/Ethernet, and Profisafe. Foundation Fieldbus: Introduction, H1 Level, Foundation Fieldbus H1 Level Topology, Foundation Fieldbus Model, Producer/Consumer Model (Publish/Subscribe), Standard Function Blocks in FF Devices. Devicenet & Controlnet: History and development of Devicenet, Topology and Connectors, Connections, Installation rules, Power Supplies, Potential Power Supply Problems, Bus Operation, Data Structure. Interbus & AS-I Bus: Interbus Protocol Efficiency, Interbus Shift Registers, Interbus System Performance, Interbus Sub-Buses, Redundancy with Interbus, The Actuator-Sensor Interface (AS-I BUS), AS-I Physical Layer.
HKCOY2A	**Applied Communication Skills 2.2** Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business Plan: Introduction to the business plan, Marketing your new business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition

	of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements; aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
EIDSY2A	**Digital Systems 2** Latches Flip-Flops and Timers: Latches, Flip-Flops, Flip-Flop Operating Characteristics, Flip-Flop Applications, One-Shots, the a-stable multi-vibrator. Shift Registers: Shift Register Operation, Types of Shift Register, Bidirectional Shift Registers, Shift Register Counters, Shift Register Applications. Counters: Finite State Machines, Asynchronous Counter Operation, Synchronous Counter Operation, Up/Down Synchronous Counters, Design of Synchronous Counters, Cascaded Counters, Counter Decoding, Counter Applications. Data Storage: Semiconductor Memory Basics, The Random-Access Memory (RAM), Read-Only Memory (ROM), Programmable Rom, The Flash Memory, Memory Expansion, Special Types of Memories, Magnetic and Optical Storage, Memory Hierarchy, Cloud Storage. Signal Conversion and Processing: Analogue-to-Digital Conversion, Methods of analogue-to-Digital Conversion, Methods of Digital -to- analogue Conversion, Digital Signal Processing, The Digital Signal Processor (DSP).
EEELEC2A	**Electronics 2** BJT Amplifiers: Amplifier Operation, Transistor Models, the Common-Emitter Amplifier, the Common-Collector Amplifier, the Common-Base Amplifier, Multistage Amplifiers, the Differential Amplifier. Power Amplifiers: The Class A Power Amplifier, The Class B and Class AB Push-Pull Amplifiers, The Class C Power Amplifier. Field Effect Transistors: The JFET, JFET Characteristics and Parameters, JFET Biasing, The Ohmic Region, The MOSFET, MOSFET Characteristics and Parameters, MOSFET Biasing, The IGBT. FET Amplifiers and Switching Circuits: The Common-Source Amplifier, The Common-Drain Amplifier, The Common-Gate Amplifier, The Class D Amplifier, MOSFET Analog Switching, MOSFET Digital Switching. Amplifier Frequency Response: Basic Concepts, The Decibel, Low-Frequency Amplifier Response, High-Frequency Amplifier Response, Total Amplifier Frequency Response. Thyristors: The Four-Layer Diode, The Silicon-Controlled Rectifier (SCR), SCR, Applications, The Diac and

	Triac , The Silicon-Controlled Switch (SCS), Programmable Uni-junction Transistor (PUT).
EIENP2A	**<u>Engineering Programming 2</u>** The Analysis Model of a system: selection of an appropriate model. Iterative System Build: Select and Prepare a use case for design and/or code; Use Case Design; Perform Class Design; Code and Unit Test a use case using the build tools as defined in the Architecture document; Integrate and test: the use case with all other use cases in the build. Principles of Database Design: The Logical Data model is transformed into a physical Data Base.
EINET2A	**<u>Networks 2</u>** Routing Concepts: Configuration, Decisions, Operation. Static Routing: Implementation, Configuration of Static and Default Routes, Summary and Floating Static Routes, Troubleshooting Static and Default Rotes. Routing Dynamically: Dynamic Routing Protocols, Distance Vector Routing, RIP and RIPng, The Routing Table. Switched Networks: LAN Design, The Switched Environment, General Concepts of Switching, Switching Configuration: Configuration, Security, Management and Implementation. VLANS: Segmentation, VLAN Implementation, Trunks, Inter-VLAN Routing, Troubleshooting, Access Control Lists: IP ACL Operation, Standard and Extended ACLs for IPv4, Troubleshooting, IPv6 ACLs. DHCP Protocol IPv4 and IPv6: Principles, Configuration and Troubleshooting. Network Address Translation, NAT Operation, Configuration and troubleshooting. Managing the Network: IOS Management, Maintenance, Backups.
EIPRI3A	**<u>Process Instrumentation 3</u>** Automatic control methods & distributed control systems, telemetering, intrinsically safe equipment, control systems, measurement with radio-active sources & non-destructive testing, analysers, SCADA systems and PLC systems.
SEMESTER 5	
EEPEL3A	**<u>Power Electronics 3</u>** Industrial Control Elements: The Elements of Logic Control, switches as Input Devices, Relays as Logic Devices, Solid State Logic Gates. Designing Logic Control Systems Using Relays and Solid state devices: Classification Control System. Programmable Logic Controllers: Introducing the PLC, Input-Output Section, Input Cards, Output Cards, Input-Output Racks, Addressing Method, the processor, Input Image File (IIF), Output Image File (OIF), The User Program Memory, The Variable Data Memory, The Central Processing Unit (CPU). Programmable Logic

	Controllers (PLC) Instructions I: Examine-On/Off Instruction, Output-Energize instruction, Rung Definition, Decision Logic of the CPU. Programmable Logic Controllers (PLC) Instructions II: Counters, Up-Down Counters, Timers, Timer-On-Delay (TON) operation, Timer-Off-Delay (TOF) operation. Programmable Logic Controllers (PLC) Instructions III: Latch and Unlatch Instructions, Immediate Input and Output instructions, Immediate Input Instruction, Immediate Input Instruction, Master Control Reset Instruction. Programmable Logic Controllers (PLC) Analog Data: Analog Data handling, Analog Input Card, Analog Input Card Operation, Analog Output Card, Analog Output Card Construction. Network Considerations: Supervisory Control and Data Acquisition (SCADA), Requirements of SCADA systems. Input Devices for Analog Data: Displacement, Pressure, Temperature, Measurements using a strain gauge, Tachometers, Moisture Content (Humidity), Light, Flow rate, Power, Shaft position measurement. Complete system design: One complete project design solution.
EIDSY3A	**Digital Systems 3** The 8051 Microcontroller: The discussion of the role of microcontrollers in everyday life, criteria for choosing microcontroller and various members of the 8051 microcontroller family. 8051 Assembly programming: The listing and discussion of 8051 registers, assemble and run 8051 program, discuss RAM memory space allocation in 8051 and understand the RISC and CISC architecture. Jump, Loop and Call Instructions: Code 8051 Assembly language instructions using loops, conditional and unconditional jump instructions and subroutines. Calculates the target address for jump instructions, describe precaution in using stack in subroutines and discuss crystal frequency VS machine cycle in 8051. I/O Port Programming: List four I/O ports of the 8051, explain the role of each port, code Assembly language to use ports as input and output, instruction for handling I/O and code I/O bit manipulation programs. 8051 Addressing Modes: List and explain the five addressing modes of the 8051 microcontroller, stack manipulation using direct addressing mode and accessing RAM, I/O and ports using bit addressing. Arithmetic Logic Instructions and Programs: Define the range of numbers possible in 8051 unsigned numbers data, code addition, subtraction, multiplications and divisions for unsigned numbers. Code logic instructions AND, OR, XOR and use logic instruction for bit manipulation. Use compare and jump for program control. Compare and contrast packed and unpacked

	BCD data. Code programs for ASCII and BCD conversion. 8051 Programming in C: Code C programs for time delay and I/O operations and BIT manipulation. Code C programs logic and arithmetic operations, ASCII and BCD conversions, and binary (hex) to decimal conversion.
EINET3A	**Networks 3** LAN Design – Introduction to LAN Design, Campus Wired LAN designs, Selecting Network Devices. Scaling VLANs – VTP, Extended VLAN's and DTP, Troubleshooting, Layer 3 Switching. STP – LAN Redundancy, Spanning Tree Concepts, Spanning Tree Configuration. Ether Channel and HSRP – Link Aggregation Concepts and Configuration, First Hop Redundancy Protocols. Dynamic Routing – Dynamic Routing Protocols, Distance Vector Routing, Links State Routing. EIGRP – EIGRP Characteristics, EIGRP Operation, Implementing EIGRP for IPv4 and IPv6. EIGRP Tuning and Troubleshooting – Tune EIGRP, Troubleshoot EIGRP. Single-Area OSPF – OSPF Characteristics, Single Area OSPF v2 and v3. Multi-Area OSPF – Multi-Area OSPF Operation, and Configuration. OSPF Tuning and Troubleshooting – Advanced Single-Area OSPF Configuration, Troubleshooting Single – Area OSPF Implementations.
EICSY2A	**Control Systems 2** Mathematical Foundation: Basic control system concepts, open-loop and closed-loop system, Block Diagrams: Block diagram terminologies, Block diagram reduction rules, Modelling: Derive the differential equation of RLC circuits, Stability: Define the stability criteria of control systems, Time Domain Analysis: Define Test signals and their transfer functions, Derive the steady state error for unity feedback system, Frequency Domain Analysis: Define frequency domain analysis of linear control systems.
EIDCS2A	**Digital Control Systems 2** HART: network topologies, communication modes, protocol stack, Benefits of HART communication, Installation and intrinsic safety barriers, Wireless-HART. MODBUS: network topologies, network physical media and wiring, registers, Query-response messaging, Application of Modbus serial and exceptional responses. Modbus –TCP, Interoperability of variants. FOUNDATION FIELDBUS: basics, protocol stack and physical media, Operation of the LAS in FF, Application layer, application, function blocks and scheduling. PROFIBUS: Profibus physical media and termination, Fieldbus Data-link layer; addressing and arbitration, Profibus slave redundancy and MBP wiring verification. PROFINET: Devices and device classes, Physical

	media and Profinet-IO topologies, Data-link layer. CAN, DEVICENET and CAN_OPEN: Physical layer in CAN, CAN data-link layer, DeviceNet, protocols, networks, communication and hardware, CAN-Open.
EIENP3A	**Engineering Programming 3** A Senior Level Certified Object Orientated Programming Course selected out of the mainstream Object Orientated Courses such as CPS - C++ Certified Senior Programmer or The Equivalent Certified Java Course or the equivalent C Programming course such as CLS - C Certified Senior Programmer Certificate or an appropriate level web-based development course, depending on the programming demands of Software Engineering Project. Sample Curriculum for CPS - C++ Certified Senior Programmer.
SEMESTER 6	
EIDSY4A	**Digital Systems 4** 8051 Timer Programming in C, Programming 8051 Timers, Counter Programming, Programming Timers 0 and 1 in 8051 C. 8051 Serial Port PROGRAMMING in C, Basic Serial Communication, 8051 connection to RS232, 8051 serial port programming in C. Interrupt Programming in C, 8051 Interrupts, Programming Timer interrupts, Programming External Hardware interrupts, Programming the Serial Communication interrupt, Interrupt Priority in 8051/8052, Interrupt Programming in C. LCD and Keyboard interfacing, LCD Interfacing, Keyboard interfacing, ADC, DAC and Sensor interfacing, Parallel and serial ADC, DAC interfacing, Sensor interfacing and signal conditioning. Relay, Opto-isolator and Stepper motor, Relay and Opto-Isolator, Stepper Motor interfacing. DC Motor Control and PWM, DC Motor interfacing and PWM SPI and I2C Protocols, SPI BUS Protocol, I2C BUS Protocol.
EICSY3A	**Control Systems 3** System representation and mathematical modelling: Ordinary differential equations of electrical, mechanical, hydraulic and thermal systems. State-space and transfer function equivalent representations. Linearization of non-linear systems. System identification and modelling from experimental data. System simulation and stability: Numerical simulation of differential equations. Lyapunov stability and eigenvalues. Time-domain performance indices. Qualitative analysis on the s-plane. Feedback systems. PID controllers and tuning. Controller design: Root locus; Identifying poles and zeros. Symmetry of the root locus. Root locus on the real axis. Angle of departure for route locus. Angle of arrival and convergence of asymptotes. State-

	space pole placement. Implementation of control algorithms: Sampled data system. z-transform and unit circle stability. s-plane to z-plane translation. Digital computer control implementation.
EINET4A	**Networks 4** WAN Concepts - WAN Technologies Overview, Selecting a WAN Technology. Point-to-Point Connections - Serial Point-to-Point Overview, PPP Operation, PPP Implementation, Troubleshoot WAN Connectivity. Branch Connections - Remote Access Connections, PPPoE, VPN's, GRE, eBGP. Access Control Lists - Standard ACL Operation and Configuration Review, Extended IPv4 ACLs, IPv6 ACLs, Troubleshoot ACLs. Network Security and Monitoring - LAN Security, SNMP, Cisco Switch Port Analyzer. Quality of Service - QoS Overview, QoS Mechanisms. Network Evolution - Internet of Things, Cloud and Virtualization, Network Programming. Network Troubleshooting - Troubleshooting Methodology, Troubleshooting Scenarios.
WBL Placement	
EIEXL1A	**Experiential Learning 1**
EIEXL2A	**Experiential Learning 2**
EIPRJ4A	**Engineering Project 4** Industrial problem solving and documentation.

Syllabi: DIPLOMA IN ELECTRICAL ENGINEERING: PROCESS CONTROL (Extended 4 year programme) (Course code: DE0865)	
Module Code	**Module Description**
SEMESTER 1	
AAXCH1A	**Foundation Chemistry 1** Atoms, molecules & ions; Stoichiometry; Reactions in aqueous solution; Rate and extent of reactions; Chemical equilibrium; Acids, bases and salts; Electrochemistry.
AMXMA1A	**Foundation Mathematics 1** Intro to Algebra, Expressions & equations, Linear & simultaneous equations, Polynomial equations, Matrix algebra, Hyperbolic functions.
APXPH1A	**Foundation Physics 1** Mechanics: Force and Newton's laws; Momentum and impulse; Vertical projectile motion in one dimension; Work, energy & power; Doppler effect.
SEMESTER 2	
AAXCH2A	**Foundation Chemistry 2**

	Organic molecules; The chemical industry.
AMXMA2A	**Foundation Mathematics 2** Polynomial equations, Partial fractions, Trigonometry (radian measure), Binomial series, Functions, Intro to differentiation, Intro to integration.
APXPH2A	**Foundation Physics 2** Electrostatics; Electric circuits; Electrodynamics; Optical phenomena; Properties of materials; Emission and absorption spectra.

