DUT
DURBAN UNIVERSITY OF TECHNOLOGY

# 2016 HANDBOOK
# ELECTRICAL POWER ENGINEERING

FACULTY OF ENGINEERING & THE BUILT ENVIRONMENT

# HANDBOOK FOR 2016

# FACULTY OF ENGINEERING AND THE BUIILT ENVIRONMENT

## DEPARTMENT of ELECTRICAL POWER ENGINEERING

## DEPARTMENTAL VISION

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

## DEPARTMENTAL MISSION

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

(Updated: 13 April 2010)

## DEPARTMENTAL AIMS AND OBJECTIVES

The general aims and objectives of the department are:

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

## WHAT IS A UNIVERSITY OF TECHNOLOGY?

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

## CONTENTS



### IMPORTANT NOTICE

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

### NOTE TO ALL REGISTERED STUDENTS

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

## 1. CONTACT DETAILS

**All departmental queries to**:

| | |
|---|---|
| Secretary: | Ms R Naidoo |
| Tel No: | 031 373 2062 |
| Fax No: | 031 373 2063 |
| Location of Department: | Steve Biko Campus, S7 L300 |

**All Faculty queries to:**

| | |
|---|---|
| Faculty officer (Acting): | Ms N Singh |
| Tel No: | 031 373 2718 |
| Fax No: | 031 373 2719 |
| Location of Faculty office: | Steve Biko Campus, S4 L300 |

| | |
|---|---|
| Executive Dean: | Prof T Andrew |
| Tel No: | 031 373 2720 |
| Fax No: | 031 373 2724 |

Location of Executive Dean's office: Steve Biko Campus, S8 L5

## 2. STAFFING

| | Name and Qualification |
|---|---|
| **Head of Department:** | Mr T Akindeji MSc (OAU); MSAIEE |
| **Associate Professor:** | Dr P Naidoo PhD; MBA; MSc Elect. Eng; B Eng; FSAIEE; RSA; SMIEEE USA; MIET UK |
| **Senior Lecturer:** | Mr E R Bussy MSc (UKZN); NDT (TN); Dip. Dat. (UNISA); GCC |
| **Lecturers:** | Mr E E Ojo MSc<br>Mr C Leoaneka MSc<br>Mr K Loji B. Tech. Eng. (VUT); MSAIEE<br>Mr R A Stops B. Tech Eng. (TN); BMDP; MSAIEE |
| **Junior Lecturers:** | Mr D Chetty B. Tech Eng. (DUT)<br>Mr F Dube BSc<br>Mr M Estrice B. Tech (DUT); NTD; HDE; Pr Tech (ECSA)<br>Ms N Loji B. Tech (DUT)<br>Mr D Reddy B. Tech Eng. (DUT) |
| **Secretary**: | Ms R Naidoo; B. Tech: Commercial Administration (MLST) |
| **Senior Technician:** | - |
| **Technicians**: | Mr S Moodlier B. Tech: Management (DUT)<br>Mr D L Ramouthar |
| **Technical Assistant:** | Vacant |

## 3. PROGRAMMES OFFERED BY THE DEPARTMENT

The engineering profession contributes to the technical, social, economic and environmental infrastructure of the country, leading to socio-economic growth. A framework of engineering qualifications develops the human resources essential for sustaining the profession.

Programmes are offered in this Department which, upon successful completion, lead to the award of the following qualifications:

| Qualification | SAQA NLRD Number |
|---|---|
| ND: Engineering: Electrical: (Heavy Current) | 72228 |
| B TECH: Engineering: Electrical: (Heavy Current) | 72129 |
| M ENG: Engineering | 96827 |
| D ENG: Engineering | 96812 |

## 4. PROGRAMME INFORMATION AND RULES: NATIONAL DIPLOMA: ENGINEERING: ELECTRICAL

This qualification is designed for the development of engineering technicians. A graduate with this qualification will be competent to apply technical knowledge, engineering principles and problem-solving techniques in the field of Electrical Engineering by operating within the relevant standards and codes in collaboration with other members of the engineering team.

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

- Practise Electrical Engineering activities and applications at the level expected of a Professional Technician (Engineering).
- Manage Electrical Engineering activities and applications at the level expected of a Professional Technician (Engineering).
- The qualified person will be able to apply to register with the Engineering Council of South Africa (ECSA) as a candidate Technician-in-Training in the field of Electrical Engineering.

This diploma is abbreviated as **N. Dip.**

### Diploma Phase-out Plan

(As approved by the University Senate on 26 August 2015)

Important information for current and prospective students (effective as of January 2016):

The current National Diploma: Engineering: Electrical (Heavy Current) will be phased out starting in 2016 to allow for the introduction of the new Bachelor of Engineering in Power Engineering.

The last cohort of first-time entering students admitted to this National Diploma qualification will be in January 2016.

