DUT
DURBAN UNIVERSITY OF TECHNOLOGY

FACULTY OF ENGINEERING & THE BUILT ENVIRONMENT

2019 HANDBOOK
CHEMICAL ENGINEERING

HANDBOOK FOR 2019

FACULTY OF ENGINEERING AND THE BUIILT ENVIRONMENT

DEPARTMENT of CHEMICAL ENGINEERING

DEPARTMENTAL VISION AND MISSION

VISION

To be a renowned department associated with chemical engineering education, research and developing professionals relevant to the needs of a changing society.

MISSION

In pursuit of its vision, the department commits itself to:

- Educating students in preparation for societal engineering and leadership needs
- Emphasizing the relevance of applied knowledge
- Ensuring that young people are trained to value the relevance of interdisciplinary relationships while committing to professional best practice
- Engaging in relevant Chemical Engineering research and community development
- Engaging actively with stake holders to promote societal development.

What is a University of Technology?

A university of technology is characterized by being research informed rather than research driven where the focus is on strategic and applied research that can be translated into professional practice. It has a multidisciplinary approach to finding solutions while taken into account social impact of technology. 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. K Ntuli
Tel No:	031 373 2218
Fax No	031 373 2376
Location of Department:	Steve Biko Campus – S4 Level 1

All Faculty queries to:

Faculty officer:	Mrs N Singh
Tel No:	031 373 2718 / 2716
Fax No:	031 373 2719
Location of Faculty office:	Steve Biko Campus - S4 Level 3

Executive Dean:	Prof T Andrew
Tel No:	031 373 2762
Fax No:	031 373 2668
Location of Executive Dean's office:	Steve Biko Campus - S5/S6

2. STAFFING

Name and Qualification

Chemical Engineering

Head of Department: Dr YM Isa, BEng (Chem Eng & Biochem Eng) (Moscow); MEng (Chem Eng) (Moscow) PhD (Petrochemical) (Moscow)

Associate Professor: Prof Paul Musonge, PhD (London), D.I.C., FASIChE

Prof S Rathilal, PhD (Eng) (UKZN); MScEng (Chem) (UDW); BScEng (Chem) (UDW)

Senior Lecturers: Dr M Chetty, PhD (Eng) (UKZN); MScEng (Chem) (UDW); BScEng (Chem) (UDW); MBA (UKZN); MSAIChE

Ms S Vallabh, MTech (Chem Eng) (MLST); BScEng (Chem) (NU)

Dr S Ramsuroop, Chartered Engineer; PrTech (Eng); PhD (UKZN); MScEng (UDW); NHD: Chem Eng (TN); MSAIChE; MIChemE

Dr S Kiambi, PhD (Chem Eng) (ENSIACET-LGC-INPT, France); MSc(Chem Eng) (ENSIACET-LGC-INPT, France), BScEng (Chem) (Moi University, Kenya)

Lecturers: Mr G K Reddy, MScEng (UDW); NHD (Chem Eng) (MLST)

Ms C P Dlamini, BTech: Eng Chem. (DUT); MEng (Chem Eng) (DUT)

Mr P Ngema, MTech (Chem Eng) (DUT); MSc (Chem Eng) (UKZN)

Senior Technician: Mr R T Christy, NHD (Chem Eng) (MLST); BCom (Unisa); MTech (DUT)

Technicians: Mr V Moodley, MTech (Mech) (DUT); BScEng (Chem), (UDW)

Mr J. M Mohammed, PrTech, BTech (Chem Eng) (DUT)

Mr M Mbili, BTech: Eng (Chem) (DUT), BTech (Pulp and Paper) (DUT)

Mrs S Pillay, BTech: Chem Eng (DUT); MBA (Mancosa)

Pulp and Paper Technology

Head of Programme and Associate Professor: Prof Theo de Koker, PhD (US)

Senior Lecturer: Dr W J Pauck, PhD (UKZN)

3. PROGRAMME RULES (ALL PROGRAMMES)

ECE 1.1 REGISTRATION

In addition to the General Rules pertaining to Registration a student whose fees are being paid by a sponsor shall provide a letter of authority from such sponsor to this effect.

ECE 1.2 LATE REGISTRATION

1.2.1 No registration for any subject will be allowed later than one week after the commencement of lectures without prior written permission from the Head of Department.