Syllabi: ADVANCED DIPLOMA IN ELECTRICAL ENGINEERING: PROCESS CONTROL ENGINEERING (Course code: AD0825)	
Module Code	**Module Description**
SEMESTER 1	
EIPRO4A	**Electrical Engineering Project** Research Methodology: Introduction to Research methodology, Research topics, Different types of research, All research concepts and outputs, Referencing. Project Proposal: Discussion of the project proposal, Introduction: (Background, Purpose, Problem), Problem statement, Sub problems, Hypothesis, Assumptions, Delimitations, Definition of terms, Importance of the project, Overview of the project and summary. Literature Review: Introduction to literature study, Background of the topic being researched, Relevance of literature used for the study, Evidence of researched literature to address the components of the project, Citations and referenced used with research literature with reference to the VUT referring documentation. Sub-Problem 1 chapter: Introduction relevant to identified sub problem 1, Restatement of what the sub problem 1 is that need to be solved, Restatement of the hypothesis associated with the stated sub problem 1, Theory, relevant laws, fundamentals applicable to the stated sub problem 1, Methods, methodology used as well as what resources used to solve the sub problem1, Results obtained through tests, analysis and interpretation of the obtained data, Discussion of the results (explanations and evaluation of the data obtained), Testing of the hypothesis, Summary of what was discussed in the chapter. Sub-Problem 2 chapter: Introduction relevant to identified sub problem 2, Restatement of what the sub problem 2 is that need to be solved, Restatement of the hypothesis associated with the stated sub

	problem 2, Theory, relevant laws, fundamentals applicable to the stated sub problem 2, Methods, methodology used as well as what resources used to solve the sub problem2, Results obtained through tests, analysis and interpretation of the obtained data, Discussion of the results (explanations and evaluation of the data obtained), Testing of the hypothesis, Summary of what was discussed in the chapter. Final chapter: Summary of the identified problem statement and sub problems, Findings and deductions, Meaning and implications of the research that was conducted, Re-assessment of the original identified problems, Recommendations, Fields for further studies. Final project demonstration: Presentation of the identified problem and sub problems, technologies used and how was the final solution obtained, Final project hardware layout, Demonstration of the solution, Questions and answers (Moderator/Examiners).
EIREM4A	**Engineering Research Methods** Aspects of research: Introduction, importance of research, elements of research, defining research, dimensions of research, what research is not, nature of research and ethical requirements for researchers. Types of Research: Introduction, basic and applied research and research as per discipline or technical group. Sources of topics for scientific research: Introduction, starting point for research, sources of research topics or problems, when a topic is not a research problem and determining the suitability of a research problem. Demarcating of the research problem: Introduction, selecting a subject for research, posing a research problem as statement and steps in problem demarcation and formulation. Formulating a hypothesis: Introduction, defining a hypothesis, inductive and deductive hypothesis, variables and examples of formulated hypothesis. Writing a research proposal: Introduction, defining a research proposal, value of a research proposal, types of research proposals and components of the research proposal.
EIPRI4A	**Process Instrumentation** Nuclear reactor instrumentation, control of chemical reactors, blending and ratio controls, analyzers, water quality monitoring systems, smoke and air quality monitors air pollution control, control centers, un-interruptible power supplies, wiring practices, plc Communication And Automation, Selecting, Commissioning and Maintenance of a PLC System, Distributed Control Systems, Hierarchy Control.
EIDSP4A	**Digital Signal Processing**

	Discrete systems and signals: Define Shannon's sampling theorem, define the impulse and step function, sketch and perform elementary algebraic operations with discrete signals, construct difference equations and block diagrams for discrete systems, determine the response of linear, time invariant system to various inputs. Time Domain Analysis: Determine the zero input response of second order circuits, determine the complete response of second order circuits with initial conditions and non-zero inputs. Z-Transform: Define the z transform X(z), verify the important properties of the z transform, determine the z transform X(z) for time functions x(k), use the method of long division and partial fractions to find the inverse z transform of X(z). Frequency Domain Analysis: Relate the transient response of a system to the roots of the denominator of the system function H(z), determine the frequency response of the system H(ω), from H(z). Discrete Fourier Transform: Determine the frequency spectrum of non-periodic signals and determine the frequency spectrum of periodic signals. Project: Low Pass FIR Filter designs: The design of fourth and fifth order low pass FIR filters.
SEMESTER 2	
AMAEM4A	**Advanced Engineering Mathematics** Mathematical skills using: Applications of integration; Laplace transform; First order differential equations and D-operators and Two dimensional Laplace equations.
BHEMN4A	**Engineering Management** Contracts, Tenders, Planning techniques, Financial planning and control, Labor, Plant and materials, Scheduling, Budgets Cash flow and cost control, Labor law.
EIDCS4A	**Digital Control Systems** Sampled Data Systems: Describe the basic elements of a digital control system and the fundamental process of sampling a continuous signal, express the input output relationship of digital systems in terms of difference equations, define the impulse function and step function, determine the z transform of important time functions and use z-transform techniques to solve difference equations. Transfer Functions: Visualise the sampling process to be composed of an ideal sampling action followed by a hold action, determine the transfer function of discrete cascaded systems and feedback systems and obtain the transfer function of a plant preceded by a zero-order hold device. Time Domain Analysis: Analyse the transient behaviour of a prototype second order continuous system, map between values in the s

	plane and the z plane, judge the response of discrete systems by relating the essential discrete characteristics to the properties of a similar and more familiar continuous system, view the transient response of discrete systems in terms of the position of the roots of the characteristic equation in the z plane and determine the steady state behaviour of digital control systems. Stability Analysis: Use the Jury test to judge the stability of discrete control systems and prescribe the set of conditions that will guarantee stable operation of a digital control system. Root Locus Techniques: Construct the root locus from the characteristic equation of a system and analyse transient and stability behaviour of systems by means of the root locus. Digital Controller Design: Improve system response with controller design based on root locus methods, determine digital forms of the PID control algorithm and realize PID controllers. Project: Level Control: To complete this project, students will be required to construct a circuit representing a water level control system with various parameters to simulate PID control.
EIINT4A	**Industrial Network Systems** The ISA-95 standard, basic concepts, different similar standards, MES Model, MESA model, ISA-95 standard functionality, ISA-95 Enterprise Process Control Model, ISA-95 parts discussions, benefits of the ISA-95 standard, End-users use of the standard, Integrator use of the standard, Integration of ISA-88 and ISA-95 standards, comparison op the two models, integrating ERP and MES systems using the two standards, Secure architecture for industrial process control systems, ICS Security architecture, Purdue model for control hierarchy, Enterprise zones, Different zones and level in the control hierarchy, practical implementation of an ICS network, architecture security patterns for ICS, access control, Log management, network security, remote access to ICS, IIOT and Plantweb Digital Eco System and Industry 4.0 for process control and mobile process control networking.

Syllabi: POSTGRADUATE DIPLOMA IN ELECTRICAL ENGINEERING: PROCESS CONTROL ENGINEERING (Course code: PG0825)	
Module Code	**Module Description**
	Process Control Engineering Research Project Process Control based problem definition (Ill Defined), literature study, design of Solution using knowledge, skill and technology,

	Implementation of the proposed solution design, demonstration of solution and reporting on how technologies and systems were used to produce the final industry related solution.
	Research Statistics This module develops the student's knowledge and skill in the application of basic mathematics; Statistics in management; Exploratory data analysis; Statistical models for forecasting and planning. How to perform basic mathematical calculations; Setting the statistical scene; Exploratory data analysis & application on Excel; Statistical models for forecasting and planning; Basic probability concepts & Probability distributions and Inferential statistics.
	Advanced DCS and Safety Systems Engineering High level Process Control Systems, "Smart" Instrumentation, Control Schemes & Strategies, Advanced Process Automation, Modelling & Simulation, Fuzzy, Neural & Expert Systems, and Plant Optimization.
	Advanced Process Instrumentation Systems Development of maintenance strategies working with Smart instrumentation, predictive maintenance strategies and implementation, Advanced instrumentation diagnostics using new IIOT technology tools and systems.
	Process Control System Design and Development Design, Optimization, and Implementation of process control plants with reference to IIOT technologies and Smart field instrumentation.
	Smart Digital Instrumentation Engineering This module introduces Smart HART and Foundation Fieldbus digital field instrumentation, Wireless HART instrumentation, interfacing instrumentation to Basic Plant Control System (BPCS) and Safety Integrated System (SIS) systems. Design, configuration, implementation, testing and asset optimization techniques are utilized for optimum plant design. Utilizing the new Smart HART, Smart Foundation Fieldbus and HART Wireless technologies used in digital field instrumentation to design industrial plants to enable industry to have more reliable operations and effective running plants.
	Smart Industrial Network Control MES, SAP system interfacing to industrial networks and various plant control systems, safety systems, 3rd party control systems and various management systems.

11.7 ELECTRICAL ENGINEERING: COMPUTER SYSTEMS

Syllabi: DIPLOMA IN ELECTRICAL ENGINEERING: COMPUTER SYSTEMS (3 year programme) (Course Code: DI0822)	
Module Code	**Module Description**
SEMESTER 1	
HKCOX1A	**Applied Communication Skills 1.1** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
EEESK1A	**Engineering Skills 1** The Engineering Profession: Different types of engineering. Mechanical, electrical, civil, chemical, computer etc. The engineering team; artisans, technicians, technologists and engineers. Engineering Teamwork: Engineering design. Teamwork versus group work. Basic principles of; engineering project management (plan, organize, lead and control), project costing, budgeting and resource management. What is a business plan? Engineering and the Environment: social responsibility, environmental impact, natural resources, sustainability of the engineering activity. Legal and safety considerations. Ethics in Engineering: professional ethics, responsibility, engineering norms, ECSA and their function.
EPEEN1A	**Electrical Engineering 1** Electrical Principles: The electron theory, Heat, Magnetism, Friction, Pressure, Light, Chemical Action, Batteries, International system of measurement. Basic Electrical Concepts: The electrical circuit, Electrical current flow, Electrical current, Electromotive force and voltage, Definitions of electric, magnetic and other SI units, Resistance, Resistors. Network Theorems in Direct Current Circuits: Kirchhoff’s laws, Superposition theorem, Thevenin

	theorem, Norton’s Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion. Electro Magnetism: The magnetic field, Electromagnetic Force on a current-carrying conductor, Electromagnetic induction, Lenz’s law, Faraday’s law. Inductance in Direct Current Circuits: Inductive circuits, Inductance, Current growth in an inductive circuit, Current decay in an inductive circuit, Energy stored in an inductor, Types of inductors. Capacitance in Direct Current Circuits: Capacitors, Capacitance, Series capacitor circuit, Parallel capacitor circuits. Parallel Magnetic Cores: Parallel magnetic circuits, electrical analogy, series and parallel in magnetic circuits.
ASICT1A	**ICT Skills 1** Recognizing Computers; Using current versions of Microsoft Windows Professional; Common Elements; Microsoft Word; Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, Getting connected and using the Internet.
AMMAT1A	**Engineering Mathematics 1** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves, Simpson’s rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre’s, Calculating roots.
APHYS1A	**Physics 1** Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton’s Law of Motion, Work and Energy, Impulse and Momentum, Electric Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids, Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.

EESIN1A	**Social Intelligence 1** Leadership styles: Democratic, Autocratic, Consensus etc. Economic systems of governance: Capitalism, Socialism and Communism. Etiquette in society and the workplace. Soft skills, Cultural influences. Success in Engineering: Professionalism, Ethics, Responsibility, Discipline, Time management, Acquiring information and Independent learning.
SEMESTER 2	
HKCOY1A	**Applied Communication Skills 1.2** Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity: Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph, Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
EICOA2A	**Computing Applications 2** Introduction: steps of program development, program design methodology, basic input, processing and output, introducing algorithms and pseudo code. Constants, Variables, and Arithmetic Operators: meaningful names, defining the problem, designing the algorithm, pseudo code, general integer division and modulus operators. Scope of variables: data types, variable naming, declarations and assignments, scope of variables. Modularization: steps of modularization, procedures, functions and passing variables. Selection structures: arithmetic operators, comparison operators, logic operators, messages, simple compound and nested structures, case structures. Repetition structures: counters and accumulators, do_while structure, for_loop, nested structures. Arrays: One dimensional arrays, defining arrays, saving displaying and searching arrays, multidimensional arrays.
EIDSY1A	**Digital Systems 1** Digital and Analogue Quantities: Binary Digits, Logic Levels, Digital Waveforms Basic Logic Functions. Number Systems, Operations and Codes: Decimal Numbers, Binary Numbers, Decimal-to-Binary Conversion, Binary Arithmetic, Compliments of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed Numbers, Hexadecimal Numbers, Octal Numbers, Binary Coded

	Decimal (BCD), Digital Codes, Error Codes. Logic Gates: The inverter, The AND gate, The OR gate, The NAND gate, The NOR gate and the Exclusive-OR and Exclusive-NOR gate, Fixed-Function Logic Gates. Boolean Algebra and Logic Simplifications: Boolean Operations and Expressions, Laws and Rules of Boolean Algebra, DeMorgan's Theorems, Boolean Analysis of Logic Circuits, Logic Simplifications using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, The Karnaugh Map, Karnaugh Map SOP Minimization, Karnaugh Map POS Minimization. Combinational Logic Analysis: Basic Combinational Logic Circuits, Implementing Combinational Logic, The Universal Property of NAND and NOR gates, Combinational Logic using NAND and NOR gates, Pulse Waveform Operation. Functions of Combinational Logic: Half and Full Adders, Parallel Binary Adders, Ripple Carry and Look-Ahead Carry Adders, Comparators, Decoders, Encoders, Code Converters, Multiplexers (Data Selectors), De-multiplexers, Parity Generators/Checkers.
EPEEN2A	**Electrical Engineering 2** Single Phase AC Circuits: Series Impedance Circuits, AC Voltage Diver, Components of current, Admittance, Parallel impedance circuits, Current divider. Power and Power Factor Correction: Active (Real) power, Power in a resistive ac circuit, Power in an active ac circuit, Power in a capacitive ac circuit, Peak and average power, the complex power triangle, Complex power, Reactive power, Power factor, Disadvantage of a low power factor, causes of low power, Power factor correction, Equipment used for power factor improvement, Importance of power factor improvement, Calculations on power factor improvement. Network Theorems in AC Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion, Maximum power transfer theorem. Resonance: Effect of varying frequency in series ac circuits, Frequency effect on the circuit impedance, Current at resonance, Resonance rise in voltage, Energy transfer between the inductor and capacitor, Resonant frequency in series ac circuits, Tuning for resonance, Q-factor of a series resonant circuit, Practical parallel resonant circuit. Complex Waves and Harmonics: Integration of waveforms, Production of harmonics, Effect of reactance in complex circuits, Composition of complex waves, Power and power factor of non-sinusoidal waves, Resonance as a result of non-sinusoidal waves, Addition and subtraction of non-sinusoidal waveforms.

AMMAT2A	**<u>Engineering Mathematics 2</u>** Differentiation: Inverse trig functions, Hyperbolic functions, Inverse hyperbolic functions, Parametric equations, Maxima and minima, Partial differentiation, Small changes, Rate of change. Integration: Revision of integration, Use of formulae sheet, Inverse functions, Partial fractions, Partial fractions, Integration by parts, Trig. & hyperbolic substitutions, t-formulae, Mean and RMS values. Differential Equations: Differential eq., separation, Using the integrating factor, Applications, Homogeneous differential equations. Matrix Algebra: Operations with matrices, Inverse of a matrix, solve equations using inverse, Cramer's rule, Eigenvalues and –vectors. Probability and Statistics: Data representation, Data summaries, Normal distribution, Conf. intervals, error est. Conf. intervals, error est. Hypothesis testing.
APHYP2A	**<u>Physics 2 Practical</u>** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising Radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
APHYT2A	**<u>Physics 2 Theory</u>** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-

	carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising Radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
EESPA1A	**Safety Principles and Law 1** Importance of health and safety: What is safety and health concepts as indicated in the OHS Act, Fundamental safety concepts and terms: Fundamental safety terms, legal appointments as per the OHS Act, duties of the legal appointees as per the OHS Act, safety awareness and fire training, What is hazards and risk in the workplace: What is a hazard, what is a risk, what is the difference between a hazard and a risk, identification of main six hazards in the workplace, occupational hazards, difference between an accident and an incident: general principles of control and risk reduction, safe systems of work, permit-to-work systems, emergency procedures and first-aid, Principles of hazard and risk control: What is a risk assessment, why do a risk assessment, how to conduct a risk assessment, Risk assessment and risk management, Tools and Machinery: Tool and machine hazards, Principles of safeguarding powered and driven machines, point of operation safeguards, controls for hand toll hazards, portable power tool controls, Electrical safety: What do I need to know about electricity, what kind of injuries result from electrical current, electrical shock hazards, arc flash, control of electrical hazards, electrical safety-related work practices, Noise and vibration: Sound and noise, hearing, hazards of noise, exposure standard for noise, engineering controls for noise, noise

	measurement, vibrations of the human body or parts of the human body.
SEMESTER 3	
HKCOX2A	**Applied Communication Skills 2.1** Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in workplace, PowerPoint Presentations: Planning and preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a logically sound and well- reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
EIDSY2A	**Digital Systems 2** Latches Flip-Flops and Timers: Latches, Flip-Flops, Flip-Flop Operating Characteristics, Flip-Flop Applications, One-Shots, the a-stable multi-vibrator. Shift Registers: Shift Register Operation, Types of Shift Register, Bidirectional Shift Registers, Shift Register Counters, Shift Register Applications. Counters: Finite State Machines, Asynchronous Counter Operation, Synchronous Counter Operation, Up/Down Synchronous Counters, Design of Synchronous Counters, Cascaded Counters, Counter Decoding, Counter Applications. Data Storage: Semiconductor Memory Basics, The Random-Access Memory (RAM), Read-Only Memory (ROM), Programmable Rom, The Flash Memory, Memory Expansion, Special Types of Memories, Magnetic and Optical Storage, Memory Hierarchy, Cloud Storage. Signal Conversion and Processing: Analogue-to-Digital Conversion, Methods of analogue-to-Digital Conversion, Methods of Digital -to- analogue Conversion, Digital Signal Processing, The Digital Signal Processor (DSP).
EEELE1A	**Electronics 1** Introduction to Electronics: The Atom, Materials Used in Electronics, Current in Semiconductors, N-Type and P-Type Semiconductors, the PN Junction. Diodes and Applications: Diode Operation, Voltage-Current (V-I) Characteristics of a diode, Diode Models, Half-Wave Rectifiers, Full-Wave Rectifiers, Power Supply Filters and Regulators, Diode Limiters and Clampers, Voltage Multipliers, The Diode Datasheet, Troubleshooting. Special-Purpose Diodes: The Zener Diode, Zener Diode Applications, The