Notwithstanding all the current rules (both General rules and Departmental Rules) that regulate this diploma, the last semester in which any student may register for each of the subjects is listed as follows:

| Subject Name | Last Possible Semester of Registration |
|---|---|
| Computer Skills I | July 2016 |
| Communication Skills I | July 2016 |
| Electrical Engineering I | July 2016 |
| Mathematics I | July 2016 |
| Projects I | July 2016 |
| Electronics I | July 2016 |
| Electrical Engineering II | July 2017 |
| Mathematics II | July 2017 |
| Projects II | July 2017 |
| Electronics II | July 2017 |
| Digital Systems I | July 2017 |
| Mechanics I | July 2017 |
| Strengths of Materials II* | July 2017 |
| Electrical Machines II | July 2018 |
| Electrical Engineering III | July 2018 |
| Mathematics III | July 2018 |
| Industrial Electronics II | July 2018 |
| Digital Systems II | July 2018 |
| Mechanical Technology I | July 2018 |
| Strengths of Materials III* | July 2018 |
| Electrical Machines III | July 2019 |
| Electrical Distribution III | July 2019 |
| Electrical Protection III | July 2019 |
| Design Project III | July 2019 |
| Power Electronics III | July 2019 |
| Mechanical Technology II | July 2019 |
| Mechanical Technology III* | July 2019 |
| Experiential Learning I (P1) | January 2020 |
| Experiential Learning II (P2) | July 2020 |
| * Subjects for extra credit are not required for the Diploma | |

**The dates stated in this rule are subject to change depending on the effective approval date for the new HEQF aligned programmes.**

a) **Suitable Candidate Selection**

i. On the basis of a variety of placement assessments, successful applicants for study towards a National Diploma will be accepted into either a three-year minimum or an augmented, four-year minimum programme of study. An augmented curriculum is devised in order to enhance student development and to improve the student's chances of successful completion.

ii. The department reserves the right to request prospective students to undergo an aptitude test.

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

iv. Final selection (into either the mainstream or foundation programmes) is made at the full discretion of the Head of Department based on a number of factors including class size, equity etc.

b) **Minimum Admission Requirements**

In addition to the general admission requirements as stated in the General Rules, the following minimum requirements (or their equivalent) shall apply:

i. Senior Certificate (SC) Symbols

| | |
|---|---|
| Mathematics | HG E or SG C |
| Science | HG E or SG C |
| English | HG Pass or SG Pass |

In addition, a student must obtain a minimum of a total score of 35 when using the following scoring system for Senior Certificate Subjects* to be conditionally accepted into a mainstream programme (less than a total of 35 implies conditional acceptance into a foundation programme)

Scoring system: using the table below, determine the scores associated with each SC subject result obtained, multiply the mathematics and science scores by two and add all the scores together to obtain a total.

| Symbol | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| HG | 8 | 7 | 6 | 5 | 4 | 3 |
| SG | 6 | 5 | 4 | 3 | 2 | 1 |

* Preference will be given to technical subjects

i. **National Senior Certificate (NSC) Requirements**

| | |
|---|---|
| English (Home) | 4 |
| OR English (1st Additional) | 4 |
| Mathematics | 4 |
| Physical Science | 4 |
| And three 20 Credit subjects (not more than one language) | 4 |

ii. **National Certificate (Vocational) Level 4**

The following subjects must be on the NCV Level 4 certificate, each with a minimum mark of 60 %:
English (First Additional Language)
Life Orientation
Mathematics
Physical Science

iii. **National N4 Certificate**

N4 Certificate with passes at 50% in four (4) relevant subjects including Mathematics and Electro-technics, or an equivalent SAQA NQF Level 4 qualification, as well as compliance with the English language requirements as stated in the General Rules.

c) **Programme Structure ***

The Diploma subjects are indicated in the Table below:

| **NATIONAL DIPLOMA: Engineering Electrical (Power and Plant Streams)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Name of subject** | **Subject** | **Study** | **NQF** | **Credits** | **C/E*** | **Pre-Req.** | **Exam**** |
| | **Code** | **Level** | **Level** | | | | |
| Communications Skills I | CSKI103 | 1 | 5 | 0,05 | C | Nil | No |
| Computer Skills I | CSCC101 | 1 | 5 | 0,05 | C | Nil | No |
| Electrical Engineering I | ELEN103 | 1 | 5 | 0,1 | C | Nil | Yes |
| Electronics I | ETRS101 | 1 | 5 | 0,1 | C | Nil | Yes |
| Mathematics I | MATH101 | 1 | 5 | 0,1 | C | Nil | Yes |
| Projects I | PRJT101 | 1 | 5 | 0,1 | C | Nil | No |
| Mechanics I | MECH101 | 2 | 5 | 0,1 | E | Nil | Yes |
| Electrical Engineering II | ELEN202 | 2 | 5 | 0,1 | C | ELEN103, MATH101 | Yes |
| Electronics II | ETRS201 | 2 | 5 | 0,1 | C | ETRS101, MATH101 | Yes |
| Digital Systems I | DSYS102 | 2 | 5 | 0,1 | E | Nil | Yes |
| Mathematics II | MATH201 | 2 | 5 | 0,1 | C | MATH101 | Yes |
| Projects II | PRJT201 | 2 | 5 | 0,1 | C | PRJT101 | No |
| Mechanical Technology I | MTCH101 | 3 | 5 | 0,1 | E | MECH101 | Yes |
| Strength of Materials II | SMAT302 | 3 | 5 | 0,083 | E | MECH101 | Yes |
| Electrical Engineering III | ELEN302 | 3 | 6 | 0,1 | C | ELEN202 | Yes |
| Electrical Machines II | EMAH202 | 3 | 5 | 0,1 | C | ELEN202 | Yes |
| Industrial Electronics II | IETS201 | 3 | 5 | 0,1 | C | ETRS201, MATH201 | Yes |
| Digital Systems II | DSYS202 | 3 | 5 | 0,1 | E | DSYS102 | Yes |
| Mathematics III | MATH301 | 3 | 6 | 0,1 | C | MATH201 | Yes |
| Mechanical Technology II | MTCH201 | 4 | 5 | 0,1 | E | MTCH101 | Yes |
| Strength of Materials III | SMAT302 | 4 | 6 | 0,083 | E | SMAT202 | Yes |
| Design Projects III | DSPJ301 | 4 | 6 | 0,1 | C | PRJT201, | |
| | | | | | | ELEN302 | No |
| Electrical Distribution III | EDIS301 | 4 | 6 | 0,1 | C | ELEN302 | Yes |
| Electrical Machines III | EMAH302 | 4 | 6 | 0,1 | C | EMAH202 | Yes |
| Electrical Protection III | EPRT301 | 4 | 6 | 0,1 | C | ELEN302 | Yes |
| Mechanical Technology III | MTCH301 | 4 | 6 | 0,1 | E | MTCH201 | Yes |
| Power Electronics III | PETR301 | 4 | 6 | 0,1 | E | IETS201 | Yes |
| Experiential Learning I | EXEP101 | - | 5 | 0,5 | C | ELEN103 | No |
| Experiential Learning II | EXEP201 | - | 6 | 0,5 | C | ELEN202 | No |

* Approved with effect 01 January 2015

Total formal time doing subjects: 2 years; Experiential Learning: 1 year*; Total credits for Graduation (minimum): 3

C = Compulsory; E = Elective; ** Subjects without NO for exams are "Continuously Evaluated"

i. Students choosing to follow the Power Plant stream will choose to do Mechanics I and Mechanical Technology I & II. They may also do Mechanical Technology III and Strengths of Material II & III for extra credit.

ii. Students choosing to follow the Power Systems stream will choose to do Digital Systems I & II and Power Electronics III.

Notwithstanding the rules for subjects allocated to streams, a student

who has passed all compulsory subjects, and has obtained 2.0 credits (SAQA), and has completed the two Work Integrated Learning Modules, (Experiential Learning I & II) shall apply to be accepted for graduation.

**d) Assessment Plan**

As indicated in the Tables, some subjects are continuously evaluated, while others are assessed with a combination of course work and final examination.

i. Continuously Evaluated Subjects
The method of evaluation for these subjects is stipulated in the relevant subject Study Guide.
(1) Course Work and Examined Subjects
(2) Course marks will be calculated as follows:
Tests (at least two) constitute 70% of course mark.
Assignments and practical component together constitute 30% of course mark

ii. A sub-minimum mark of 50% for the course practical component is required to obtain a valid course mark for the particular subject.

iii. A minimum course mark of 40% must be obtained to enable a student to write the final examinations.

iv. Only registered students qualify for a course mark.
A sub-minimum examination mark of 40% must be obtained to enable a student to pass.
(1) In accordance with G 15(9), the final pass mark is calculated as follows:
Examination - 60% Course mark - 40%
(2) A final mark of at least 50% is required to pass.

**e) RE-REGISTRATION RULES**

i) No registration for any subject will be allowed later than one week after commencement of lectures, unless the student has obtained PRIOR permission from the Head of Department to register late. In addition, students who, for any reason, are unable to register during the published registration periods, must obtain permission to attend class from lecturers concerned before the end of the first week of lectures.

ii) No student will be allowed to register for a subject if there is a timetable clash with any other subject. In the event of there being a clash then the student will be required to register for the subject from the lowest level of the qualification for which they are registering.

iii) Deleted wef 01 Jan 2015

## f) PROMOTION TO A HIGHER STUDY LEVEL

i. Deleted with effect 01 January 2015.

ii. S2 to S3

The student must pass all study level S1subjects before registering for any subjects in study level S3.

iii. S3 to S4

The student must pass all study level S2 subjects before registering for any subjects in study level S4.

## g) MONITORING OF ACADEMIC PROGRESS

Students registered for this Diploma are required to meet the following progression rules:

i. The student must pass a minimum number of subjects to accumulate at least 0.25 credits for each semester of registration of the first four semesters of registration. In addition, the student must accumulate at least 1.5 credits by the end of the fifth semester of registration. (This does not include Work Experience registrations.)

ii. For each of study levels S1 to S3, a student must pass a minimum of 0.25 credits to be promoted to the next level.

iii. Notwithstanding the above, a student is required to accumulate 2.0 credits to complete all the subject requirements for the Diploma in six semesters of registration.

iv. A student who fails any subject twice will not be permitted to re-register.