1.2.2 No student will be permitted to add or delete subjects later than one week after the commencement of lectures.

ECE 1.3 WORK DONE DURING THE SEMESTER/YEAR

1. Unless otherwise stated the semester mark will make up 40% of the over-all mark and will be based on the results of tests, assignments and practicals where appropriate. A sub-minimum of 40% must be obtained for the semester mark in order to qualify to write the examination. The method of calculation of the year/semester mark for each subject, for the purpose of issuing a certificate is indicated in the learner guide for each subject. For year/semester marks consisting of a theory and a practical component, a sub-minimum of 40% applies to the practical component, unless stated otherwise in the learner guide
2. In addition to the general requirements for a year/semester mark, the definition of the term" attended satisfactorily" shall include:
   a) 80% attendance at all lectures and tutorials scheduled for each subject and a satisfactory completion of tutorial work;
   b) 100% attendance at all scheduled practical classes.
3. The definition of" satisfactory reason" shall include presentation of a medical certificate stating that the person was not fit to attend the lecture, tutorial or tests on the day in question

ECE 1.4 CONDUCT OF STUDENT IN LABORATORY

Rules of conduct pertaining to a specific laboratory, as instituted and amended from time to time by the heads of department, shall apply to all students using the laboratory. These rules shall be made available to the students at the beginning of each semester.

ECE 1.5 EXAMINATIONS

1. The examinations in each instructional programme where applicable will consist of theory and/or practical and/or oral examinations as indicated in the study guide.
   Unless otherwise indicated with the relevant syllabus all theory examinations will be of 3-hour duration and the marks obtained will constitute 60% of the overall mark for the subject.
   For subjects which consist of two or more modules it is necessary to pass all modules individually in order to obtain the subject credit. The normal semester mark and examination requirements apply to each module. The modules may be written during different examination sessions.

ECE 1.6 SUPPLEMENTARY EXAMINATIONS

1. No supplementary examinations will be set for practical subjects and failure in such a subject will necessitate re-attendance of the entire practical programme for that subject.

   A supplementary examination will be granted to a candidate who obtains at least 45% as a final mark. These candidates will be permitted to write the supplementary exam at the next available examination session.

ECE 1.7 AWARDING OF DIPLOMAS / DEGREES

Diplomas/degrees are not automatically awarded to students who have satisfied all of the requirements for each instructional programme. The onus is on the student to apply to the Institution for the award of the diploma/degree. In terms of Rule G18 a student must, when applicable, apply on the prescribed form to the Faculty Office at the Durban University of Technology for such diploma/degree.
In cases where in-service training is a requirement for the award of a diploma, students are required to register with the Department (Experiential Learning Coordinator) at the start of their experiential learning.

ECE 1.8 SICKNESS OR ABSENCE DURING TESTS OR PRACTICALS

Absence from tests or practicals will not be condoned. At the discretion of the Head of Department, arrangements can be made for aegrotat tests to be written. Written application must be made to the Head of Department on the prescribed form within five days of the test or practical scheduled date.

ECE 1.9 VALIDITY OF COURSE MARKS FOR RE-SIT EXAMINATIONS

Semester marks obtained for any subject are only valid for the examination in the semester in which the student is registered.

ECE 1.10 EXPERIENTIAL LEARNING

The National Diploma programme requires the student/candidate to undergo a period of experiential learning as part of the course. All prescribed compulsory subjects (instructional offerings) and the prescribed experiential component must be passed in order to obtain sufficient credits to qualify for the qualification.

Although the Durban University of Technology undertakes to assist the student/candidate in obtaining suitable experiential learning placement, the onus is on the student/candidate to find a suitable "employer". The employer must be accredited by the Institution for the purposes of experiential learning. An experiential learning agreement creates a separate contract between the "employer" and the student/candidate.

The student must fulfill all the requirements as laid out in the experiential learning manual. The experiential learning manual will be made available to students on registration for experiential learning.

Experiential Learning must be completed within 18 months from the date of first registration. If a student has not completed experiential learning within this prescribed period, the student may approach the Head of Department to request an extension on reasonable grounds; otherwise they will be excluded from the programme.

ECE 1.11 STUDENT SELECTION

The number of first-year enrolments is restricted. Student selection is based on academic merit.