	Varactor Diode, Optical Diodes, Other Types of Diodes, Troubleshooting. Bipolar Junction Transistors: BJT Structure, Basic BJT Operation, BJT Characteristics and Parameters, The BJT as an Amplifier, The BJT as a Switch, The Phototransistor, Transistor Categories and Packaging, Troubleshooting. Transistor Bias Circuits: The DC Operating Point, Voltage-Divider Bias, Other Bias Methods, Troubleshooting.
EIENP1A	**Engineering Programming 1** Introduction to programming: different languages, first program, integer variables, numbers and operators, characters, flow control, input and output. Advanced Flow Control and Data Aggregates: if and else, more types, loops, Boolean algebra, vectors, initiators: simple arrays, multidimensional arrays, structures and why we need them. Extending Expressive Power: pointers, functions and memory. Accessing Different kinds of Data: arrays of pointers, conversions, strings, and namespaces. Object Programming Essentials: basic concepts, a class, static components, and objects vs pointers inside objects. Inheritance: class hierarchy, inheritance and type compatibility, polymorphism and virtual methods, objects as parameters and dynamic casting, various supplements, constant keyword. Exceptions: to errors in human, throw statement, categorizing exceptions, catching exceptions. Operators and Enumerated types: overloading operators, enumerated types.
EINET1A	**Networks 1** Introduction – Exploring the Network: Global Connectivity, Networking Today, LANs, WANs, and the Internet, Components of a Network, The Network as a data communications platform, The changing Network Environment. Configuring a Network Operating System: The IOS, Basic Configurations, Network Addressing Schemes. Network Protocols and Communications: The Rules of Communications, Protocols and Standards, How Data moves in a Network. Network Access: Physical layer Protocols, Network Media, Data Link Layer Protocols, Media Access Control. Ethernet: Ethernet Protocol, Address Resolution Protocol, LAN Switches Network Layer: Network Layer Protocols, Routing Principles, what is a Router, Configuring Routers. IP Addressing: IPV4 and IPV6 Addressing, Connectivity, ICMP. Sub netting IP Networks: Sub netting of IPV4 Networks, Addressing Schemes, Structured Design, Design Considerations for IPV6. Transport Layer: Transport layer Protocols, TCP and UDP Characteristics and Operation. Application layer: Application layer Protocols, Well-known Application Layer Protocols and

	Services, HTTP, DHCP, DNS, SMTP etc. Build a Small Network: Network Design, Network Security, Network performance, Troubleshooting.
EISEN1A	**Software Engineering 1** Model Driven Architecture (MDA), Object Methods Groups (OMG) and Unified Modelling Language (UML); Rational Unified Process (RUP); Software Engineering Body of knowledge (SWEBOK). Tools, IBM Rational Software Architect, IBM InfoSphere Data Architect. Building the Analysis Model: Problem Statement, Use Case Diagram (Actors and Use Cases), Activity Diagram, Use Case Specification (Overview and Detail), Structure Use Case Model, Design and Prototype the User Interface, Concepts of Object Orientated Analysis. Introduction to Use Case Analysis: Use Case Realization, Finding Analysis Classes and Class Responsibility Analysis, Domain Model, View of Participating Classes (VOPC), Distribute Use Case Behaviour to Analysis Classes, Describe Attributes and Associations and Qualify Analysis Mechanism. Integrate Project: VOPC from Individual Use Case VOPC's, Conceptual and Logical Data Modelling Concepts, Derive the Integrated Logical Data Model for the Use Case from the VOPC.
EIOSY1A	**Operating Systems 1** Introduction to operating systems: Overview of Hardware and Operating system concepts, components. Role of Operating systems, View of Operating systems. Operating systems structure: Operating systems structures: OPS Services, System calls, Device management, Design goals, Overview of the booting process using LINUX architecture. Process concept: Process concept, Process state, Process scheduling, Inter process communication. Multithreading programming: Overview of threads, types of threads, operations, benefits, multithreading. Process scheduling: CPU Scheduling: basic concepts, scheduling criteria and algorithms (FCFS, PS, RR, SJF). Synchronization: Process Synchronization: Basic process interactions: Critical section problem. Cooperation, Semaphores. Deadlocks: System model,, deadlock characterization, methods of handling deadlocks, deadlocks prevention, deadlocks detection, deadlock avoidance, deadlocks recovery.
	SEMESTER 4
HKCOY2A	**Applied Communication Skills 2.2** Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business Plan: Introduction to the business plan, Marketing your new

	business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements; aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
EIDSY3A	**Digital Systems 3** The 8051 Microcontroller: The discussion of the role of microcontrollers in everyday life, criteria for choosing microcontroller and various members of the 8051 microcontroller family. 8051 Assembly programming: The listing and discussion of 8051 registers, assemble and run 8051 program, discuss RAM memory space allocation in 8051 and understand the RISC and CISC architecture. Jump, Loop and Call Instructions: Code 8051 Assembly language instructions using loops, conditional and unconditional jump instructions and subroutines. Calculates the target address for jump instructions, describe precaution in using stack in subroutines and discuss crystal frequency VS machine cycle in 8051. I/O Port Programming: List four I/O ports of the 8051, explain the role of each port, code Assembly language to use ports as input and output, instruction for handling I/O and code I/O bit manipulation programs. 8051 Addressing Modes: List and explain the five addressing modes of the 8051 microcontroller, stack manipulation using direct addressing mode and accessing RAM, I/O and ports using bit addressing. Arithmetic Logic Instructions and Programs: Define the range of numbers possible in 8051 unsigned numbers data, code addition, subtraction, multiplications and divisions for unsigned numbers. Code logic instructions AND, OR, XOR and use logic instruction for bit manipulation. Use compare and jump for program control. Compare and contrast packed and unpacked BCD data. Code programs for ASCII and BCD conversion. 8051 Programming in C: Code C programs for time delay and I/O operations and BIT manipulation. Code C programs logic and arithmetic operations, ASCII and BCD conversions, and binary (hex) to decimal conversion.
EEELE2A	**Electronics 2** BJT Amplifiers: Amplifier Operation, Transistor Models, the Common-Emitter Amplifier, the Common-Collector Amplifier, the

	Common-Base Amplifier, Multistage Amplifiers, the Differential Amplifier. Power Amplifiers: The Class A Power Amplifier, The Class B and Class AB Push-Pull Amplifiers, The Class C Power Amplifier. Field Effect Transistors: The JFET, JFET Characteristics and Parameters, JFET Biasing, The Ohmic Region, The MOSFET, MOSFET Characteristics and Parameters, MOSFET Biasing, The IGBT. FET Amplifiers and Switching Circuits: The Common-Source Amplifier, The Common-Drain Amplifier, The Common-Gate Amplifier, The Class D Amplifier, MOSFET Analog Switching, MOSFET Digital Switching. Amplifier Frequency Response: Basic Concepts, The Decibel, Low-Frequency Amplifier Response, High-Frequency Amplifier Response, Total Amplifier Frequency Response. Thyristors: The Four-Layer Diode, The Silicon-Controlled Rectifier (SCR), SCR, Applications, The Diac and Triac , The Silicon-Controlled Switch (SCS), Programmable Uni-junction Transistor (PUT).
EIENP2A	**Engineering Programming 2** The Analysis Model of a system: selection of an appropriate model. Iterative System Build: Select and Prepare a use case for design and/or code; Use Case Design; Perform Class Design; Code and Unit Test a use case using the build tools as defined in the Architecture document; Integrate and test: the use case with all other use cases in the build. Principles of Database Design: The Logical Data model is transformed into a physical Data Base.
EINET2A	**Networks 2** Routing Concepts: Configuration, Decisions, Operation. Static Routing: Implementation, Configuration of Static and Default Routes, Summary and Floating Static Routes, Troubleshooting Static and Default Rotes. Routing Dynamically: Dynamic Routing Protocols, Distance Vector Routing, RIP and RIPng, The Routing Table. Switched Networks: LAN Design, The Switched Environment, General Concepts of Switching, Switching Configuration: Configuration, Security, Management and Implementation. VLANS: Segmentation, VLAN Implementation, Trunks, Inter-VLAN Routing, Troubleshooting, Access Control Lists: IP ACL Operation, Standard and Extended ACLs for IPv4, Troubleshooting, IPv6 ACLs. DHCP Protocol IPv4 and IPv6: Principles, Configuration and Troubleshooting. Network Address Translation, NAT Operation, Configuration and troubleshooting. Managing the Network: IOS Management, Maintenance, Backups.
EIOSY2A	**Operating Systems 2**

	Main Memory: Contiguous Memory Allocation, Paging, Swapping. Virtual Memory: Demand Paging, Page Replacement, Frame Allocation. Mass Storage System: Overview of Mass Storage Structure, HDD Scheduling, NVM Scheduling, Error Detection and Correction, Storage Device Management, Swap-Space Management, RAID Structure. I/O Systems: I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations. File System Interface: File Concept, Access Methods, Disk and Directory Structure, File-System Mounting, File Sharing, Protection. File System implementation: File-System Structure, File-System Operations, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance. File System Internals: File Systems, File-System Mounting, Partitions and Mounting, File Sharing, Virtual File Systems, Remote File Systems, NFS. Security: Program Threats, System and Network Threats, Cryptography as a Security, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications. Virtual Machines: Benefits and Features, Building Blocks, Types of Virtual Machines and Their Implementations, Virtualization and Operating-System Components. Network and Distributed Systems: Advantages of Distributed Systems, Network Structure, Communication Structure, Network and Distributed Operating Systems, Design Issues of Distributed Systems, Distributed File Systems.
EISEN2A	**Software Engineering 2** The Analysis Model of a system: selection of an appropriate model. Iterative System Build: Select and Prepare a use case for design and/or code; Use Case Design; Perform Class Design; Code and Unit Test a use case using the build tools as defined in the Architecture document; Integrate and test: the use case with all other use cases in the build. Principles of Database Design: The Logical Data model is transformed into a physical Data Base.
SEMESTER 5	
EIENP3A	**Engineering Programming 3** A Senior Level Certified Object Orientated Programming Course selected out of the mainstream Object Orientated Courses such as CPS - C++ Certified Senior Programmer or The Equivalent Certified Java Course or the equivalent C Programming course such as CLS - C Certified Senior Programmer Certificate or an appropriate level web-based development course, depending on

	the programming demands of Software Engineering Project. Sample Curriculum for CPS - C++ Certified Senior Programmer.
AMMAT3A	**<u>Mathematics 3</u>** Application of Integration: Volumes of solids of revolution, Length of Curves, Double Integrals: Iterated Integrals & Fubini's theorem, Double Integrals, Polar Coordinates. First Order Differentiation Equations: Exact DE, Homogeneous DE, Bernoulli DE, Applications (Excluding Newton's Law of Cooling), D-Operator Methods. Numerical Solutions of First Order Differential Equations: Euler's method, Runge-Kutta order 2, Runge-Kutta order 4. Operator D Methods/Undetermined coefficients: Complementary Solutions, D-operator & Inverse, binomial or long division method, Theorem 1, Theorem 2, Theorem 3, Special cases, General solution, Applications. Laplace Transforms, and Table of transforms. (Derivation from first principles not for examination purposes), First shifting property, Laplace transforms of derivatives, Inverse Laplace Transforms using tables, Laplace Transforms of discontinuous functions, Inverse Laplace Transforms of discontinuous functions, Solution of differential equations, Application to electric circuits, Application to beams. Fourier Series: Periodic functions and harmonics, sketching of graphs and determining Fourier Series, Series with period 2l, Even and Odd functions, Full range and Half range series, Numerical Harmonic Analysis.
EINET3A	**<u>Networks 3</u>** LAN Design – Introduction to LAN Design, Campus Wired LAN designs, Selecting Network Devices. Scaling VLANs – VTP, Extended VLAN's and DTP, Troubleshooting, Layer 3 Switching. STP – LAN Redundancy, Spanning Tree Concepts, Spanning Tree Configuration. Ether Channel and HSRP – Link Aggregation Concepts and Configuration, First Hop Redundancy Protocols. Dynamic Routing – Dynamic Routing Protocols, Distance Vector Routing, Links State Routing. EIGRP – EIGRP Characteristics, EIGRP Operation, Implementing EIGRP for IPv4 and IPv6. EIGRP Tuning and Troubleshooting – Tune EIGRP, Troubleshoot EIGRP. Single-Area OSPF – OSPF Characteristics, Single Area OSPF v2 and v3. Multi-Area OSPF – Multi-Area OSPF Operation, and Configuration. OSPF Tuning and Troubleshooting – Advanced Single-Area OSPF Configuration, Troubleshooting Single – Area OSPF Implementations.
EIOSY3A	**<u>Operating Systems 3</u>** Domain Controllers. Active Directory. Authentication and Account Policies. Complex Enterprise Environments. Group Policy

	Objects, processing, settings and preferences (GPOs). Certificate Services (AD CS). Digital Certificates. Active Directory Federation Services (AD FS). Web Application Proxy (WAP). Active Directory Rights Management (AD RMS). Samba on Linux server. Apache web server on Linux server. Linux clients to access Windows-based services.
EISEN3A	**Software Engineering 3** Software Engineering Project: using a pre-developed problem, all the aspects learned are put together in one project to complete phase by phase. Each phase to be started with the best solution. Data Query Language: constructs and use of data query language.
EIDSY4A	**Digital Systems 4** 8051 Timer Programming in C, Programming 8051 Timers, Counter Programming, Programming Timers 0 and 1 in 8051 C. 8051 Serial Port PROGRAMMING in C, Basic Serial Communication, 8051 connection to RS232, 8051 serial port programming in C. Interrupt Programming in C, 8051 Interrupts, Programming Timer interrupts, Programming External Hardware interrupts, Programming the Serial Communication interrupt, Interrupt Priority in 8051/8052, Interrupt Programming in C. LCD and Keyboard interfacing, LCD Interfacing, Keyboard interfacing, ADC, DAC and Sensor interfacing, Parallel and serial ADC, DAC interfacing, Sensor interfacing and signal conditioning. Relay, Opto-isolator and Stepper motor, Relay and Opto-Isolator, Stepper Motor interfacing. DC Motor Control and PWM, DC Motor interfacing and PWM SPI and I2C Protocols, SPI BUS Protocol, I2C BUS Protocol.
SEMESTER 6	
EIENP4A	**Engineering Programming 4** Developing a foundational comprehension of selected software engineering principles with reference to various software engineering knowledge areas, their practice and application in the Discipline of Systems Engineering as applied to Engineered Systems (ES).
EINET4A	**Networks 4** WAN Concepts - WAN Technologies Overview, Selecting a WAN Technology. Point-to-Point Connections - Serial Point-to-Point Overview, PPP Operation, PPP Implementation, Troubleshoot WAN Connectivity. Branch Connections - Remote Access Connections, PPPoE, VPN's, GRE, eBGP. Access Control Lists - Standard ACL Operation and Configuration Review, Extended IPv4 ACLs, IPv6 ACLs, Troubleshoot ACLs. Network Security and

	Monitoring - LAN Security, SNMP, Cisco Switch Port Analyzer. Quality of Service - QoS Overview, QoS Mechanisms. Network Evolution - Internet of Things, Cloud and Virtualization, Network Programming. Network Troubleshooting - Troubleshooting Methodology, Troubleshooting Scenarios.
WBL Placement	
EIEXC1A	**Experiential Learning 1 (Computer Systems)**
EIEXC2A	**Experiential Learning 2 (Computer Systems)**
EIPRC4A	**Engineering Project 4** Industrial problem solving and documentation.