A student who fails to meet any the above progression requirements will have an Exclusion Status placed on his academic record and further registration will not be permitted. (The student may appeal this ruling in accordance with the University General Rules.)

(Revised with effect 01 January 2015)

## h) ABSENCE FROM CLASS TESTS AND PRACTICAL SESSIONS

A special test may be granted by the Head of Department to a student who has been prevented from taking a test:

(Where the student is unable to return to class within two days of missing the event, it is the student's responsibility to contact the department to inform them of the late return. Documented proof of the reasons for absence must then be submitted within two (2) working days of returning.)

i. By illness on the day of the test or immediately before it, provided that he/she submits a medical certificate on the prescribed form G194 on which a medical practitioner,

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

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

**OR**

ii. By circumstances which in the opinion of the Head of Department were beyond his/her control at the time of the test provided that satisfactory evidence of such circumstances is provided. Such circumstances shall not include:

(1) any misinterpretation by him/her of the date, time or venue of the test;

(2) transportation difficulties, where his/her residential term time address is within the area serviced by a scheduled bus or commuter train service to central Durban area, and provided otherwise that he/she informs the Head of Department of such difficulty prior to the time of commencement of the test;

(3) failure by him/ her to bring to the test venue any equipment normally required for that subject as specified in the study guide for the particular subject;

(4) participation in events, unless the student is granted permission to be absent BEFORE the evaluation takes place.

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

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

## i) CONDUCT

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

(1) Class Rooms and Laboratories

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

## j) TOOLS

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

## k) PROJECT FEE

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

## l) WORK INTEGRATED LEARNING (WIL)

Work integrated learning within the electrical power industry forms an essential part of the requirements for the National Diploma: Engineering: Electrical (Power). Such formal experiential learning as specified by the departmental experiential learning program is uniquely competency based with predefined outcomes. This incorporates a recommended syllabus in which proven competencies are to be developed. Variations to such syllabi in individual cases, is possible, subject to prior written motivation to the department and its subsequent approval.

It is the student's responsibility to investigate and secure appropriate experiential learning opportunities within the industry. The onus is upon the student to verify that experiential learning offered by a service provider, complies with departmental requirements prior to commencement of such learning and or paying any training fees.

Registration procedures may be conducted with the department though electronic media.

An informative overview guide to the competency based experiential training requirements of the department is available in both hard copy and electronic formats.

**Note:** Rules indicated here-under are subject to the competency based departmental requirements as indicated and explained in the experiential learning guides.

i. Electrical Engineering Practice I [P-I] (0.5 credits)
   (1) Pre-requisites: Complete ALL Diploma subjects BEFORE commencing Experiential Learning I (*Approved by Senate wef 01 January 2016*)

(2) Minimum duration: 6 months, of prior specified and departmentally approved, competency based, full time training to specification in accordance with the departmental syllabus.
(3) Academic reporting: Portfolio development to departmental experiential learning outcome standards.

ii. Electrical Engineering Practice 2 [P-2] (0.5 credits)
(1) Pre-requisites: Complete Experiential Learning I, and ALL Diploma subjects BEFORE commencing Experiential Learning II. (*Approved by Senate wef 01 January 2016*)
(2) Minimum duration: 6 months, of prior specified and approved competency based training, conducted in industry in accordance with the departmental exposure domain guide.
(3) Academic reporting: Portfolio development plus industrial project report both to departmental academic experiential learning outcome standards.

iii. Departmental/ Faculty Registration
(1) Module registration must be departmentally approved, prior to engaging in any experiential learning activities.
(2) Registration is not subject to any census date.
(3) Deleted with effect 01 January 2015
(4) Module registration: Subject to approval of documents in point C 3 above, plus the payment of the required academic and registration fees applicable. Module registration must be concluded within ONE academic month (a 28 day period excluding official institutional academic vacation periods) in which such departmentally approved training has commenced.
(5) Late registration: Will only be considered where module registration has been departmentally approved but proof of registration is outstanding. In such cases only up to the end of the second month with the proviso that the registration date will be reflected as the date of presentation of the proof of payment.
(6) Concession Registration: Considered at P-1 level only, and then by prior motivation, in support of approved technical trades. Such registration, if approved, will be subject to point C 4 and C 5 above as well as the portfolio requirement as per point B 3 above.
(7) No student may register for a full time subject at any institution while completing WIL, except Design Project III.

iv. Change of service providers
Experiential learning transfers between different service providers must meet the prior approval of the department to ensure compliance with the registered training Memory of Understanding (MoU).

v. Academic accreditation of registered modules
(1) Portfolios may not be lodged for assessment before the minimum registered training period has expired.
(2) Developed portfolios are due within 1 month of completion of the training period.
(3) Completed portfolios will be assessed in accordance with departmental experiential learning outcome standards, the reported outcomes will be subject to faculty and examination verification and notice. Unsatisfactory assessments would require re-submission to the final approval of the department.