ECE.1.12 EXCLUSION FROM PROGRAMMES

This rule must be read in conjunction with Rule G17 in the DUT Rule book. Where a student fails to obtain a credit in a specific instructional offering after two year/semesters of study in such offering, he/she shall not be permitted to re-register in the relevant programme at the Institution without the permission of the Senate, on the recommendation of the Head of Department subject to such additional requirements as may be imposed. In addition, the following assessments will apply:

A student must have passed 50% of the subjects comprising the instructional programme after four semesters of registered study.

Second Assessment A student must have passed all the subjects comprising the instructional programme after eight semesters of registered study.

The above includes periods of study and exemptions granted for subjects passed at any other educational institution towards the same or equivalent qualification.

A student who is prevented from re-registering in terms of Rule ECE.1.11 may appeal to the Faculty Board Executive provided there is proof of extenuating circumstances that prevented that student from completing the required number of subjects in the time allowed. A student must take such an appeal, in writing, to the Dean of the Faculty within five (5) working days of having been notified by the Head of Department that he/she is not permitted to re-register.

If the appeal succeeds, the Faculty Board Executive may set such specific conditions for re-registering as it deems fit.

4. PROGRAMMES OFFERED IN CHEMICAL ENGINEERING

Programmes are offered in chemical engineering which upon successful completion leads to the award of the following qualifications:

Qualification	SAQA NLRD Number
ND: Chemical Engineering	**72225****
B. Tech: Chemical Engineering	**72127**
Bachelor of Engineering Technology in Chemical Engineering	**98955**
Master of Engineering	**96827**
Doctor of Engineering	**96812**

** Qualification is being phased out and there is no new student intake for the qualification

Purpose of the Chemical Engineering Programmes

The Engineering profession contributes to the technological, socio-economic, built environment and environmental infrastructure of the country, facilitating socio-economic growth and sustainability. The Department of Chemical Engineering contributes to this development by providing learning opportunities by offering the following qualifications in chemical engineering: National diploma, Bachelor of Technology, Bachelor of Engineering Technology, Master of Engineering and Doctor of Engineering. These qualifications in Engineering Technology are designed to meet the needs of the country in respect of engineering competence.

The target market for the primary qualifications (National Diploma, Bachelor of Technology and Bachelor of Engineering Technology) is the chemical and allied industry. These qualifications are the starting points of career paths, and are still generic enough to allow maximum mobility, within this diverse industry. Skills, knowledge, values and attitudes reflected in these qualifications are building blocks for the development of engineering competence.

These qualifications are intended to:

- Promote the development of engineering knowledge and skills that are required to serve public and private needs.
- Release the potential of people.
- Provide opportunities for people to move up the value chain.
- Provide learners with life-long learning and articulation opportunities in the engineering profession.

All the chemical engineering courses offered are registered with The South African Qualification Authority (SAQA), and accredited by the Engineering Council of South Africa (ECSA).

In addition, the department offers the following qualifications in the specialized field of Pulp and Paper Technology: National Diploma and Bachelor of Technology. These qualifications have been registered with the South African Qualification Authority (SAQA) and are supported by the Paper Manufacturers Association of South Africa (PAMSA).

5. PROGRAMME STRUCTURES

ECE 2.1 National Diploma in Chemical Engineering Qualification Code (3208086)

Qualification is being phased out and there is no new student intake for the qualification.

A learner achieving this qualification will be competent in applying theoretical knowledge, engineering principles, proven techniques, practical experience, and appropriate skills to the solution of well-defined problems in the field of Chemical Engineering, by operating within the relevant standards and codes.

ECE 2.1.1 ENTRANCE REQUIREMENTS: NEW NSC SYSTEM

In addition to the relevant General Rules pertaining to the Registration (e.g. G3 - G10); learners must, as a minimum, have obtained the following NSC, or equivalent, subject results:

Mathematics	4 (adequate achievement)
Physical Science	4 (adequate achievement)
English (Primary)	4 (adequate achievement)
English (First Additional)	4 (adequate achievement)

Note that the subject Mathematical Literacy will not be accepted as a substitute for the subject Mathematics.

In addition, a leaner must obtain a minimum of a total score of 28 excluding Life Orientation when using the following scoring system for NSC subject results in order to be conditionally accepted into the programme.

Scoring system: using the table below, determine the scores associated with each NSC subject results obtained, and add all the scores together to obtain a total.