Syllabi: DIPLOMA IN ELECTRICAL ENGINEERING: COMPUTER SYSTEMS (Extended 4 year programme) (Course code: DE0862)	
Module Code	**Module Description**
SEMESTER 1	
AAXCH1A	**Foundation Chemistry 1** Atoms, molecules & ions; Stoichiometry; Reactions in aqueous solution; Rate and extent of reactions; Chemical equilibrium; Acids, bases and salts; Electrochemistry.
AMXMA1A	**Foundation Mathematics 1** Intro to Algebra, Expressions & equations, Linear & simultaneous equations, Polynomial equations, Matrix algebra, Hyperbolic functions.
APXPH1A	**Foundation Physics 1** Mechanics: Force and Newton’s laws; Momentum and impulse; Vertical projectile motion in one dimension; Work, energy & power; Doppler effect.
SEMESTER 2	
AAXCH2A	**Foundation Chemistry 2** Organic molecules; The chemical industry.
AMXMA2A	**Foundation Mathematics 2** Polynomial equations, Partial fractions, Trigonometry (radian measure), Binomial series, Functions, Intro to differentiation, Intro to integration.
APXPH2A	**Foundation Physics 2** Electrostatics; Electric circuits; Electrodynamics; Optical phenomena; Properties of materials; Emission and absorption spectra.

Syllabi: ADVANCED DIPLOMA IN ELECTRICAL ENGINEERING: COMPUTER SYSTEMS ENGINEERING (Course code: AD0822)	
Module Code	**Module Description**
SEMESTER 1	
EIPRO4A	**Electrical Engineering Project** Research Methodology: Introduction to Research methodology, Research topics, Different types of research, all research concepts and outputs, Referencing. Project Proposal: Discussion of the project proposal, Introduction: (Background, Purpose, Problem), Problem statement, Sub problems, Hypothesis, Assumptions, Delimitations, Definition of terms, Importance of the project, Overview of the project and summary. Literature Review: Introduction to literature study, Background of the topic being researched, Relevance of literature used for the study, Evidence of researched literature to address the components of the project, Citations and referenced used with research literature with reference to the VUT referring documentation. Sub-Problem 1 chapter: Introduction relevant to identified sub problem 1, Restatement of what the sub problem 1 is that need to be solved, Restatement of the hypothesis associated with the stated sub problem 1, Theory, relevant laws, fundamentals applicable to the stated sub problem 1, Methods, methodology used as well as what resources used to solve the sub problem1, Results obtained through tests, analysis and interpretation of the obtained data, Discussion of the results (explanations and evaluation of the data obtained), Testing of the hypothesis, Summary of what was discussed in the chapter. Sub-Problem 2 chapter: Introduction relevant to identified sub problem 2, Restatement of what the sub problem 2 is that need to be solved, Restatement of the hypothesis associated with the stated sub problem 2, Theory, relevant laws, fundamentals applicable to the stated sub problem 2, Methods, methodology used as well as what resources used to solve the sub problem2, Results obtained through tests, analysis and interpretation of the obtained data, Discussion of the results (explanations and evaluation of the data obtained), Testing of the hypothesis, Summary of what was discussed in the chapter. Final chapter: Summary of the identified problem statement and sub problems, Findings and deductions, Meaning and implications of the research that was conducted, Re-assessment of the original identified problems, Recommendations, Fields for further studies

	Final project demonstration: Presentation of the identified problem and sub problems, technologies used and how was the final solution obtained, Final project hardware layout, Demonstration of the solution, Questions and answers (Moderator/Examiners)
EIREM4A	**<u>Engineering Research Methods</u>** Aspects of research: Introduction, importance of research, elements of research, defining research, dimensions of research, what research is not, nature of research and ethical requirements for researchers. Types of Research: Introduction, basic and applied research and research as per discipline or technical group. Sources of topics for scientific research: Introduction, starting point for research, sources of research topics or problems, when a topic is not a research problem and determining the suitability of a research problem. Demarcating of the research problem: Introduction, selecting a subject for research, posing a research problem as statement and steps in problem demarcation and formulation. Formulating a hypothesis: Introduction, defining a hypothesis, inductive and deductive hypothesis, variables and examples of formulated hypothesis. Writing a research proposal: Introduction, defining a research proposal, value of a research proposal, types of research proposals and components of the research proposal.
EIMSD4A	**<u>Micro Systems Design</u>** Introduction: Concepts of embedded systems and Internet-of-Things (IoT), Architecture of microcontrollers, three-layered IoT architecture, Hardware platforms - Arduino UNO hardware and NodeMCU/ESP8266. Programming IDE (Integrated development environment), Circuit design in electronic design automation (EDA) simulator software. Programming and algorithm design: Embedded system design, Design of algorithms – pseudocode and flow charts, C++ coding; variable and data types, Operators, Flow control statements and loops, functions, libraries and pre-compiler directives. Interfacing and sensors: Interfacing microprocessors to the physical world, Using interrupts and polling, Resistive sensors, analogue and Digital interfaces, Analogue to digital conversion. Serial communication peripheral interfaces: Universal Asynchronous Receiver/Transmitter (UART), Serial Peripheral Interface (SPI), Inter-integrated Circuit (I2C), Interfacing the LCD and custom digital interface - DHT22. Communication layer: Implementation of wireless sensor networks (WSN), The need for energy efficiency in WSN, TCP/IP protocol stack, Network layer, transport layer, lower layer

	wireless communication protocols; IEEE 802.11, IEEE 802.15.4, Bluetooth low energy and Z-wave. Application layer: Hyper Text Transport Protocol (HTTP) - server and client, Message Queue Telemetry Transport (MQTT)- clients and broker, data logging on the Serial Peripheral Interface Flash File System (SPIFF) and other application layer protocols; CoAP, XMPP and AMQP.
EEAEL4A	**Electronics** Advanced biasing; Universal preamplifier; Three stage semi-power amplifier signal sources and Signal processing; Power amplifier; Power supply; RF coil; Differential amplifier; Dual-gate MOSFET and Power MOSFET.
EINTP4A	**New Technology Programming** Design, create, build and debug an Android app.•Apply algorithm thinking to develop useful apps. Use the development tools in the Android development environment. Use the major components of Android API set to develop their own apps. Describe the life cycles of Activities, Applications and Fragments. Use the Java programming language to build Android apps. Know UI best-practices. Be familiar with new UI components like Fragments and the Action Bar. Store and manipulate data using Content Providers, SQLite and Notifications. GPS to add orientation and location to their apps. Package and prepare their apps for distribution on the Google Play Store.
EIDBP4A	**Database Programming** Introduction to database system and SQL: Core components of a Database Systems; Database Application Architecture; Database Systems performance metrics; History of SQL; SQL Categories. Introduction to SQL Server: SQL Server origins; SQL Server hierarchy; System & User databases; Database Logins & Users; Creating & reading database diagrams. Creating database structures in SQL Server: Object naming rules in SQL Server; Rules & conventions in SQL Server; SQL Server datatypes and their usage; Concept of NULL; Concept of three-valued logic and its implication on logical evaluations; Creating database objects; Renaming database object and the implications thereof. Basic data retrieval: SQL query life cycle within SQL Server; Execute queries in SQL Server and view the results; Result set vs Print statement; Data retrieval with SELECT statement; Projection vs Selection; Filter results with WHERE clause; Order results with ORDER BY; Operator precedence; Aliasing and the use thereof. Data modification: INSERT data into a table and variation of the INSERT statement; Modifying data with UPDATE statement; Removing rows with DELETE statement; Copy rows with

	INSERT…SELECT statement; Importance of WHERE clause. Advanced data retrieval: Filter rows with pattern matching, range selection, list or set containment; Perform aggregate function over a set of data; Perform aggregate function over a group of data; Using derived tables. Joining data: Concept and usage of JOINs, UNIONs and Sub-queries; Differentiate between the different types of JOINs; Implement the different types of JOINs; Extend a join between more than two tables; Implement Union operation; Implement correlated and uncorrelated sub-queries. Writing SQL scripts and batches: SQL Server scripts and batches; Single and multiline comments; Declare and working with variables; Alter the flow of code using selection with IF and CASE; Iterating through code with loops; Exception handling in a database; Database transactions; Database cursors; Using temporary tables; Executing dynamic SQL statements. Working with User Defined Functions: Define of User Defined Functions (UDF); Benefits of UDFs; Deterministic vs non-deterministic functions; System UDFs; Scalar functions compared to inline & normal table valued functions; Limitations of UDFs. Working with Stored Procedures: Define Stored Procedures; Benefits of stored procedures; System & Extended stored procedures; Creating and modifying stored procedures; Passing parameters into and out of a stored procedure; Using the RETURN value; Code encryption in stored procedures. Working with Triggers: Define Triggers within a database system; Differentiate between the different trigger option; Create and modify triggers; Enable and disable triggers. Working with XML: Define XML and its usage in a database; Define "Well-formed" XML; XML technology and related concepts; XML in SQL Server and generating XML; XML datatype and available methods.
SEMESTER 2	
AMAEM4A	**Advanced Engineering Mathematics** Mathematical skills using: Applications of integration; Laplace transform; First order differential equations and D-operators and Two dimensional Laplace equations.
BHEMN4A	**Engineering Management** Contracts, Tenders, Planning techniques, Financial planning and control, Labor, Plant and materials, Scheduling, Budgets Cash flow and cost control, Labor law.
EISEN4A	**Software Engineering** Software requirements, Software design, Software construction, Software testing, Software maintenance, Software configuration management, Software Engineering management.

EIWDC4A	**<u>Wireless Data Communications</u>** Introduction to wireless channel: Physical modelling for wireless channels; input and output model of the wireless channels; time and frequency coherence; statistical channel modelling. Point to point communication: detection, diversity and channel uncertainty: Detection in Rayleigh fading channel; Time Diversity; Antenna Diversity; Frequency Diversity; Impact of channel uncertainty. Cellular Systems: multiple access and interference management: Narrowband cellular systems; wideband systems. Capacity of Wireless Channels: AWGN channel capacity; Resources of AWGN channel; Linear time invariant Gaussian channels; Capacity of fading channels. Multi-user capacity and opportunistic communication: Uplink AWGN channel; Downlink AWGN channel; Uplink fading channel; Downlink fading channels; frequency selective fading channel; multi-user diversity.
EICNS4A	**<u>Computer Network Security</u>** Network Security Threats: Fundamental principles, Worms, Viruses and Trojan Horses. Attack methodologies. Securing Network Devices: Device Access and Files, Privilege Levels and CLi. Monitoring Devices. Automated features. Authentication, Authorization and Accounting: Purpose of AAA, Local AAA, Server Based AAA, Implementing Firewall Technologies: Access Control Lists, Firewall Technologies, Context based Access Control, Zone based Policy Firewalls. Intrusion prevention: IPS Technologies, Implementation of IPS.
EIDBS4A	**<u>Database Administration</u>** Manage database systems that help companies and corporations effectively and efficiently store, manage, and retrieve large volumes of data. Update outdated systems or integrate old data into a new system. Test existing systems and make changes or troubleshoot problems when necessary. Keep the database system functioning properly and add or delete users as needed. Responsible coordinating the maintenance of data integrity, back-up systems, and security with network administrators. Think logically, concentrate, and pay attention to details because those in this field are often required to pay attention to several tasks at once. Work as part of a team. Provide data to external systems using exports, and include external data using imports. Track database performance and troubleshoot problems. Develop a complete database and demonstrate administrative tasks. Should investigate new technologies in the field of database including but not limited to NoSQL.
EIARI4A	**<u>Artificial Intelligence</u>**

	An introduction to artificial intelligence, machine learning in business, natural language processing, robotics in business, artificial intelligence in business and society and the future of artificial intelligence.

Syllabi: POSTGRADUATE DIPLOMA IN ELECTRICAL ENGINEERING: COMPUTER SYSTEMS ENGINEERING (Course code: PG0822)	
Module Code	**Module Description**
	Engineering Research Project Problem Definition (Ill Defined), Literature Study, Design of Solution, Implementation of design, Demonstration of solution and Reporting of what technologies and systems were used to produce the final solution.
	Research Statistics This module develops the student's knowledge and skill in the application of basic mathematics; Statistics in management; Exploratory data analysis; Statistical models for forecasting and planning. How to perform basic mathematical calculations; Setting the statistical scene; Exploratory data analysis & application on Excel; Statistical models for forecasting and planning; Basic probability concepts & Probability distributions and Inferential statistics.
	Advanced Software Engineering Module 1 Practice and Application of the following Software Engineering Knowledge Areas: Software Requirements, -Design, -Construction, -Testing, -Quality, -Maintenance and -Configuration Management.
	Advanced Software Engineering Module 2 Practice and Application of the following Software Engineering Knowledge Areas: Software Engineering Models and Methods, Management, -Process, -Professional Practice, -Economics, -Foundations, Computing Foundations and Mathematical Foundations.
	Systems Engineering Module 1 Using the SEBoK and GRCSE as guidelines to concentrate on the practice of Systems Design and Development (SDD) by acquiring in-depth Knowledge about the Software engineering process, Software engineering models and methods, Software quality.
	Systems Engineering Module 2

	Using the SEBoK and GRCSE as guidelines to concentrate on the practice of Systems Design and Development (SDD) by acquiring in-depth Knowledge of Software engineering professional practices, Software engineering economics, Computing foundations, Mathematical foundations an Engineering foundations.
	Advanced Networking Module 1 Advanced Routing Services, Configuring the EIGRP protocol, Configuring the OSPF protocol, Manipulating Route Updates, Implementing Path Control, Implementing BGP protocol for ISP connectivity. Routing Facilities for Branches and Mobile connectivity, IPV6 in the enterprise.
	Advanced Networking Module 2 Advanced Switching: The Enterprise Campus Architecture, VLANS in a campus architecture, Implementing Spanning tree, Inter VLAN Routing, Availability and redundancy, Securing the switched network Advanced Services. Maintenance and Troubleshooting complex networks, Maintaining and Troubleshooting Routing, addressing and performance issues. Troubleshooting security implementations.
	Computer Systems Security Local Network Security: Endpoint Security, Layer 2 Security considerations, Wireless, VoIP and SAN Security, Configuring Switch Security, SPAN and RSPAN. Cryptography: Services, Hashes and Digital Signatures, Symmetric and Asymmetric Encryption. Virtual Private Networks: VPNs, IPSec, Site to Site IPSec VPN, Remote Access VPN, SSL VPN. Managing a Secure Network: Network Lifecycle, Self-defending Networks, Building a comprehensive security policy.
	Advanced Hardware Systems Perspectives on the Design, Development and Deployment of Advanced Hardware Systems as deployed in the Petrochemical-, Steel-, Health-, Automotive-, Aeronautical-, Defense - and other Industries that may be impacted by these systems.
	Emerging Systems New and Emerging IOT Systems and Developing Platforms, Techniques and Tools.
	Operating System Design Operating System Concepts, Understanding the structure of Linux kernel, Special Purpose Systems, Designing and building the special purpose operating system based on the Linux kernel.
	Intelligent Systems

	Perspectives on the theory and application of systems that perceive, reason, learn, and act intelligently as they serve many different professionals in a broad range of fields.