## 5) PROGRAMME INFORMATION AND RULES: BACCALAUREUS TECHNOLOGIAE: ENGINEERING: ELECTRICAL

This degree is abbreviated as **B. Tech**

### a) PURPOSE STATEMENT: BACHELOR OF TECHNOLOGY: ENGINEERING: ELECTRICAL

The engineering profession contributes to the technical, social, economic and environmental infrastructure of the country, leading to socio-economic growth. A framework of engineering qualifications develops the human resources essential for sustaining the profession. Within that framework, this qualification is designed for the development of engineering technologists.

A qualifying student will be competent to design, implement and control production, testing, planning, construction, commissioning and maintenance in the field of Electrical Engineering by applying technical knowledge, engineering principles, innovative design, problem-solving techniques and managerial skills. He/ she will be capable of exercising independent technological judgment and responsible decision making by taking into account the relevant financial, economic, commercial, social, environmental and statutory factors.

The qualification:

- is a planned combination of the following exit level outcomes that culminate in the competence specified in the purpose statement:
- Practice Electrical Engineering activities and applications at the level expected of a Professional Technologist (Engineering)

- Manage Electrical Engineering activities and applications at the level expected of a Professional Technologist (Engineering)
- serves as a basis for further learning in the field of Electrical Engineering, but could also lead to learning in the related fields of Mechanical Engineering and Computer Systems Engineering.

The qualification adds value to the student as it provides for:

- employment possibilities as an Electrical Engineering technologist.
- status as a Professional Technologist (Engineering).
- marketability in terms of the competencies listed in the specified outcomes.
- a contribution to the economy through employment or self-employment.
- Supports the objectives of the NQF in that it fits within the framework of the NQF, accommodates all forms of formal and non-formal learning through recognition within the stated specified outcomes-framework, and promotes mobility and articulation through the system of credits attached to the framework of specified outcomes.
- The qualified person will be able to register with the Engineering Council of South Africa (ECSA) as a Candidate Technologist in the field of Electrical Engineering.

**b) Admission Criteria**

i. The entrance qualification is the National Diploma: Engineering: Electrical; subject to having been completed within 8 semesters of registration, (including all experiential training requirements).

ii. Persons in possession of other similar qualifications may apply to have them evaluated for acceptance.

## c) Programme Structure

From the table below, do eight subjects. One these eight subjects must be Industrial Project IV. Another four must be chosen from those listed with a **C** in the **C/O** column.

| **Baccalaureus Technologiae: Engineering Electrical: (Heavy Current)** | | | | | | |
|---|---|---|---|---|---|---|
| **Code** | **Subjects:** | **C/O*** | **Assessment Method** | **NQF** | **Pre-requisite** | **Co-req.** |
| EMAH402 | Electrical Machines IV | C | Exam | 7 | Electrical Machines III | |
| EPRT401 | Electrical Protection IV | C | Exam | 7 | Electrical Protection III | |
| ELMF401 | Electric and Magnetic Field Theory IV | C | Exam | 7 | Electrical Engineering III | |
| HVEN401 | High Voltage Engineering IV | C | Exam | 7 | Electrical Engineering III | |
| CRTA401 | Circuit Analysis IV | C | Exam | 7 | Electrical Engineering III | |
| | Illumination IV | C | Exam | 7 | Electrical Engineering III | |
| | Plant Engineering and Legal Knowledge IV | C | Exam | 7 | Electrical Engineering III | |
| PETR401 | Power Electronics IV | C | Exam | 7 | Electrical Engineering III | |
| PSYS401 | Power Systems IV | C | Exam | 7 | Electrical Engineering III | |
| PRTC401 | Protection Technology IV | C | Exam | 7 | Electrical Engineering III | |
| EMTH401 | Engineering Mathematics IV | O | Exam | 7 | Mathematics III | |
| EMGT402 | Engineering Management IV<br>**OR**<br>Entrepreneurship IV | O | | 7<br><br>7 | | |
| PRMN401 | Project Management IV | O | | 7 | | |
| INPR401/11/21 | Industrial Project IV | C | Continuous | 7 | | |
| *C = Compulsory; O = Optional<br>A minimum of four (4) compulsory (C) subjects PLUS Industrial Project MUST be offered.<br>Industrial Project IV is ALWAYS compulsory | | | | | | |

## d) INDUSTRIAL PROJECT IV

(1) An industrial project having a minimum duration 300 hours must be undertaken.

(2) The project is supervised by Durban University of Technology staff.

(3) Unless special permission is granted by the Head of Department, Industrial Project IV may only be registered after the student has obtained at least 0.4 subject credits.

(4) Where all requirements of Industrial Project IV have been met within the first two registrations, the credit will be deemed to have been obtained at first attempt and in one semester for the purposes of rule G(18)(9)(a)(I).

## e) ASSESSMENT PLAN

As indicated in the Tables, some subjects are continuously evaluated, while others are assessed with a combination of course work and final examination.

i. Continuously Evaluated Subjects

The method of evaluation for these subjects is stipulated in the relevant subject Study Guide.

ii. Course Work and Examined Subjects

(1) Course marks will be calculated as follows:

Tests (at least two) constitute 70% of course mark.