NSC rating Code	7	6	5	4	3	2	1
Score	7	6	5	4	3	2	1

Students who did not write the Mathematics Paper 3 (Geometry Paper) will be required to attend an additional Mathematics 1 sub-module which will be run concurrently with the normal Mathematics 1 course. The onus is on the students to prove that they wrote the Mathematics Paper 3 otherwise they will be required to attend the additional Mathematics 1 sub-module.

A person who wants to embark on a career in Chemical Engineering must have a basic knowledge of Chemistry and Physics, a logical mind, and an aptitude for the practical application of Mathematics.

ECE2.1.2 ENTRANCE REQUIREMENTS: OLD MATRIC SYSTEM

In addition to the University's English minimum requirement, the applicant must meet the following minimum requirements: A matriculation exemption, with at least a C symbol (Higher Grade) or B symbol (Standard Grade) in Physical Science and Mathematics. A pass in the subjects Technical Drawing and/or Computer Studies will be an added recommendation. Registration in the first instance will be provisional, until selection of students is made on the basis of their results.

ECE2.1.3 ENTRANCE REQUIREMENTS: NEW NC (V) SYSTEM

In addition to the relevant General Rules pertaining to the Registration (e.g. Rules G3 - G10), learners must, as a minimum, have obtained the following NC (V) subjects results:

Subject	**Result**
English (First Additional)	4 (highly competent: 70-79%)
Mathematics	4 (highly competent: 70-79%)
Physical Science	4 (highly competent: 70-79%)

Note that the subject Mathematical literacy will not be accepted as a substitute for the subject Mathematics. Students who did not write the Mathematics Paper 3 (Geometry Paper) will be required to attend an additional Mathematics I sub-module which will be run concurrently with the normal Mathematics I course. The onus is on the students to prove that they wrote the Mathematics Paper 3 otherwise they will be required to attend the additional Mathematics I sub-module.

E.C.E. 2.2. COURSE STRUCTURE

Minimum formal time - 2 years Minimum experiential time - 1 year

SUMMARY OF PROGRAMME:

ND: Chemical Engineering

Subject Offering	Code	Semester	Assessment Method	NQF Level	Pre-requisite	Co-requisite
~~Chemistry I~~	~~CHEM102~~	~~1~~	~~Examination~~	5		
~~Drawing: Chem Eng I~~	~~DRCE103~~	~~1~~	~~Continuous assessment~~	5		
~~Mathematics I~~	~~MATH101~~	~~1~~	~~Continuous assessment~~	5		
~~Physics I~~	~~PYSC105~~	~~1~~	~~Examination~~	5		
~~Communication Skills I~~	~~COSK101~~	~~1~~	~~Continuous assessment~~	5		
~~Computer Skills I~~	~~COMS101~~	~~1~~	~~Continuous assessment~~	5		
~~Inorganic Chemistry II~~	~~INCH201~~	~~2~~	~~Examination~~	5	Chemistry I	
~~Organic Chemistry II~~	~~ORCH201~~	~~2~~	~~Examination~~	5	Chemistry I	
~~Physical Chemistry II~~	~~PHCH201~~	~~2~~	~~Examination~~	5	Chemistry I	
~~Mathematics II~~	~~MATH201~~	~~2~~	~~Continuous assessment~~	5	Mathematics I	
~~Chem Eng Tech II~~	~~CENT201~~	~~2~~	~~Examination~~	5	Chemistry I	
~~Engineering Physics II~~	~~EPHY201~~	~~2~~	~~Examination~~	5	Physics I	