11.8 INDUSTRIAL AND OPERATIONS MANAGEMENT

Syllabi: DIPLOMA IN INDUSTRIAL ENGINEERING (3 year programme) (Course code: DI0830)	
Module Code	**Module Description**
SEMESTER 1	
HKCOX1A	**Applied Communication Skills 1.1** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
EEESK1A	**Engineering Skills 1** The Engineering Profession: Different types of engineering. Mechanical, electrical, civil, chemical, computer etc. The engineering team; artisans, technicians, technologists and engineers. Engineering Teamwork: Engineering design. Teamwork versus group work. Basic principles of; engineering project management (plan, organise, lead and control), project costing, budgeting and resource management. What is a business plan? Engineering and the Environment: social responsibility, environmental impact, natural resources, sustainability of the engineering activity. Legal and safety considerations. Ethics in Engineering: professional ethics, responsibility, engineering norms, ECSA and their function.
AAECH1A	**Engineering Chemistry 1** Matter and measurement; Atoms; Molecules and ions; Formulas, Equations and moles; Chemical reactions in aqueous solution; Periodicity and atomic structure; Ionic bonds; Covalent bonds and

	molecular structure; Chemical equilibrium; Acids and bases; Organic chemistry.
ASICT1A	**ICT Skills 1** Recognizing Computers; Using current versions of Microsoft Windows Professional; Common Elements; Microsoft Word; Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, getting connected and using the Internet.
AMMAT1A	**Engineering Mathematics 1** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves, Simpson's rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre's, Calculating roots.
APHYS1A	**Physics 1** Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton's Law of Motion, Work and Energy, Impulse and Momentum, Electric Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids, Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.
EESIN1A	**Social Intelligence 1** Leadership styles: Democratic, Autocratic, Consensus etc. Economic systems of governance: Capitalism, Socialism and Communism. Etiquette in society and the workplace. Soft skills, Cultural influences. Success in Engineering: Professionalism, Ethics, Responsibility, Discipline, Time management, Acquiring information and Independent learning.
SEMESTER 2	
HKCOY1A	**Applied Communication Skills 1.2**

	Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity: Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph, Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
EBCOA2A	**Computing Applications 2** Navigating EECOA2A on VUTela, Laboratory rules & guidelines. SIMetrix Software: Working principles, Interfaces, creating electronic circuits, simulation, graphs, measurements. Microsoft Word 2016: Working principles, creating engineering documents, navigating word, using operations. Microsoft Excel 2016: Working principles, creating engineering spreadsheets, navigating excel to solve engineering problems, using operations for engineering applications.
AAECH2A	**Engineering Chemistry 2** Introduction to chemical bonding; Ionic bonds; Covalent bonding and molecular structure; Hydrogen; The Group IA and IIA metals; Boron and Aluminium; Chemical reactions in aqueous solutions; Carbon, Silicon, Germanium, Tin, and Lead; Acids, bases, and non-aqueous solvents; Nitrogen Phosphorus, Arsenic; Oxygen, Sulphur, Selenium, and Tellurium; Halogens.
EMEDR1A	**Engineering Drawing 1** Drawing instruments; Drawing skills; Object visualization and drawing; sketch and drawing of chemical engineering process equipment's using computer software.
EBMRE2A	**Manufacturing Relations 2** Introduction; Personnel and the personnel function; Job design; Analysis and evaluation; Interviewing. Human relations: Importance; Motivation theories; Organisation climate; Stress and Conflict handling. Labour relations. Labour economy: Demand and supply; Collective bargaining; Law machinery; Acknowledged agreements and Negotiations.
AMMAT2A	**Engineering Mathematics 2** Differentiation: Inverse trig functions, Hyperbolic functions, Inverse hyperbolic functions, Parametric equations, Maxima and minima, Partial differentiation, Small changes, Rate of change.

	Integration: Revision of integration, Use of formulae sheet, Inverse functions, Partial fractions, Partial fractions, Integration by parts, Trig. & hyperbolic substitutions, t-formulae, Mean and RMS values. Differential Equations: Differential equation, separation, Using the integrating factor, Applications, Homogeneous differential equations. Matrix Algebra: Operations with matrices, Inverse of a matrix, solve equations using inverse, Cramer's rule, Eigenvalues and –vectors. Probability and Statistics: Data representation, Data summaries, Normal distribution, Conf. intervals, error est. Conf. intervals, error est. Hypothesis testing.
APHYP2A	**Physics 2 Practical** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
APHYT2A	**Physics 2 Theory** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator,

	Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising Radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
EBSPA1A	**Safety Principles and Law 1** Importance of health and safety: What is safety and health concepts as indicated in the OHS Act, Fundamental safety concepts and terms: Fundamental safety terms, legal appointments as per the OHS Act, duties of the legal appointees as per the OHS Act, safety awareness and fire training, What is hazards and risk in the workplace: What is a hazard, what is a risk, what is the difference between a hazard and a risk, identification of main six hazards in the workplace, occupational hazards, difference between an accident and an incident: general principles of control and risk reduction, safe systems of work, permit-to-work systems, emergency procedures and first-aid, Principles of hazard and risk control: What is a risk assessment, why do a risk assessment, how to conduct a risk assessment, Risk assessment and risk management, Tools and Machinery: Tool and machine hazards, Principles of safeguarding powered and driven machines, point of operation safeguards, controls for hand toll hazards, portable power tool controls, Electrical safety: What do I need to know about electricity, what kind of injuries result from electrical current, electrical shock hazards, arc flash, control of electrical hazards, electrical safety-related work practices, Noise and vibration: Sound and noise, hearing, hazards of noise, exposure standard for noise, engineering controls for noise, noise measurement, vibrations of the human body or parts of the human body.
SEMESTER 3	
HKCOX2A	**Applied Communication Skills 2.1**

	Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in workplace, PowerPoint Presentations: Planning and preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a logically sound and well- reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
EPEEN1A	**Electrical Engineering 1** Electrical Principles: The electron theory, Heat, Magnetism, Friction, Pressure, Light, Chemical Action, Batteries, International system of measurement. Basic Electrical Concepts: The electrical circuit, Electrical current flow, Electrical current, Electromotive force and voltage, Definitions of electric, magnetic and other SI units, Resistance, Resistors. Network Theorems in Direct Current Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion. Electro Magnetism: The magnetic field, Electromagnetic Force on a current-carrying conductor, Electromagnetic induction, Lenz's law, Faraday's law. Inductance in Direct Current Circuits: Inductive circuits, Inductance, Current growth in an inductive circuit, Current decay in an inductive circuit, Energy stored in an inductor, Types of inductors. Capacitance in Direct Current Circuits: Capacitors, Capacitance, Series capacitor circuit, Parallel capacitor circuits. Parallel Magnetic Cores: Parallel magnetic circuits, electrical analogy, series and parallel in magnetic circuits.
EBEWS1A	**Engineering Work Study 1** Introduction to work-study; Productivity; Choice of study method techniques; Study method (standard level); Work measurement (time study); Human factors; Ergonomics; Working conditions and environment, Jigs and fixtures (introduction) and Computer applications.
EMMEN1A	**Mechanical Manufacturing Engineering 1** Safety and safety legislation; Identification and application of materials; Elementary measuring equipment and Elementary hand and Machine tools.
EBPEN1A	**Production Engineering 1**

	Operating strategies; Forecasting; Process planning and designing; Trade-off analysis; Automated processes; Allocating resources with LP; Decision trees; Facility location; Aggregate planning; Master production schedules; Inventory systems; Material requirements planning and Lot-sizing for MRP and CRP.
EBQTE1A	**Qualitative Techniques 1** Introduction; Descriptive techniques; Probability and probability distributions; Sample selection and sampling theory; Statistical process control; Hypothesis testing; Regression analysis and Acceptance sampling.
EMMEC1A	**Mechanics 1** Statics: Analysis of vectors in 2-D and 3-D Cartesian spaces; Equilibrium of mechanical system and application to the calculation of reaction; Resultant, Moments of force and coordinates of Centre of gravity (Centroid); Friction; Dynamics; Linear and angular motion; Momentum and impulse; Work energy and power and Radial acceleration.
AMMAT3A	**Mathematics 3** Application of Integration: Volumes of solids of revolution, Length of Curves, Double Integrals: Iterated Integrals & Fubini's theorem, Double Integrals, Polar Coordinates. First Order Differentiation Equations: Exact DE, Homogeneous DE, Bernoulli DE, Applications (Excluding Newton's Law of Cooling), D-Operator Methods. Numerical Solutions of First Order Differential Equations: Euler's method, Runge-Kutta order 2, Runge-Kutta order 4. Operator D Methods/Undetermined coefficients: Complementary Solutions, D-operator & Inverse, binomial or long division method, Theorem 1, Theorem 2, Theorem 3, Special cases, General solution, Applications. Laplace Transforms, and Table of transforms. (Derivation from first principles not for examination purposes), First shifting property, Laplace transforms of derivatives, Inverse Laplace Transforms using tables, Laplace Transforms of discontinuous functions, Inverse Laplace Transforms of discontinuous functions, Solution of differential equations, Application to electric circuits, Application to beams. Fourier Series: Periodic functions and harmonics, sketching of graphs and determining Fourier Series, Series with period 2l, Even and Odd functions, Full range and Half range series, Numerical Harmonic Analysis.
SEMESTER 4	
	Applied Communication Skills 2.2

HKCOY2A	Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business Plan: Introduction to the business plan, Marketing your new business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements; aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
BACOS2A	**Costing 2** Elements of cost; The introduction of elementary accounts; Absorption / marginal costing; Cost-Volume-Profit analyses; Budget and Standard costing variance analysis.
EBEWS2A	**Engineering Work Study 2** Work environment design; Value engineering; Proposed method implementation; Standard data; Formula construction; Predetermined time systems; Work sampling; Standard follow-up and times; Wage payment and Training other management practices.
EBFLA2A	**Facility Layout and Material Handling 2** Introduction; Facilities in general; Elementary flow system: Material; People; Equipment and Information; Process design; Auxiliary services; Employee services; Handling systems: Types; Design; Constructing and Evaluation; The problems with material handling: Area location; Layout evaluation and Selling the layout.
EMMEN2A	**Mechanical Manufacturing Engineering 2** Fault diagnosis; Failure analysis and measuring equipment; Test methods; Interpretation and action; Powder metallurgy; Metal forming; Erosion; Casting; Plastics-moulding and machining; Welding and joining and Obtaining finish and accuracy.
EBPEN2A	**Production Engineering 2** Capacity management; Forecasting; Linear programming; Transportation algorithms; Assignment problems; Scheduling product focused; Manufacturing; Planning and scheduling service; JIT manufacturing; Activity scheduling; MRP I and MRP II; Project planning and control; Scheduling batch processing; Design and scheduling flow; Processing systems; Material and purchasing and Maintenance management and reliability.

EBQAS2A	**Quality Assurance 2** Introduction to quality; Quality improvement and cost reduction; Strategic quality management; Developing a quality culture; Designing for quality; Inspection, test and sampling plans; Assessment of quality; Control of quality; Organisation for quality; Understanding customer needs; Manufacture; Inspection test and measurement and Quality assurance.
EBCAD1A	**Computer-Aided Draughting 1** Introduction to a 3D parametric software interface; Creating sections, parts, assemblies and drawings.
EPEEN2A	**Electrical Engineering 2** Single Phase AC Circuits: Series Impedance Circuits, AC Voltage Diver, Components of current, Admittance, Parallel impedance circuits, Current divider. Power and Power Factor Correction: Active (Real) power, Power in a resistive ac circuit, Power in an active ac circuit, Power in a capacitive ac circuit, Peak and average power, the complex power triangle, Complex power, Reactive power, Power factor, Disadvantage of a low power factor, causes of low power, Power factor correction, Equipment used for power factor improvement, Importance of power factor improvement, Calculations on power factor improvement. Network Theorems in AC Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion, Maximum power transfer theorem. Resonance: Effect of varying frequency in series ac circuits, Frequency effect on the circuit impedance, Current at resonance, Resonance rise in voltage, Energy transfer between the inductor and capacitor, Resonant frequency in series ac circuits, Tuning for resonance, Q-factor of a series resonant circuit, Practical parallel resonant circuit. Complex Waves and Harmonics: Integration of waveforms, Production of harmonics, Effect of reactance in complex circuits, Composition of complex waves, Power and power factor of non-sinusoidal waves, Resonance as a result of non-sinusoidal waves, Addition and subtraction of non-sinusoidal waveforms.
EMMAE1A	**Maintenance Engineering 1** Maintenance organisation, Work execution, Parts and materials, Maintenance systems and documentation, Maintenance planning and scheduling, Preventive and corrective maintenance, Computerized maintenance systems, Maintenance safety and efficiency, Reliability centred maintenance and Evaluation of a maintenance program.

EMMOM2A	**Mechanics of Machines 2** Torque acceleration; Vehicle dynamics; Simple lifting machines; Hoists and haulages; Moment of inertia; Simple harmonic motions and Power transmission.
EMSOM2A	**Strength of Materials 2** Pin jointed structures; Stress and strain; Testing of materials; Stresses in thin rotating cylinders; Thin cylinders; Shafts; Rigid couplings; Helical springs; Shear force and bending moments in simply supported beams and cantilevers.
SEMESTER 5	
EBAUT3A	**Automation 3** Introduction: What is production? What is automation? What is a system? Automation considerations; Levels of automation; Jigs and figures and its applications; Press work and material usage; Fundamentals of manufacturing and high volume production systems; Numerical control production system; Press work processes: Features of tools: Design of progression tooling, Calculation for minimum material usage; Pneumatic and hydraulic automation of a workstation; Transfer machine; CNC machines: Types, Classification and Writing a programme; The selection of the correct level of automation (cycle time, quantity, economy and other); Laboratory project; Associated operations: Automatic feeding and orientation: Electronic detection of size, colour and proximity, Pneumatic auto-sizing; Project: Design of an automotive system; Design a workstation; Design an automated workstation or selected standard production machines or design a transfer machine for this application.
EBEWS3A	**Engineering Work Study 3** Information systems analysis and design; Performance improvement programmes; Entrepreneurship theory; Financial plan; Marketing plan and Business plan.
EBIAC3A	**Industrial Accounting 3** Introduction: The finance function; Financial analysis; Planning and Control. Working capital management: Working Capital; Inventory models; Credit management and Investment decisions. Capital budgeting techniques; Risk and investment return; Cost of capital and Capital structure and leverage.
EBILE3A	**Industrial Leadership 3** Managers, diversity and change; Environment competitive advantage and quality operations; International management; Managing ethics and social responsibilities; Fundamentals of planning; Strategic management; Organising; Human resource

	management; Leading; Motivation; Communication; Interpersonal skills; Group dynamics; Innovation and planned changes and Controlling.
EBORE3A	**Operations Research 3** Introduction; Decision theory; Decisions trees; Linear programming and formulation; Transportation and network algorithms; Markov analysis; Project management; Simulation; Dynamic programming; Game theory and applications and Use of software packages.
SEMESTER 6	
EBWIL1A	**Workplace Based Learning (Industrial)**

Syllabi: DIPLOMA IN INDUSTRIAL ENGINEERING (Extended 4 year programme) (Course code: DE0831)	
Module Code	**Module Description**
SEMESTER 1	
AAXCH1A	**Foundation Chemistry 1** Atoms, molecules & ions; Stoichiometry; Reactions in aqueous solution; Rate and extent of reactions; Chemical equilibrium; Acids, bases and salts; Electrochemistry.
AMXMA1A	**Foundation Mathematics 1** Intro to Algebra, Expressions & equations, Linear & simultaneous equations, Polynomial equations, Matrix algebra, Hyperbolic functions.
APXPH1A	**Foundation Physics 1** Mechanics: Force and Newton's laws; Momentum and impulse; Vertical projectile motion in one dimension; Work, energy & power; Doppler effect.
SEMESTER 2	
AAXCH2A	**Foundation Chemistry 2** Organic molecules; The chemical industry.
AMXMA2A	**Foundation Mathematics 2** Polynomial equations, Partial fractions, Trigonometry (radian measure), Binomial series, Functions, Intro to differentiation, Intro to integration.
APXPH2A	**Foundation Physics 2** Electrostatics; Electric circuits; Electrodynamics; Optical phenomena; Properties of materials; Emission and absorption spectra.
EMXDR1A	**Foundation Drawing 1**

	Letter and number notation; Line notation; Handling of apparatus; Measurement notation; Geometrical construction; Orthographic projections; Arcs of penetration and developments; Detailed works drawing; Composite drawings.