Assignments and practical component together constitute 30% of course mark

(2) A sub-minimum mark of 50% for the course practical component is required to obtain a valid course mark for the particular subject.

(3) A minimum course mark of 40% must be obtained to enable a student to write the final examinations.

(4) Only registered students will qualify for a course mark.

(5) A sub-minimum examination mark of 40% must be obtained to enable a student to pass.

(6) In accordance with G 15(9), the final pass mark is calculated as follows:

Examination - 60% Course mark - 40%

(7) A final mark of at least 50% is required to pass.

## f) EXEMPTIONS

i. Where tuition is not provided at the Durban University of Technology, a student may apply to the Head of Department to study the subject at another university of technology and be exempted from doing the subject at this University.

ii. Exemptions will only be given for a maximum of 0.5 credits.

## g) RE-REGISTRATION RULES

i. No registration for any subject will be allowed later than one week after commencement of lectures, unless the student has obtained PRIOR permission from the Head of Department to register late. In addition, students who, for any reason are unable to register during the published registration periods, must obtain permission to attend class from lecturers concerned before the end of the first week of lectures.

ii. No student will be permitted to register for any subject combination where the lectures are given on the same time in the timetable.

iii. Deleted wef 01 Jan 2015

## h) MONITORING OF ACADEMIC PROGRESS

i. The student must pass a minimum number of subjects to accumulate at least 0.1 credits for every semester of registration.

ii. Notwithstanding the minimum progress requirement in 5. g. i. above, a part-time student is required to complete ALL the subjects for the B. Tech in six semesters.

iii. A student who fails any subject twice will not be permitted to re-register.

iv. From the first registration for Industrial Project IV, a student must complete it within two consecutive semesters, or the student will NOT be permitted to continue with the degree.

A student who fails to meet any the above progression requirements will have an Exclusion Status placed on his academic record and no further registration will be permitted.

## i) METHOD OF TUITION

i. Tuition is provided for the majority of students who are registered on a part time basis. The department cannot guarantee that enough subjects will be available for students who wish to register on a full-time basis.

ii. Subjects can only be offered where the department has the capacity and where there is sufficient demand.

## j) ABSENCE FROM CLASS TESTS AND PRACTICAL SESSIONS

A special test may be granted by the Head of Department to a student who has been prevented from taking a test:

(Where the student is unable to return to class within two days of missing the event, it is the student's responsibility to contact the department to inform them of the late return. Documented proof of the reasons for absence must then be submitted within two (2) working days of returning.)

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

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

**OR**

ii. By circumstances which in the opinion of the Head of Department were beyond his/her control at the time of the test provided that

satisfactory evidence of such circumstances is provided. Such circumstances shall not include:

(1) any misinterpretation by him/her of the date, time or venue of the test;

(2) transportation difficulties, where his/her residential term time address is within the area serviced by a scheduled bus or commuter train service to central Durban area, and provided otherwise that he/she informs the Head of Department of such difficulty prior to the time of commencement of the test;

(3) failure by him/ her to bring to the test venue any equipment normally required for that subject as specified in the study guide for the particular subject;

(4) participation in events, unless the student is granted permission to be absent BEFORE the evaluation takes place.

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

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

## k) CONDUCT

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

(1) Class Rooms and Laboratories

(2) Disruptive behaviour and vandalism will be dealt with in terms of the student disciplinary code.

(3) Eating, smoking or drinking in the classrooms is strictly forbidden.

(4) Safety rules must be strictly observed at all times.

(5) Attendance and punctuality are essential.

## l) APPEALS

Any student wishing to appeal against the implementation of any of these rules must do so in terms of Rule G1 in the general rule book for students.

## 6) RULES FOR POST GRADUATE DEGREES

a) NAME OF DEGREE: MASTER OF ENGINEERING

This is abbreviated as **M Eng**

i. PURPOSE STATEMENT

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

ii. Rules

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

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

b) NAME OF DEGREE: DOCTOR OF ENGINEERING

This is abbreviated as **D Eng**

i. PURPOSE STATEMENT

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

ii. RULES

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

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

## 7) SUBJECT CONTENT
## a) NATIONAL DIPLOMA LEVEL COURSES

**COMPUTER SKILLS I:**
Microcomputer; Software; Computer utilisation.

**COMMUNICATION SKILLS I:**
Communication theory; Oral presentation; Technical writing skills; Group communication skills.

**DESIGN PROJECT III:**
The design, construction, testing and documentation of a complete project in electrical engineering. The standard of which is to be comparable with this level of study.

**DIGITAL SYSTEMS I:**
The decimal, binary and hexadecimal number systems. The BCD system. Conversion between systems. Alphanumeric binary codes. Parity. Gray code. Basic logic functions. The AND, OR and NOT. The NAND, NOR XOR and XNOR. The universality of NAND and NOR. Dual symbols. Simplification using Boolean algebra. Simplification using the Karnaugh map. Combinational logic circuits. Functions of combinational logic, Adders, Comparators, Decoders, Encoders, Code converters, Multiplexers and Demultiplexers. Sequential logic circuits. Latches and Flip-Flops. Shift registers. Counters.