~~Chem Eng Tech III (3 Modules)~~	~~CENT303~~	~~3~~				
~~Chem Eng Tech 301~~	~~CENT313~~	~~3~~	~~Examination~~	6	Chem Eng Tech II	
~~Chem Eng Tech 302~~	~~CENT323~~	~~3~~	~~Examination~~	6	Chem Eng Tech II	
~~Chem Eng Tech 303~~	~~CENT333~~	~~3~~	~~Examination~~	6	Chem Eng Tech II	
~~Chemical Process Industries II~~	~~CPIN201~~	~~3~~	~~Examination~~	5	Chemistry I	
~~Thermodynamics: Applied III~~	~~TDYA301~~	~~3~~	~~Examination~~	6		
~~*Chem Proc Design Principles III~~	~~CPDP301~~	~~3~~	~~Continuous assessment~~	6	Chem Eng Tech II	Chem Eng Tech 301 Chem Eng Tech 302
~~Process Control III~~	~~PCCR301~~	~~4~~	~~Examination~~	6		
~~Thermodynamics: Chem Eng III~~	~~TMOC302~~	~~4~~	~~Examination~~	6	Chem Eng Tech II and Exposure to Applied Thermodynamics	
~~Chemical Plant III (2 Modules)~~	~~CHPL304~~	~~4~~				
~~Chemical Plant 301~~	~~CHPL314~~	~~4~~	~~Examination~~	6		
~~Chemical Plant 302~~	~~CHPL324~~	~~4~~	~~Examination~~	6		
~~Management Skills I~~	~~MASK101~~	~~4~~	~~Examination~~	5		
~~Chem Proc Design Principles III~~	~~CPDP301~~	~~4~~	~~Continuous assessment~~	6	Chem Eng Tech II	Chem Eng Tech 301 Chem Eng Tech 302
Experiential Learning 1	EXCE101	5	Continuous assessment	6	As per rule G28	
Experiential Learning 2	EXCE201	6	Continuous assessment	6	As per rule G28	

* Strikethrough subjects have been phased out

ECE 2.3 PROMOTION TO HIGHER LEVEL

1. In order to gain promotion from Semester I to Semester II, students must pass Chemistry I and either Mathematics I OR Physics I, and at least one other Level I course.

2. In order to gain promotion from Semester II to Semester III or IV, students must pass Chemical Engineering Technology II and at least two other Level II courses.

ECE2.4 Important information for current and prospective students (effective as of January 2016):

The current National Diploma: Engineering: Chemical is currently being phased out to allow for the introduction of the new Bachelor of Engineering Technology in Chemical Engineering. The last cohort of first-time entering students admitted to this National Diploma qualification was 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	January 2017
Communication Skills I	January 2017
Mathematics I	January 2017
Chemistry I	January 2017
Drawing I	January 2017
Physics I	January 2017
Mathematics II	July 2017
Engineering Physics	July 2017
Organic Chemistry	July 2017
Physical Chemistry	July 2017
Inorganic Chemistry	July 2017
Chemical Engineering Technology II	July 2017
Chemical Technology 301	January 2018
Chemical Technology 302	January 2018
Chemical Technology 303	January 2018
Chemical Process Design 3	January 2018
Thermodynamics: Applied III	January 2018
Chemical Process Industries III	January 2018
Process Control III	July 2018
Chemical Thermodynamics	July 2018
Chemical Plant 301	July 2018
Chemical Plant 302	July 2018
Management Skills I	July 2018
Experiential Learning I (EXCE101)	January 2020
Experiential Learning II (EXCE 201)	January 2020

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

ECE. 3 BACHELOR OF TECHNOLOGY ENGINEERING: CHEMICAL QUALIFICATION CODE (3308005)

A learner achieving this qualification will be competent in applying and integrating theoretical knowledge, engineering principles, proven techniques, practical experience, and appropriate skills to the solution of well-defined and ill-defined problems in the field of Chemical Engineering, by operating within the relevant standards and codes. The learner will be capable of independent decision-making taking into account the relevant technical, social, economic, and environmental factors.

ECE. 3.1 ADMISSION REQUIREMENTS

Please note that due to National legislation, signed into effect by the Minister of Higher Education in the Government Gazette no. 40123 of 6th July 2016, the last permitted enrolment for any non-HEQSF aligned programme will be the 31st December 2019. This means that you will not be able to enrol in a Bachelor of Technology (BTech) degree at DUT, or at any other institution in South Africa after this date.

1. National Diploma: Chemical Engineering (3208022/3208038/3208054)

OR

2. National Diploma: Chemical Engineering
(3208593) PLUS credits in the following subjects:
Process Control III
Chem. Proc. Des. Principles III
Chemical Plant III: Mod II
Thermodynamics: ChemEng III
Chemical Engineering Tech III: 302

OR

3. National Higher Diploma: Chemical Engineering (3508464)

OR

4. Conferment of Status

Persons not meeting the above requirements may make an application to the department, which will determine further requirements that are necessary.