Syllabi: ADVANCED DIPLOMA IN INDUSTRIAL ENGINEERING (Course code: AD0830)	
Module Code	**Module Description**
SEMESTER 1	
EBMPS4A	**Manufacturing and Production Science** Introduction and Basic Principles; Generalized Additive Manufacturing Process Chain; Extrusion Based Systems; The Impact of Low-Cost AM Systems Guidelines for Process Selection; Post-Processing; Development of Additive Manufacturing Technology; Business Opportunities and Future Directions; Automated Inspection, Renewable Energy & CAD/CAM; Software Issues for Additive Manufacturing; Direct Digital Manufacturing; Design for Additive Manufacturing; Rapid Tooling; Applications for Additive Manufacture; Final Additive Manufacturing Project.
EBQIC4A	**Quality Control and Improvement** Trilogy of quality processes; Fundamentals and principles of quality assurance; Use of engineering statistics in reducing product variation; International standards for quality/quality management systems; Use of lean Six Sigma in reducing waste and/or reduction of process or product variation; Process design and/or Design of experiments to design robust processes and products; Reliability engineering and product safety concepts; TQM management and concepts; Inspection and testing; Quality audits.
EBRMI4A	**Research Methods and Industrial Engineering Project** Research as a way of thinking and the role of research in product and service industries; Research process or concept map, Identification of research approaches and evaluating research strategies; Formulation of research problems; Research main question and sub-questions; Setting research aim(s) and objectives; Conceptualization and design of research; Critically reviewing literature and secondary data; Types of data: quantitative and qualitative; Constructing an instrument for Data collections; How to select a research sample; Collecting

	primary data through experimentation, measurement, observation, interviews and questionnaires; Data management/analysis and data presentation techniques, The writing of research proposal; Writing research report, Research Ethics.
SEMESTER 2	
EBFPD4A	**Facility Planning and Design** Introduction to facility planning and material handling; Product, process and schedule design; Flow systems, activity relationships and space requirements; Principles of material handling; Plant layout generation; Warehouse operations; Manufacturing systems and material handling; Facilities systems; Quantitative techniques for facility planning; Evaluating, selecting, and implementing the facilities plan.
EBHFE4A	**Human Factors and Ergonomics** Ergonomics; Human factors; Work design; Method study; Work measurement; Health and safety including healthcare; Enterprise applications.
EBIEM4A	**Industrial Engineering Management** This module takes an in-depth look into the managerial systems in the working environments; Providing the students with understanding of managerial principles and practice in internal and external working environments; The various challenges face by managers in today's manufacturing/working environments, and way forward; An approach and models for decision making and problem solving; In addition, the module focuses on the Industrial engineering managerial principles in managing operation, Quality and Crisis management. The topics covered include, amongst others: Introduction to Management Practice, Managing in organizations, Model of management, Managing internationally, Cooperate responsibility and employability skills, Planning, Decision making, Managing strategy, Managing marketing, Organizational structure, Creativity, Innovation and change, Teams, Managing operation and quality, Control and performance measurement.
EBFEE4A	**Financial Engineering and Economics** Discrete-time models of equity, bond, credit, and foreign-exchange markets; Introduction to derivative, complete and incomplete markets; Arbitrage and fundamental theorem of asset pricing; Assess risk and return in an organisation; Perform financial planning; Mean variance analysis; Capital asset pricing model; The arbitrage pricing theory.
EBIKM4A	**Information and Knowledge Management**

	Introduction on knowledge management; Developing a knowledge management system; Knowledge processes and governance; Types of Information systems; System development methodologies; information requirements analysis; Process analysis and specifications; Designing effective output and input; Quality assurance and implementation of Information Systems.
EBMOS4A	**Modelling and Simulation** Continuous systems: classification of systems, system's abstraction and modelling, types of systems and examples, system variables, input-output system description, system response and analysis of system behaviour; System simulation (computer-aided: Arena software), real-world system examples; Discrete systems: difference equations, numerical simulation of continuous-time dynamics, discrete-event systems, and real-world system examples.
Syllabi: POSTGRADUATE DIPLOMA IN INDUSTRIAL ENGINEERING (Course code: PG0830)	
Module Code	**Module Description**
YEAR MODULES	
EBIPD5A	**Industrial Engineering Project Planning and Design** Overview of the project cycle; Starting, organising and preparing a project; Dealing with ethical dilemmas, Project quality management; Preparing the capstone project; Planning, project organisation, financial control, controlling and leading projects within the industrial environment; Investigating real-life cases from industry.
EBIDI5A	**Industrial Engineering Project Design and Implementation** Product design; Process Design; Field survey; Workshop design; Emphasizing project design and implementation from an organisational perspective by acquiring data and validating the relationship between the project and the overall strategy of the organisation (governance); Investigating real-live cases from industry.
SEMESTER 1	
EBADA5A	**Advanced Decision Analysis** Introduction to decision analysis, modelling and decision making, decision analysis and probability; Benchmarking, modelling of preferences and experts' values; Structuring decision problems and measuring uncertainties; Modelling uncertainty and multi-attribute models; Structuring and building

	of decision trees; Conditional probabilities, sensitivity and specificity probabilistic risk assessment, likelihood ratios; Root cause analysis; Dynamic modelling basics; Stochastic cohort models and microsimulation models.
EBAMS5A	**Advanced Modelling and Simulation** Introduction to discrete event simulation; Simulation project methodology, event calendar and implications; Advanced statistic distributions; Making decisions with simulation; Introduction to advanced modelling techniques; Modelling material handling devices; Conveyor modelling; Continuous systems; Discrete systems; System simulation software, real-world system examples.
SEMESTER 2	
EBMPE5A	**Manufacturing and Production Engineering** Industry 4.0/smart factory; Programmable Logic Control (PLC) programming; Internet of Things (IoT) Technology; Robotics programming; Computer Numerical Control (CNC) Programming.
EBAFD5A	**Advanced Facility Design** Material handling concepts; Layout design algorithms; Manufacturing systems; Quantitative facility planning models; Evaluating and selecting the facilities plan.
EBFEN5A	**Financial Engineering** Derivatives in financial engineering; Financial engineering risk measurement and management; credit risk concepts and modelling; Ethics in financial markets; Equity and currency markets; Allocation of money and asset management.
EBPRE5A	**Project Engineering** Introduction to project engineering; Project charter and preliminary scope statement; Develop project scope; Work breakdown structure and communication plan; Risk planning and management; Project quality management; Project team development; Measuring and controlling team performance; Managing participation, teamwork and conflict; Monitoring and control change; Controlling work results and closing out the project.

Syllabi: DIPLOMA IN OPERATIONS MANAGEMENT (Course code: DI0400)	
Module Code	**Module Description**

SEMESTER 1	
HKCOX1A	**<u>Applied Communication Skills 1.1</u>** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
ASICT1A	**<u>ICT Skills 1</u>** Recognizing Computers; Using a current versions of Microsoft Windows Professional; Common Elements; Microsoft Word; Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, getting connected and using the Internet.
EBMFX1A	**<u>Manufacturing Technology 1.1</u>** Safety and safety legislation; Manufacturing methods, techniques and processes; Hand tools; Power tools; Marking out; Cutting tools and cutting fluids; Drilling machines; Centre Lathe; Pedestal grinder and sawing machines; Joining.
AMMAT1A	**<u>Engineering Mathematics 1</u>** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves, Simpson's rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre's, Calculating roots.
EBOPX1A	**<u>Operations Management 1.1</u>** Introduction to production management; Product and service design; Application of forecasting; Facilities planning and layout; Location planning and analysis; Capacity management;

	Productivity, competitiveness and strategy; Process selection and capacity planning.
EBOGX1A	**Organisational Effectiveness 1.1** Introduction to Work Study; Productivity; Method study; Work measurement (time study); Human factors in work study; Ergonomics; Working conditions and environment; Jigs and fixtures.
EBWPX1A	**Workplace Dynamics 1.1** Production environment; Human behaviour; Group behaviour; Communication skills; Legal aspects; Negotiation skills and the application of these skills; Performance expectations.
SEMESTER 2	
HKCOY1A	**Applied Communication Skills 1.2** Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity: Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph, Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
EBMFY1A	**Manufacturing Technology 1.2** Introduction to product development; PACE - An integrated process for product & cycle time excellence; Core team approach to project organization; Design techniques and automated development; Product strategy; Technology management; Evolution of the product development process; Implementing PACE.
EBOPY1A	**Operations Management 1.2** Introduction to reliability centred maintenance; Functions; Functional failure; Failure modes and effects analysis; Consequences; Proactive maintenance; Default action; Implementing reliability centred maintenance; Applying the reliability centred maintenance process; What reliability-centred maintenance achieves.
EBOGY1A	**Organisational Effectiveness 1.2** Introduction to business logistics; Defining the logistic product; Logistic customer service; Forecasting logistics requirement; The storage and handling systems; Storage and material handling

	decision; Purchasing and production scheduling decision; Inventory policy decision.
EBQMA1A	**Quality Management 1** Introduction; Descriptive techniques; Probability and probability distributions; Sample selection and sampling theory; Statistical process control; Hypothesis testing; Regression analysis and Acceptance sampling.
EBWPY1A	**Workplace Dynamics 1.2** Evaluate and implement personnel administration procedures; Personnel and the personnel function; Job design, analysis and evaluation; Interviewing; Human relations; Labour.
SEMESTER 3	
HKCOX2A	**Applied Communication Skills 2.1** Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in workplace, PowerPoint Presentations: Planning and preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a logically sound and well- reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
BACEX1A	**Costing and Estimating 1.1** Elements of cost; Introduction to elementary accounts; Absorption costing; Marginal costing; Cost-volume-profit analysis; Budgeting; Profitability of new projects; Just-in-time accounting.
EBMAX2A	**Operations Management 2.1** Management functions; Business functions; Inventory management; Master production schedule; Material requirements planning.
EBOGX2A	**Organisational Effectiveness 2.1** Revision of work study techniques; Compiling of operations procedures; Advanced work measurement; Application of ergonomics; Indices of production factors; Value analysis; Work environment design; Value engineering; Proposed method implementation; Standard data; Formula construction; Predetermined time systems; Work sampling; Standard follow-up time; Wage payment; Training other management practices.
EBQAS2A	**Quality Assurance 2**

	Introduction to quality; Quality improvement and cost reduction; Strategic quality management; Developing a quality culture; Designing for quality; Inspection, test and sampling plans; Assessment of quality; Control of quality; Organisation for quality; Understanding customer needs; Manufacture; Inspection test and measurement and quality assurance.
EBSTX1A	**Statistics 1.1** Introduction to statistics; Presenting data; Measuring data; Probability; Probability distribution; Sampling distribution; Estimation; Hypothesis testing; Comparing populations; Regressions.
AAECH1A	**Engineering Chemistry 1** Matter and measurement; Atoms; Molecules and ions; Formulas, Equations and moles; Chemical reactions in aqueous solution; Periodicity and atomic structure; Ionic bonds; Covalent bonds and molecular structure; Chemical equilibrium; Acids and bases; Organic chemistry.
HLAWX1A	**Labour Law 1.1** Common law contract of service; Collective labour law includes a working knowledge of the following acts: Labour relations, Workforce training, Basic employment conditions, Workmen's compensation, Unemployment Insurance and the Wages Act.
APHYS1A	**Physics 1** Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton's Law of Motion, Work and Energy, Impulse and Momentum, Electric Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids, Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.
ASPRG1A	**Programming 1** This module introduces the student practically to the fundamentals of programming. Aspects covered include the basics of programming techniques and principles. The sequence, selection and repetition programming structures are examined and discussed. Method creation and parameter passing are introduced.
SEMESTER 4	
HKCOY2A	**Applied Communication Skills 2.2** Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business

	Plan: Introduction to the business plan, Marketing your new business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements; aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
BACEY1A	**Costing and Estimating 1.2** Elements of cost; Introduction to elementary accounts; Absorption costing; Marginal costing; Cost-volume-profit analysis; Budgeting; Profitability of new projects; Just-in-time accounting.
EBMAY2A	**Operations Management 2.2** Just-in-time systems; Scheduling of operations; Quality management; Decision-making; Linear programming; The transportation module; Supply chain management; Project management.
EBMAT2A	**Operations Management Techniques 2** Game Theory & applications; Decision analysis; Decision trees; Fundamentals of decision theory; Probability concepts and distributions; Forecasting; Inventory models; Involved formulation of decision problems; Graphical solution to linear programming problems; The simplex method; Use of computer in solving problems.
EBOGY2A	**Organisational Effectiveness 2.2** Facilities in general; Elementary flow system: Material, People, Equipment, Information; Process design; Auxiliary services; Employee services; Handling systems: Types, Designs, Constructing, Evaluation, Problems with material handling; Area location; Layout evaluation; Selling the layout.
AAECH2A	**Engineering Chemistry 2** Introduction to chemical bonding; Ionic bonds; Covalent bonding and molecular structure; Hydrogen; The Group IA and IIA metals; Boron and Aluminium; Chemical reactions in aqueous solutions; Carbon, Silicon, Germanium, Tin, and Lead; Acids, bases, and non-aqueous solvents; Nitrogen Phosphorus, Arsenic; Oxygen, Sulphur, Selenium, and Tellurium; Halogens.
EMMAE2A	**Maintenance Engineering 2**

	Condition Monitoring; Failure analysis; Vibration Analysis; Fault detection techniques and tools: Thermography Analysis, Oil Analysis, Ultrasound Analysis.
EMMEN2A	**Manufacturing Engineering 2** Fault diagnosis; Failure analysis and measuring equipment; Test methods; Interpretation and action; Powder metallurgy; Metal forming; Erosion; Casting; Plastics-moulding and machining; Welding and joining and Obtaining finish and accuracy.
APHYS2A	**Engineering Physics 2** Projectile motion; rotational motion; simple harmonic motion and elasticity; fluids; gas behaviour; thermodynamics; current and capacitors; magnetism; nuclear physics, radioactivity and ionising radiation; Calculus.
ASPRG2A	**Programming 2** This module builds upon the first module and covers additional fundamentals of programming. Aspects covered include arrays, object-oriented programming, files and MDI Windows applications.
SEMESTER 5	
EBILE3A	**Industrial Leadership 3** Managers, diversity and change; Environment competitive advantage and quality operations; International management; Managing ethics and social responsibilities; Fundamentals of planning; Strategic management; Organising; Human resource management; Leading; Motivation; Communication; Interpersonal skills; Group dynamics; Innovation and planned changes and Controlling.
EBMAX3A	**Operations Management 3.1** Production planning; Production control; Quality control & quality management; Purchasing; Rating and productivity; Project management; Application of quality management; Maintenance management; Case studies; Use of computer in solving problems.
EBMAT3A	**Operations Management Techniques 3** Multi-dimensional LP; Matrix algebra; Involved LP problems; Sensitivity analysis and dual simplex algorithm; Changing the LP problem; Duality theory; Transportation and assignment models; Integer programming; Dynamic programming; Network models; Project management; Waiting lines & queuing theory; Markov analysis; Use of computer in solving problems.
EBOMG3A	**Operations Management Technology 3** Fundamentals of Manufacturing; Fundamentals of Systems; Fundamentals of Manufacturing Systems; Integrated Manufacturing and Management Systems; Material and

	Technological Information Flows in Manufacturing Systems; Product Planning and Design; Process Planning and Design; Quality Engineering; Capital Investment for Manufacturing; Principles of Computer-integrated Manufacturing (CIM); Factory Automation (FA), Computer-aided Manufacturing (CAM) and Computer-integrated Manufacturing (CIM) Systems; Fundamentals of Information Technology; Computer-based Production Management Systems; Manufacturing Strategy; Global Manufacturing; Industrial Structure and Manufacturing Efficiency; Industrial Input-Output Relations; Manufacturing Excellence for Future Production Perspectives.
EBOEG3A	**Organisational Effectiveness 3** Information systems analysis and design; Performance improvement programs; Entrepreneurship theory; Financial plan; Marketing plan; Business plan; Computer applications; Consultation theory; Project management (review); A 6-month industrial project under supervision of an industrial mentor.
SEMESTER 6	
EBMAP1A	**Operations Management Practice 1**