**DIGITAL SYSTEMS II:**
Sequential logic circuits. JK and D flip flops and latches, operation, applications, timing diagrams, counters, shift registers, serial/parallel data transfer, sequence tables, astable and monostable multivibrators. Interfacing and data converters. Interface busses, digital to analog and analog to digital converters, parameters and performance issues. Memory devices. Data and Program memory devices. Flash memories. Application in microcomputers. Integrated circuit technologies. Displays. Multiplexing.

**ELECTRICAL DISTRIBUTION III:**
Introduction; Generation Technologies; Tariffs; Switch-gear and Sub-station Technology; Overhead lines; Underground cables and insulation co-ordination; Quality of Supply and Energy Efficiency; New developments.

**ELECTRICAL ENGINEERING I:**
Quantities and applications; Batteries; DC theory network analysis; Measurements; Electromagnetism; Magnetic circuits; Inductance; Capacitance; Basic A.C. theory.

**ELECTRICAL ENGINEERING II:**
A.C. Networks; Resonance; Power factor correction; Circuit theorems (DC and AC network analysis); Harmonics; Three-phase circuits.

**ELECTRICAL ENGINEERING III:**
Advanced three-phase circuits; Transmission lines; Power systems; Fault analysis

**ELECTRICAL ENGINEERING PRACTICE I:**
(Assessed through a portfolio development) Orientation; Safety and first aid; Basic hand skills; Measuring instruments; Motor starters and generators; Industrial lighting, Conduits/cables and wiring work; Programmable devices; Variable speed drives; Industrial instruments. Various electives apply

**ELECTRICAL ENGINEERING PRACTICE II:**
(Assessed through a portfolio development) On -site working exposure in design, installation, maintenance to, testing and fault finding on and or commissioning on three of the following:- Generation Technology, Electrical distribution and reticulation, Electrical protection, Electrical machinery, Electrical plant maintenance, Quality of electric supply and energy management.

**ELECTRICAL MACHINES II:**
Single phase transformers - Construction, Principles of Operation, Loading, regulation, Efficiency, Testing. Moving machinery Introduction. Synchronous machines - Construction, Principle of operation. Induction machines - Construction, Principle of Operation, Starting, Speed, Torque. DC machines - Construction, Types, Design of Generators, Design of Motors, Starters and Speed Control

**ELECTRICAL MACHINES III:**
DC Machines - Armature Reaction, Commutation. Three phase transformers - Nomenclature and connections, Construction, Parallel operation, Windings, Materials, Oils and insulants, magnetic circuits, tap Changing, auto-transformers. Induction motors - Equations and Phasor Diagrams, Circle Diagram, Steady state performance, Starting, Speed Control, Braking. Synchronous machines - Synchronous Power and Torque, Voltage regulation, Load Diagrams, V-curves, Parallel operation. Special machines of the following machines: Instrument Transformers, Single phase fractional-kilowatt motors.

**ELECTRICAL PROTECTION III:**
Introduction; Fundamental theory; Over voltage protection; Fault calculations; Fuses and links; Circuit-breaker analysis and testing under fault conditions; Instrument transformers; Protective relays; Elementary protection schemes.

**ELECTRONICS I:**
Basic measurements; Semiconductor theory; Diodes; Transistor theory; Applied technology.

**ELECTRONICS II:**
Field effect transistors; Other semiconductor devices; Basic rectification; Single stage transistor amplifiers; Operational amplifiers; Applied technology.

**INDUSTRIAL ELECTRONICS II:**
Basic Instrument Systems. Measurement and Control Systems. Performance Terms Errors, Calibration, Standards. Sensors Temperature (RTD's, Thermocouples, Thermistors), Pressure (Bourdon Tube, Bellows, Capacitance, Ultra sonic), Flow (Mag flow meters), Speed Tachometers), Displacement Transducers (LVDT's). Signal Convertors - Signal Conditioning, Wheatstone bridge, Potentiometer Measurement System, Signal processing, Amplifiers, Signal Transmission. Displays Types, Operation. Fibre Optics - Light acceptance, Attenuation, Bandwidth, Modulation. Optical Fibre Systems. PLC's

**MATHEMATICS I:**
Determinants; Algebra; Trigonometry; Complex numbers; Hyperbolic functions; Differentiation; Integration.

**MATHEMATICS II:**
Differentiation; Integration; Matrix algebra; Differential equations (1st/2nd order)

**MATHEMATICS III:**
Fourier Analysis; Differential equations (La Place)

**MECHANICAL ENGINEERING DRAWING I:**
Instruments; Sketching; Pictorial drawing; Orthographic projection; Mechanical Engineering; Drawing

**MECHANICS I:**
Static's; Dynamics

**MECHANICAL TECHNOLOGY I:**
Toothed gears; Clutches; Belt and rope drives; Block and band brakes; Governors; Conveyors; Dynamics; Hoists, haulage and rope ways; Wire ropes; Balancing; Introduction to gas laws.