ECE. 3.2 COURSE STRUCTURE

SUMMARY OF PROGRAMME: BTECH: CHEMICAL ENGINEERING - BTCMEI

Subject Offering	Code	Semester	Assessment Method	NQF Level	Pre-requisite	Co-requisite
Chem Eng Tech IV (3 Modules)	CENT402	I				
Chem Eng Tech 401 (Fluid Flow IV)	CETE401	I	Examination	7		
Chem Eng Tech 402 (Heat & Mass IV)	CHTE401		Examination	7		
Chem Eng Tech 403 (Unit Operations IV)	CTEC401	I	Examination	7		
Mathematics: Chem Eng III	MCEN301	I	Examination	7		
Reactor Technology IV	RTEC401	I	Examination	7		
*Project IV: Chem Eng	PRCE401	I	Continuous Assessment	7		
Chem Proc Design IV (2 modules)	CPDE401					
*Chem Proc Design 402	CEPD401	I	Continuous Assessment	7		Chem Eng Tech 402 Chem Eng Tech 403 Reactor Technology IV
Chem Proc Design 401	CHPD401	2	Continuous Assessment	7		
Process Control IV	PCCR402	2	Examination	7	Mathematics: Chem Eng III	
Production Eng.: Chem Eng	PECI401	2	Examination	7		

*Project IV: Chemical Engineering and Chemical Process Design 402 are annual subjects.

ECE. 4 MASTER OF ENGINEERING

(96827)

ECE. 4.1 COURSE OBJECTIVE

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. This will include the ability to make an informed decision on the choice of method for tackling a given problem, the communication of ideas and results of scientific investigation and the use of scientific literature.

ECE 4.2 ENTRANCE QUALIFICATION

Students are required to have completed an appropriate honours degree or equivalent in Chemical Engineering. Graduates with an appropriate engineering degree in any discipline within the engineering profession plus related experience in the field of Chemical Engineering can apply for the qualification using rule G10 – Conferment of Status.

ECE 4.3 COURSE STRUCTURE

The duration of this course is equivalent to a minimum of 1-year. The project must involve either developmental or applied research. Examining will be done by a panel of examiners appointed by the University.

ECE 5 DOCTOR ENGINEERING (96812)

ECE 5.1 COURSE OBJECTIVES

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.

A student must provide proof of original and creative thinking and problem solving, and make a real contribution to the knowledge field. The dissertation must comply with the normal general technical requirements and rules with regard to scope, quality and layout.

ECE 5.2 ENTRANCE QUALIFICATION

Students are required to have completed a Master's degree in Chemical Engineering. Graduates with an appropriate degree in engineering plus an appropriate Master's degree relevant to the field of Chemical Engineering can apply for the qualification using rule G10 – Conferment of Status.

ECE 5.3 COURSE STRUCTURE

The duration is equivalent to a minimum of two (2) years study.

Examining will be done by a panel of examiners appointed by the University

6. PROGRAMMES OFFERED IN PULP AND PAPER

Programmes are offered in Pulp and Paper which upon successful completion lead to the award of the following qualifications:

Qualification	SAQA NLRD ID
ND: Pulp and Paper Technology	72257
BTECH: Pulp and Paper Technology	72156

7. SPECIFIC RULES FOR PULP AND PAPER PROGRAMMES

ECE 6 NATIONAL DIPLOMA IN PULP AND PAPER TECHNOLOGY (NDPPT2)

QUALIFICATION CODE (3208112)

A learner achieving this qualification will be competent in applying theoretical knowledge, engineering principles, proven techniques, practical experience, and appropriate skills to the solution of well-defined problems in the field of pulp and paper technology. This qualification is designed to prepare students for positions as operational staff in the pulp and paper industry.

ECE 6.1 ENTRANCE REQUIREMENTS

In addition to the Institution's General Minimum Admission Rule, the applicant must meet the following minimum requirements:

Mathematics - rating code 4 (Adequate achievement), and

Physical Science - rating code 4 (Adequate achievement)

Students who did not write the Mathematics Paper 3 (Geometry Paper) will be required to attend an additional Mathematics I sub-module which will be run concurrently with the normal Mathematics I course. The onus is on the students to prove that they wrote the Mathematics Paper 3 otherwise they will be required to attend the additional Mathematics I sub-module.

Alternatively, a matriculation certificate, with at least a D symbol (Higher Grade) or B symbol (Standard Grade) in Physical Science and Mathematics. A pass in the subjects Technical Drawing and/or Computer Studies will be an added recommendation.