Syllabi: ADVANCED DIPLOMA IN OPERATIONS MANAGEMENT (Course code: AD0400)	
Module Code	**Module Description**
SEMESTER 1	
EBQMA4A	**Quality Management** Quality definition; Quality in manufacturing; Foundations of Quality; Customer service, satisfaction, and engagement; Workforce contributions at workplace; Manufacturing process; Tools and techniques for Quality; Design for Quality; Process improvement and Six Sigma.
EBRMO4A	**Research Methodology for Operations Management** Research as a way of thinking and the role of research in product and service industries; Research process or concept map, Identification of research approaches and evaluating research strategies; Formulation of research problems; Research main question and sub-questions; Setting research aim(s) and objectives; Conceptualization and design of research; Critically reviewing literature and secondary data; Types of data:

	quantitative and qualitative; Constructing an instrument for Data collections; How to select a research sample; Collecting primary data through experimentation, measurement, observation, interviews and questionnaires; Data management/analysis and data presentation techniques, The writing of research proposal; Writing research report, Research Ethics.
EBSCM4A	**Supply Chain Management** Purchasing and supply management in perspective; The task of purchasing and supply management; Process and procedures; Policies and strategies; Assessment and selection of suppliers; Sustainable purchasing and supply management; Price and cost analysis; Electronic commerce and procurement applications.
SEMESTER 2	
EBFIM4A	**Financial Management** Principles of financial management; Analysing and interpreting financial statements; Budgeting; Capital investment decisions; Risk and return; Risk and management tools.
EBWDE4A	**Workplace Design** Introduction to facilities planning and materials handling; Workplace design and shape, The ergonomic workplace design Product, process, and schedule design; Flow systems, activity relationships, and space requirements; Principles of material handling; Plant layout generation; Warehousing operations; Manufacturing systems and material handling; Facilities systems Quantitative techniques for facilities planning; Evaluating, selecting, and implementing the facilities plan, Improving work performance; Minimizing the physical strain; Designing workload of the working person; Facilitating task execution. Occupational health and safety; Workplace elements.
EBMAS4A	**Manufacturing Systems** This module takes an in-depth look into production systems; Providing the students with an understanding of product development and design activities; Production planning and control methods, as well as the coordination of the entire manufacturing processes.; Hands-on experience in the practical sessions will ensure an understanding of the complexity and challenges of the various production systems; In addition, the module focuses on the practical application of the taught theoretical concepts in industrial companies.
EBMOM4A	**Modelling in Operations Management** Continuous systems: classification of systems, system's abstraction and modelling, types of systems and examples, system variables, input-output system description, system

	response and analysis of system behaviour; System simulation (computer-aided: Arena software), real-world system examples; Discrete systems: difference equations, numerical simulation of continuous-time dynamics, discrete-event systems, and real-world system examples.
Syllabi: POSTGRADUATE DIPLOMA IN OPERATIONS MANAGEMENT (Course Code: PG0400)	
Module Code	**Module Description**
YEAR MODULES	
EBOPD5A	**Operations Management Project Planning and Design** Overview of the project cycle; Starting, organising and preparing a project; Dealing with ethical dilemmas, Project quality management; Preparing the capstone project; Planning, project organisation, financial control, controlling and leading projects within the operations management environment; Investigating real-life cases from industry.
EBODI5A	**Operations Management Project Design and Implementation** Product design; Process Design; Field survey; Workshop design; Emphasizing project design and implementation from an organisational perspective by acquiring data and validating the relationship between the project and the overall strategy of the organisation (governance); Investigating real-live operations management cases.
SEMESTER 1	
EBAMA4A	**Advanced Modelling in Operations Management** Introduction to discrete event simulation; Simulation project methodology, event calendar and implications; Advanced statistic distributions; Making decisions with simulation; Introduction to advanced modelling techniques; Modelling material handling devices; Conveyor modelling; Continuous systems; Discrete systems; System simulation software, real-world system examples.
EBQRM5A	**Quality and Reliability Management** Leadership and Total Quality Management (TQM); Organisation for TQM; Customer satisfaction; Total employee involvement; Supplier partnership; Total productive maintenance; Quality circles; Inspection; Kaizen and continuous improvement; 5S, Six sigma and Lean; Reliability engineering; Business process reengineering; Value engineering.
SEMESTER 2	
EBOMS5A	**Advanced Manufacturing Systems**

	Industry 4.0/smart factory; Programmable Logic Control (PLC) programming; Internet of Things (IoT) Technology; Robotics programming; Computer Numerical Control (CNC) Programming.
EBAIM5A	**<u>Advanced Industrial Management</u>** Business strategic formulation process; internal and macro-environmental assessments; Industry assessment; Selection of best business strategy; Implementation of business strategy and managing change; Components of successful strategy implementation; Short-term objectives, functional tasks and policies; strategic control and evaluation; strategic leadership and governance.
EBAFD5A	**<u>Business Finance</u>** Just in time processes and financial implications; Financial calculations in Just-in-time processes; Project evaluation and review; Financial strategy; Sources of Funding; Pricing Decisions; Management control systems; Performance management.

11.9 MECHANICAL ENGINEERING

Syllabi: DIPLOMA IN MECHANICAL ENGINEERING (3 year programme) (Course code: DI0840)	
Module Code	**Module Description**
SEMESTER 1	
HKCOX1A	**<u>Applied Communication Skills 1.1</u>** Communication theory: what is meant by communication; elements common to all forms of communication; Reading for academic purpose: what it means to read a written text purposefully; Writing process and referencing: writing requires knowledge of grammar, punctuation, spelling, style, structure and audience; Listening process: why people fail to listen; the different types of listening; aspects of intercultural listening, Creative thinking, critical thinking and disability communication: critical thinking.
EEESK1A	**<u>Engineering Skills 1</u>** The Engineering Profession: Different types of engineering. Mechanical, electrical, civil, chemical, computer etc. The engineering team; artisans, technicians, technologists and engineers. Engineering Teamwork: Engineering design. Teamwork versus group work. Basic

	principles of; engineering project management (plan, organise, lead and control), project costing, budgeting and resource management. What is a business plan? Engineering and the Environment: social responsibility, environmental impact, natural resources, sustainability of the engineering activity. Legal and safety considerations. Ethics in Engineering: professional ethics, responsibility, engineering norms, ECSA and their function.
AAECH1A	**Engineering Chemistry 1** Matter and measurement; Atoms; Molecules and ions; Formulas, Equations and moles; Chemical reactions in aqueous solution; Periodicity and atomic structure; Ionic bonds; Covalent bonds and molecular structure; Chemical equilibrium; Acids and bases; Organic chemistry.
ASICT1A	**ICT Skills 1** Recognizing Computers; Using current versions of Microsoft Windows Professional; Common Elements; Microsoft Word; Microsoft Excel; Microsoft PowerPoint; Microsoft Outlook, getting connected and using the Internet.
AMMAT1A	**Engineering Mathematics 1** Binomial expansion, radian measure and limits of functions: Binomial theorem, Radian measure. Applications of radian measure. Differentiation techniques: Limits of functions, Differentiation from first principles, Derivatives of polynomials & product rule, The quotient and chain rules, Derivatives of trig functions, Derivatives of exponential & log functions, Higher order derivatives, Implicit differentiation, Logarithmic differentiation, Applications. Integration techniques: Integration (Indefinite integrals), Definite integrals, Area enclosed by two curves, Simpson's rule. Vectors: Rep & magnitude of vectors. Resolving vectors, Unit vectors and direction vectors, Scalar multiplication, addition and sub, Dot product, the angle between two vectors and work done, Determinant of a 2 x 2 matrix. Cross product and the moment of a vector. Complex numbers: Rep. of complex numbers and operations, Equality of complex numbers, Argand diagram, polar form & De Moivre's, Calculating roots.
APHYS1A	**Physics 1** Units of measurement, Waves and sound, Principles of Linear Superposition and Interference, Electromagnetic waves, Interference and Wave nature of light, Reflection of Light: Mirrors, Refraction of Light, Lenses and optical instruments, Vectors and scalars, Kinematics in one dimension, Forces and Newton's Law of Motion, Work and Energy, Impulse and Momentum, Electric Forces and Electric Fields, Electric Potential and Potential Energy, Electric circuits, Fluids,

	Temperature and heat, Transfer of heat, Nuclear Physics and Radioactivity.
EESIN1A	**Social Intelligence 1** Leadership styles: Democratic, Autocratic, Consensus etc. Economic systems of governance: Capitalism, Socialism and Communism. Etiquette in society and the workplace. Soft skills, Cultural influences. Success in Engineering: Professionalism, Ethics, Responsibility, Discipline, Time management, Acquiring information and Independent learning.
SEMESTER 2	
HKCOY1A	**Applied Communication Skills 1.2** Social Intelligence: Characteristics of Social Intelligence; Paragraphing: The structure of a paragraph, Elements of a Paragraph, Report writing: Different types of reports, Purpose of a report, Perception: What does perception involve? Facts vs Opinions: Facts, opinions. Subjectivity and Objectivity: Introduction, Subjectivity, objectivity. Denotations and Connotations: Denotation, connotation. Bias: Age Bias, Belief system or Religious Bias, Disability, Visual Literacy: Different types of visual literacy. Graphics: Tables, Bar Graphs, Histogram, Pie Chart, Line Graph, Pictogram, and Flow Chart. Advertisements: Examples of Figurative language.
EMCOA2A	**Computing Applications 2** Provides basics of computing applications, integrates computation and visualization into a flexible computing environment, and offers a diverse family of built-in functions that will give background in a straightforward manner to the basics of program language and ability of student to write their own simple programs to solve typical problems encountered in a variety of modules and in engineering practice. The subject covers elementary programming concepts that include, Variables and built-in Symbolic Math functions ,Solving equation and system of linear equations , Range variables, 2D Plots of Functions, 3D Plots of Functions, Programming algorithm syntax, Programming – Loops.
AAECH2A	**Engineering Chemistry 2** Introduction to chemical bonding; Ionic bonds; Covalent bonding and molecular structure; Hydrogen; The Group IA and IIA metals; Boron and Aluminium; Chemical reactions in aqueous solutions; Carbon, Silicon, Germanium, Tin, and Lead; Acids, bases, and non-aqueous solvents; Nitrogen Phosphorus, Arsenic; Oxygen, Sulphur, Selenium, and Tellurium; Halogens.
EMEDR1A	**Engineering Drawing 1**

	Drawing instruments; Drawing skills; Object visualization and drawing; sketch and drawing of chemical engineering process equipment's using computer software.
AMMAT2A	**<u>Engineering Mathematics 2</u>** Differentiation: Inverse trig functions, Hyperbolic functions, Inverse hyperbolic functions, Parametric equations, Maxima and minima, Partial differentiation, Small changes, Rate of change. Integration: Revision of integration, Use of formulae sheet, Inverse functions, Partial fractions, Partial fractions, Integration by parts, Trig. & hyperbolic substitutions, t-formulae, Mean and RMS values. Differential Equations: Differential eq., separation, Using the integrating factor, Applications, Homogeneous differential equations. Matrix Algebra: Operations with matrices, Inverse of a matrix, solve equations using inverse, Cramer's rule, Eigenvalues and –vectors. Probability and Statistics: Data representation, Data summaries, Normal distribution, Conf. intervals, error est. Conf. intervals, error est. Hypothesis testing.
APHYP2A	**<u>Physics 2 Practical</u>** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer, Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
APHYT2A	**<u>Physics 2 Theory</u>** Electric Circuits, Alternating Current, Kirchhoff's Rules, Capacitors in series and in parallel, RC Circuits. Magnetic Fields, Force on a moving charge, Particle motion in a magnetic field, Mass spectrometer,

	Current in a magnetic field, Torque on current-carrying coil, Magnetic fields produced by current, Amperes Law. Electromagnetic Induction, Induced EMF, Motional EMF, Magnetic Flux, Faraday's Law, Lenz's Law, Electric Generator, Transformers. Alternating Current Circuits, Capacitive Reactance, Inductive Reactance, RLC Circuits. Fluids, Archimedes principle, Viscous Flow, Ideal gas law and Kinetic Theory, Molecular mass, The Mole, Avogadro's constant, Ideal gas law, Kinetic theory of gas, Diffusion. Thermodynamics, Thermodynamic Systems, Zeroth Law, First law of thermodynamics, Thermal processes, Specific heat capacities, Second Law of Thermodynamics, Heat engines, Carnot's Principle, Refrigeration, Entropy. Nature of the Atom, X Rays, Lasers. Radiation, Ionising Radiation, Nuclear Energy and Elementary Particles, Biological Effects of Ionizing Radiation, Induced Nuclear Reactions, Nuclear Fission, Nuclear Reactors, Nuclear Fusion. Kinematics in two dimensions, Displacement velocity and acceleration, Equations, Projectile motion. Uniform Circular Motion, Acceleration, Centripetal force, Rotational Kinematics, Rotational Dynamics. Simple Harmonic motion and Elasticity.
EMSPA1A	**Safety Principles and Law 1** Importance of health and safety: What is safety and health concepts as indicated in the OHS Act, Fundamental safety concepts and terms: Fundamental safety terms, legal appointments as per the OHS Act, duties of the legal appointees as per the OHS Act, safety awareness and fire training, What is hazards and risk in the workplace: What is a hazard, what is a risk, what is the difference between a hazard and a risk, identification of main six hazards in the workplace, occupational hazards, difference between an accident and an incident: general principles of control and risk reduction, safe systems of work, permit-to-work systems, emergency procedures and first-aid, Principles of hazard and risk control: What is a risk assessment, why do a risk assessment, how to conduct a risk assessment, Risk assessment and risk management, Tools and Machinery: Tool and machine hazards, Principles of safeguarding powered and driven machines, point of operation safeguards, controls for hand toll hazards, portable power tool controls, Electrical safety: What do I need to know about electricity, what kind of injuries result from electrical current, electrical shock hazards, arc flash, control of electrical hazards, electrical safety-related work practices, Noise and vibration: Sound and noise, hearing, hazards of noise, exposure standard for noise, engineering controls for noise, noise measurement, vibrations of the human body or parts of the human body.
SEMESTER 3	
EMMEC1A	**Mechanics 1**