**MECHANICAL TECHNOLOGY II:**
Thermodynamics; Steam and steam generation; Internal Combustion engines; Combustion of fuels; Air compressors: Bearings; lubrication; Refrigeration and air conditioning; Pollution and water purification.

**MECHANICAL TECHNOLOGY III:**
Thermodynamics; Turbines; Hydrodynamics; Flow; Pumps; Fluid couplings; Fans; Materials.

**POWER ELECTRONICS III:**
Introduction to Power Electronics; Power semiconductor switches; Conduction and switching Losses; Power Diodes - ratings and protection, series and parallel operation of diodes; Power Transistors; Power Metal-oxide Semiconductor Field-Effect Transistors (MOSFETS); Insulated Gate Bipolar Transistors (IGBTS); Thyristor Devices - SCR and its characteristics, ratings and power loss, protection, Basic SCR gate triggering; Single Phase Uncontrolled ½- and Full-wave Rectifiers; Single Phase ½- and Fully-Controlled Rectifiers; Applications

**PROJECTS I:**
Introduction to project work; Basic hand skills; Design and manufacture of a small project; report writing

**PROJECTS II:**
Basic electrical drawing; Computer aided design (AUTOCAD); The design and manufacture of a more complex project; report writing.

**STRENGTH OF MATERIALS II:**
Stress and strain; Shear force and bending moment; Torsion and circular shafts; Helical springs; Thin cylinders; Frames; Testing of materials

**STRENGTHS OF MATERIALS III:**
Framed structures (space); Catenaries; S.F. and B.M (built in beams, propped cantilevers); Uniformly varying loads; Moment of inertia; Bending stress; Eccentric loading; Reinforced concrete beams; Fatigue.

## b) B. TECH LEVEL COURSES

**ENGINEERING MATHEMATICS IV:**
Matrix theory, Complex analysis, Z-Transforms, Fourier Transforms

**ELECTRICAL PROTECTION IV:**
Fault calculations; The electric arc; Surge voltage theory; Earthing; Operation and transient performance of protective gear

**PROTECTION TECHNOLOGY IV:**
Practical considerations; Standards and requirements; Major elements of protective systems; Protective schemes; Testing, commissioning and operating of protective schemes

**HIGH VOLTAGE ENGINEERING IV:**
Insulation breakdown of solids, liquids and gases; High voltage generation; High voltage measurements; High voltage testing; Corona

**POWER SYSTEMS IV:**
Transmission line design parameters; Steady state operation of transmission lines; Multi-port representation of power systems and load flow analysis; Control of power; Transient operation of transmission lines; Stability; H.V.D.C. transmission; Energy management systems; Tariffs

**PLANT ENGINEERING AND LEGAL KNOWLEDGE IV:**
As required by the Government Engineer for the Government Certificate of Competency.
(NOTE: NO TUITION is given in this subject, but, exemption is given to those students who have a government Electrical Engineering Certificate of Competency.)

**PROJECT MANAGEMENT IV (CIVIL)**:
Planning of Projects; Quality and time management of projects; Quality and time management; Management systems; Computer applications; Project

**ELECTRICAL MACHINES IV:**
Generalised Machine Theory, Synchronous machines; Induction machines; Transformer harmonics

**POWER ELECTRONICS IV:**
Three phase controlled and uncontrolled converters; D.C. drives; DC/ AC Inverters; A.C. drives; Power electronics in transmission systems.

**CIRCUIT ANALYSIS IV:**
Circuits with non-linear component; Circuits under transient conditions; Two port networks and transmission lines; Switching transient analysis.

**INDUSTRIAL PROJECT IV:**
A suitable industrial project chosen in conjunction with the student's employer as approved by the department

**ELECTRIC AND MAGNETIC CIRCUIT THEORY IV:**
Principles of electro-magnetism; Electric charges; Magnetic field of steady state currents; Electromagnetic induction; Electro-mechanics

**ENGINEERING MANAGEMENT IV;**
Good Management Practices; Principles of Management; Strategic Planning; Marketing Management; Product development; Innovation; Project Management; Time; Value of Money; Law of Contracts; Human Resources; Teamwork and creativity.

## 8) GENERAL INFORMATION

a) Central Applications Office (CAO)
Private Bag X06, Dalbridge 4014.
Tel: 031268 4444,
Website: www.cao.ac.za

b) Engineering Council of South Africa (ECSA)
Private Bag X691, Bruma, 2026.
Tel: 011 607 9500,
Fax: 011 622 9295
Email: engineering@ecsa.co.za, website: www.ecsa.co.za

c) South African Institute of Electrical Engineers (SAIEE)
Secretary: Ms Gill Nortier, PO Box 22222, Glenashley, 4022
Tel/fax: 031 572 5838
Email: saiee@africa.com, website: www.saiee.org.za

d) South African Qualifications Authority (SAQA)
Postnet Suite 248, Private Bag X06, Waterkloof, 0145
Tel: 012 482 0858
Fax: 012 482 0895,
Website: www.saqa.org.za