	Statics: Analysis of vectors in 2-D and 3-D Cartesian spaces; Equilibrium of mechanical system and application to the calculation of reaction; Resultant, Moments of force and coordinates of Centre of gravity (Centroid); Friction; Dynamics; Linear and angular motion; Momentum and impulse; Work energy and power and Radial acceleration.
EMPRJ1A	**Project 1 (WIL Mechanical)** The module is intended to offer hands-on workshop exposure to students. It shapes the behavior of graduates to the mechanical and general manufacturing environment and develop safety awareness in campus controlled environment in preparation for future workplace based learning.
EPEEN1A	**Electrical Engineering 1** Electrical Principles: The electron theory, Heat, Magnetism, Friction, Pressure, Light, Chemical Action, Batteries, International system of measurement. Basic Electrical Concepts: The electrical circuit, Electrical current flow, Electrical current, Electromotive force and voltage, Definitions of electric, magnetic and other SI units, Resistance, Resistors. Network Theorems in Direct Current Circuits: Kirchhoff's laws, Superposition theorem, Thevenin theorem, Norton's Theorem, Star-Delta and delta conversion, Delta-Star conversion, Star-delta conversion. Electro Magnetism: The magnetic field, Electromagnetic Force on a current-carrying conductor, Electromagnetic induction, Lenz's law, Faraday's law. Inductance in Direct Current Circuits: Inductive circuits, Inductance, Current growth in an inductive circuit, Current decay in an inductive circuit, Energy stored in an inductor, Types of inductors. Capacitance in Direct Current Circuits: Capacitors, Capacitance, Series capacitor circuit, Parallel capacitor circuits. Parallel Magnetic Cores: Parallel magnetic circuits, electrical analogy, series and parallel in magnetic circuits.
EMEDR2A	**Engineering Drawing 2** Advance constructions; Orthographic projection of true planes; Isometric; Interpenetration and development; Machine drawing and Assemblies.
AMMAT3A	**Mathematics 3** Application of Integration: Volumes of solids of revolution, Length of Curves, Double Integrals: Iterated Integrals & Fubini's theorem, Double Integrals, Polar Coordinates. First Order Differentiation Equations: Exact DE, Homogeneous DE, Bernoulli DE, Applications (Excluding Newton's Law of Cooling), D-Operator Methods. Numerical Solutions of First Order Differential Equations: Euler's method, Runge-Kutta order 2, Runge-Kutta order 4. Operator D Methods/Undetermined coefficients: Complementary Solutions, D-

	operator & Inverse, binomial or long division method, Theorem 1, Theorem 2, Theorem 3, Special cases, General solution, Applications. Laplace Transforms, and Table of transforms. (Derivation from first principles not for examination purposes), First shifting property, Laplace transforms of derivatives, Inverse Laplace Transforms using tables, Laplace Transforms of discontinuous functions, Inverse Laplace Transforms of discontinuous functions, Solution of differential equations, Application to electric circuits, Application to beams. Fourier Series: Periodic functions and harmonics, sketching of graphs and determining Fourier Series, Series with period 2l, Even and Odd functions, Full range and Half range series, Numerical Harmonic Analysis.
HKCOX2A	**Applied Communication Skills 2.1** Introduction to Group Dynamics: Show understanding of different group characteristics, Communication Theory: Communication Model, Communication Barriers, Communication styles in workplace, PowerPoint Presentations: Planning and preparation of a presentation (Audience, Language, Knowledge of topics, Level of education, Social variables, Values, Needs and Size of Audience, Non-verbal and Intercultural Communication: Introduction to Non-verbal Communication, Logic and Reasoning: Conceptualise vital terminology uses in argumentative writing, construct a logically sound and well- reasoned argument, write and present logical arguments, Meetings and Interviews: Introduction of meetings, Types of meetings.
EMMEN1A	**Mechanical Manufacturing Engineering 1** Safety and safety legislation; Identification and application of materials; Elementary measuring equipment and Elementary hand and Machine tools.
SEMESTER 4	
EMMED2A	**Mechanical Engineering Design 2** Design process steps; Simple design without calculations; Engineering material selection; Rod connections; Riveted joints; Fasteners and connections; Shafts; Couplings; Keys and splines; Plain bearings; Spur gears; Eccentric loading of connections and Project.
EMMOM2A	**Mechanics of Machines 2** Torque acceleration; Vehicle dynamics; Simple lifting machines; Hoists and haulages; Moment of inertia; Simple harmonic motions and Power transmission.
EMSOM2A	**Strength of Materials 2** Pin jointed structures; Stress and strain; Testing of materials; Stresses in thin rotating cylinders; Thin cylinders; Shafts; Rigid couplings;

	Helical springs; Shear force and bending moments in simply supported beams and cantilevers.
EMFMM2A	**Fluid Mechanics 2 (Mechanics)** Hydrostatics; Fluid dynamics; Fluid power circuit elements; Hydraulic and Pneumatic systems.
EMTHE2A	**Thermodynamics 2** Introduction to thermodynamics; The First Law of thermodynamics; Working fluid; Solving thermodynamics systems; The Second Law; The gas cycles; Mixtures fundamentals.
EMPRJ2A	**Project 2 (WIL Mechanical)** This module is a builds on and enhance attributes enquired during Project 1 (WIL Mechanical).
HKCOY2A	**Applied Communication Skills 2.2** Interpersonal Skills in the Workplace: Group Dynamics, Conflict Resolution, Persuasion, Negotiation, Mediation, the Business Plan: Introduction to the business plan, Marketing your new business; Intellectual Property; How to obtain funding for your small business; The Business Pitch, Disability Etiquette: Definition of disability and disablism, Different depictions of disability, Words to describe different disabilities, Disability in South Africa, Models of disability; Disability Etiquette, Job advertisement, Curriculum Vitae and Cover letter: Analysing job advertisements; aligning your skills with job advertisements; Designing a professional curriculum vitae; Online job applications, Drafting a cover letter, Written Messages: E-mail etiquette; Writing Styles; Memoranda, Business Letters; The News Article.
EMCAI1A	**Computer-Aided Draughting 1** Introduction to a 3D parametric software interface; Creating sections, parts, assemblies and drawings.
SEMESTER 5	
EMMOM3A	**Mechanics of Machines 3** Kinematics; Balancing and Gears.
EMSOM3A	**Strength of Materials 3** Temperature stress; Properties of beam sections; Bending moments and beam sections; The theory of bending; Fatigue; Short columns and struts; Strain energy and Shear stress in beams.
EMFME3A	**Fluid Mechanics 3** Pipe flow; Viscous flow; Flow under varying head; Fluid friction in oiled bearings, Channel Flow; Wetted Perimeter and Positive displacement piston pumps.
EMTHE3A	**Thermodynamics 3**

	General thermodynamics; Ideal cycles; Internal combustion engines; Steam turbines; Refrigeration; Air compressors and Natural flow heat transfer.
EMMED3A	**Mechanical Engineering Design 3** Lubrication; Ergonomics; Springs; Bearings; Brakes; Clutches; Spur gears; Welded joints; Frame structure analysis by computer; Wire ropes; OSH Act; Parametric modelling; Pro-Engineer advanced; Mechanical elements into CAD models and Project.
EMMEN2A	**Manufacturing Engineering 2** Fault diagnosis; Failure analysis and measuring equipment; Test methods; Interpretation and action; **Powder** metallurgy; Metal forming; Erosion; Casting; Plastics-**molding** and machining; Welding and joining and Obtaining finish and accuracy.
EMMAE1A	**Maintenance Engineering 1** Maintenance organisation, Work execution, Parts and materials, Maintenance systems and documentation, Maintenance planning and scheduling, Preventive and corrective maintenance, Computerized maintenance systems, Maintenance safety and efficiency, Reliability centered maintenance, and Evaluation of a maintenance program.
EMPRJ3A	**Project 3 (WIL Mechanical)** The module is a practical component of typical maintenance experienced in industry. It is supporting the module Maintenance Engineering 2 covers the machine failure and analytical methods to monitor the condition of machines. It shapes the behavior of graduates to the mechanical maintenance environment and prepares the student for future workplace based learning.
SEMESTER 6	
EMTOM3A	**Theory of Machines 3** Introduction to the dynamics and vibrations of mechanical systems; Free and forced vibration of linear one and two-degree of freedom models of mechanical systems; Work-energy concepts; Unbalance and base excitation of systems.
EMAOM3A	**Applied Strength of Materials 3** Slope and deflection of beams; Leaf springs; Struts; Complex stress and complex strain and Thick cylinders.
EMHYM3A	**Hydraulic Machines 3** Channel flow and Wetted perimeter. Centrifugal pump, single pump, series pump, parallel pump, pump system characteristics equations (operating point of a pump), radia Flow, axial flow, mixed flow, best operating speed, best impeller size, Cavitations in pump, Thomas cavitations, velocity triangle(velocity vector, Euler head and manonetric head). Turbines(impulse turbine: pelton wheel, reaction

	turbine and velocity triangle). Fluid system (hydraulic system, hydraulic accumulator, hydraulic intensifier, hydraulic ram, hydraulic lift, hydraulic crane, hydraulic coupling, hydraulic torque converter, air lift pump and gear wheel pump.
EMSPL3A	**Steam Plant 3** Steam plant; Psychrometry; Rotary compressors; Heat transfer; Gas turbines; Cooling towers and Legislation and Forced convection.
EMMDE3A	**Machine Design 3** Shaft Design, Belt Design and Selection, Gear Design (Spur and Helical) Fatigue, Machine Screws and Fastener Design, Limits and Fits (Tolerances); Machine Design project to be written in the Harvard Style; Problem Statement, Literature Review, Evaluation of Preliminary Ideas, Component design (calculations), CAD of components and assembly, Summary and Conclusion.
EMMAE2A	**Maintenance Engineering 2** Condition Monitoring; Failure analysis; Vibration Analysis; Fault detection techniques and tools: Thermography Analysis, Oil Analysis, Ultrasound Analysis.
EMMEC2A	**Modelling and Engineering Computation 2** In this module, the students develop specific skills to program and use computational techniques to solve engineering problems. The module provides an introduction to Numerical methods relevant to Mechanical systems, including integration, solution of linear equations, and ordinary differential equations. Presents simulation approaches use for examples in Mechanical Engineering, particularly from dynamics, and structural analysis using MATLAB programming.
EMEXM1A	**Workplace Based Learning 1 (Mechanical)**

Syllabi: DIPLOMA IN MECHANICAL ENGINEERING (Extended 4 year programme) (Course code: DE0841)	
Module Code	**Module Description**
SEMESTER 1	
AAXCH1A	**Foundation Chemistry 1** Atoms, molecules & ions; Stoichiometry; Reactions in aqueous solution; Rate and extent of reactions; Chemical equilibrium; Acids, bases and salts; Electrochemistry.

AMXMA1A	**Foundation Mathematics 1** Intro to Algebra, Expressions & equations, Linear & simultaneous equations, Polynomial equations, Matrix algebra, Hyperbolic functions.
APXPH1A	**Foundation Physics 1** Mechanics: Force and Newton's laws; Momentum and impulse; Vertical projectile motion in one dimension; Work, energy & power; Doppler effect.
SEMESTER 2	
AAXCH2A	**Foundation Chemistry 2** Organic molecules; The chemical industry.
AMXMA2A	**Foundation Mathematics 2** Polynomial equations, Partial fractions, Trigonometry (radian measure), Binomial series, Functions, Intro to differentiation, Intro to integration.
APXPH2A	**Foundation Physics 2** Electrostatics; Electric circuits; Electrodynamics; Optical phenomena; Properties of materials; Emission and absorption spectra.
EMXDR1A	**Foundation Drawing 1** Letter and number notation; Line notation; Handling of apparatus; Measurement notation; Geometrical construction; Orthographic projections; Arcs of penetration and developments; Detailed works drawing; Composite drawings.

Syllabi: ADVANCED DIPLOMA IN MECHANICAL ENGINEERING (Course code: AD0840)	
Module Code	**Module Description**
SEMESTER 1	
EMEPR4A	**Engineering Professionalism** Provide students with the knowledge and understanding of the general and necessary responsibilities of the engineering profession, the roles of engineers in society, and the need for professionalism and ethics in the engineering profession.
EMECN4A	**Engineering Economics** Explain financial statements and perform ratio analysis, cost control and its application; Classify and distribute overheads, depreciation, perform depreciation calculations, determine the effects of overheads to production cost; Apply standard costing and its utility variances, budgetary control, marginal costing to production; Explain the

	significance of waste extraction, waste recovery in relation to engineering costing.
EMAEM4A	**<u>Applied Engineering Mathematics</u>** Perform numerical analysis; Perform error analysis; Solve and estimate solutions of ordinary and partial differential equations; Demonstrate the solutions of equations using examples from mechanical engineering systems; Apply the solution techniques in polar; Cylindrical and spherical co-ordinates to mechanical engineering problems.
EMMTS4A	**<u>Material Science</u>** Identify different types of engineering materials; Processes that enhance their properties, selection and their uses.
SEMESTER 2	
EMTFM4A	**<u>Thermo-Fluids and Turbo Machinery</u>** Apply the laws of Thermodynamics and Fluid Mechanics to predict and analyse Rotor-dynamics in Turbo Machines; Specifically Turbines and Compressors, with emphasis on flow regimes, energy transformation and performance characteristics.
EMHMT4A	**<u>Heat and Mass Transfer</u>** The optimal transfer of mass and energy in modern industry cannot be over-emphasised. This module will equip students with the appropriate tools required in the prediction and analysis of the performance of units/systems involved in this process.
EMSMS4A	**<u>Solid Mechanics and Stress Analysis</u>** The purpose of this module is to equip the students with the fundamental principles of determining Stress and strain in a Mechanical system and apply Finite Element Method for numerical representation and analysis of Stress distributions in a loaded Mechanical system.
EMVCE4A	**<u>Vibration and Control Engineering</u>** This module introduces students to the theory and practice of control systems engineering, by emphasizing on the practical application of the subject to the analysis and design of feedback systems. Its enables the student to develop representative models of real vibrating systems, to determine and control the dynamic systems performance and behaviour parameters under a given set of constraints.
YEAR MODULE	
EMRMD4A	**<u>Research Methods and Engineering Design Project</u>** The student will be guided in order to: identify a mechanical engineering design problem, set the objectives, develop the methodology, determine the project plan, determine the budgetary constraints of the project, systematically develop a solution using a step-by-step scientific approach, and present the solution in a scientifically written design project report to a panel of assessors.

Syllabi: POSTGRADUATE DIPLOMA IN MECHANICAL ENGINEERING (Course code: PG0840)	
Module Code	**Module Description**
SEMESTER 1	
EMEAM5A	**Advanced Engineering Mathematics** The purpose of this module is to provide participants with the skills, knowledge and attitudes required to further extend the concepts learned in Advanced Mathematics 1 to include the topics of Integral Calculus, Complex Numbers, Differential Equations, Statistics and Linear Algebra. The module aims to show the relevance of mathematics to engineering and applied science. This module, in conjunction with Applied Engineering Mathematics, also facilitates articulation to Degree courses in all streams of Engineering and forms a basis for more specialist branches of mathematics.
EMEMS5A	**Engineering Modelling and Simulations Module 1** The module is aimed at identifying simple mechanical engineering systems in order to build representative analytical models for simulating their behaviour and system characteristics using computational techniques. It identifies and models simple fundamental laws and principles in which mechanical engineering systems are operating and their physical activities.
EMEIC5A	**Internal Combustion Engine Analysis** The module enables students to apply the fundamental principles of thermo-chemistry that govern the design, analysis and operation of internal combustion engines. The emphasis here is on thermodynamics, combustion chemistry and mass flow processes relevant for the design, performance, efficiency, emission control and fuel requirements of both the Spark Ignition (SI) and Compression Ignition (CI) engines.
EMEMM5A	**Maintenance Management** Requires managerial experience in business practice in the maintenance environment. It will provide the understanding of the principles, ethics, and skills to manage maintenance activities in organizations, under different organizational circumstances.
SEMESTER 2	
EMECM5A	**Continuum Mechanics** This module offers an in depth clear understanding of the tensor notation, three-dimensional stress strain relationships, Stress strain law in elasticity, and Stress functions in the determination of principal stresses, principal planes and their principal directions. Analysis of the

	kinematic and mechanical behaviour of materials modelled on a continuum assumption. Development of the constitutive equations to characterise the behaviour of specific ideal materials, which are homogeneous and isotropic in nature.
EMEES5A	**Energy Systems** The module enables students to identify, discuss and evaluate different energy systems, old and new technologies. Also included is a study of mechanisms and processes for cycles and system integration, the sizing of plant components for required output, what they cost, and what is their benefit or impact (plus mitigation strategies) on the natural environment. The module also enables student to proffer solutions to a given energy demand scenario using the *Thermoptim* software.
EMEMS5B	**Engineering Modelling and Simulations Module 2** This course examines a variety of engineering system modelling and simulation methods, as well as numerical and computer based solution techniques utilized in industrial and engineering environments. Techniques for finding solutions to these systems include: graphical, algebraic, numerical, state space, simulation and computational processes. Case studies in industry and engineering applications are used to illustrate the techniques and modelling concepts. Examples of simulation and analysis methods will be related to the linear and non-linear, deterministic and non-deterministic systems.
EMEPM5A	**Production and Manufacturing** The purpose of this module is to enable the student understand the concepts of production and manufacturing, and to apply the knowledge in designing of appropriate manufacturing systems for optimal productivity. This module will give student in-depth knowledge of how to use Hand and Power tools effectively. More so, the module give a practical introduction to what can be a very complex subject ,and significant update and revised to include new material on current health and safety legislation, gauging and digital measuring instruments as well as modern measuring techniques such as laser scan micrometre, co-ordinate and visual measuring systems.
EMERE5A	**Refrigeration and Air-conditioning** This module aims at providing students with in-depth knowledge on how to design, develop simulate and analyze Heating, Refrigeration and Air Conditioning processes and systems in a given industrial or commercial setup. It also enables learners to explore new developments in the field.
YEAR MODULE	
EMEAR5A	**Applied Research Methodology in Mechanical Engineering** This module offers students a clear understanding of research methodologies, sourcing and interpretation of researched topics, how

	to explain research work done in seminar presentations, and the compilation of a technical report on the selected topic.

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