Applicants who do not have the required matric symbols/ratings in Mathematics or Physical Science, but have passed Mathematics 1, Chemistry I and/or Physics I at an accredited tertiary educational institution will also be considered for entry into the program.

In addition to the above requirements, bursary students will have to meet additional criteria prescribed by their sponsor company, which may include interviews, psychometric assessments, and work based skills tests. Favourable results of such assessments can also mitigate for lower matric symbols/ratings, subject to the minimum institutional requirements.
A person who wants to embark on a career in the pulp and paper industry must have a basic knowledge of Chemistry, Physics, Mathematics and a logical mind. An aptitude for solving practical process problems in a team environment is essential.

NC (V) SYSTEM

In addition to the relevant General Rules pertaining to the Registration (e.g. Rules G3), learners must, as a minimum, have obtained the following NC (V) subjects results:

Subject	**Result**
English (First Additional)	3 (Competent: 50-69%)
Mathematics	3 (Competent: 60-69%)
Physical Science	3 (Competent: 60-69%)

Note that the subject Mathematical literacy will not be accepted as a substitute for the subject Mathematics. Students who did not write the Mathematics Paper 3 (Geometry Paper) will be required to attend an additional Mathematics I sub-module which will be run concurrently with the normal Mathematics I course. The onus is on the students to prove that they wrote the Mathematics Paper 3 otherwise they will be required to attend the additional Mathematics I sub-module.

ECE. 6.2 COURSE STRUCTURE

Minimum experiential time - 1 year
Minimum formal time - 2 years

SUMMARY OF PROGRAMME: ND: Pulp and Paper Technology

Subject Offering	Code	Semester	Assessment Method	NQF Level	Pre-requisite	Co-requisite
Chemistry I	CHEM102	1	Examination	5		
Mathematics I	MATH101	1	Continuous assessment	5		
Physics I	PYSC105	1	Examination	5		
Communication Skills I	COSK101	1	Continuous assessment	5		
Computer Skills I	COMS101	1	Continuous assessment	5		
Intro to Pulp & Paper Making	IPPM101	1	Examination	5		
Quality Assurance and Statistics	QAST101	2	Examination	5	Mathematics I	
Intro to Pulp & Paper Making	IPPM101	2	Examination	5		
Physical Chemistry II	PHCH201	2	Examination	5	Chemistry I	
Pulp and Paper Technology I	PPPT101	2	Examination	5		
Chem Eng Technology II	CENT201	2	Examination	5	Chemistry I	
Engineering Physics II	EPHY201	2	Examination	5	Physics I	
Pulp and Paper Chemistry II	PPPC201	2	Examination	5	Chemistry I	
Chem Eng Tech III (2 Modules)	CENT304	3				
Chem Eng Tech 301 (Transfer Processes III)	CENT314	3	Examination	6	Chem Eng Tech II	
Chem Eng Tech 302 (Unit Operation III)	CENT324	3	Examination	6	Chem Eng Tech II	
Pulp and Paper Technology II	PPPT201	3	Examination	6	Pulp & Paper Technology I	
Pulp and Paper Chemistry III	PPPC301	3	Examination	6	Physical Chemistry II	Pulp and paper Technology II
Thermodynamics: Applied III	TDYA301	3	Examination	6	Chem Eng Tech II	
Pulp & Paper Technology III	PPPT301	4	Examination	6	Pulp & Paper Technology II	
Chemical Plant III (2 Modules)	CHPL304	4				
Chemical Plant 301	CHPL314	4	Examination	6		
Chemical Plant 302	CHPL324	4	Examination	6		
Management Skills I	MASK101	4	Examination	5		
Process Control III (Only for students registered under NDPPT2)	PCCR301	4	Examination	6		
Pulp and Paper Practice I	PPPR101	5	Continuous assessment	6		
Pulp and Paper Practice II	PPPR201	5	Continuous assessment	6		
Pulp and Paper Practice III	PPPR301	6	Continuous assessment	6		

The current National Diploma: Pulp and Paper Technology will be phased out starting in 2019 to allow for the introduction of the new Diploma in Pulp and Paper Technology. The last cohort of first-time entering students admitted to this National Diploma qualification will be in January 2019. 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
Chemistry 1	January 2020
Mathematics 1	January 2020
Physics 1	January 2020
Communication skills 1	January 2020
Computer skills 1	January 2020
Intro to pulp and paper making	January 2020
Quality assurance & statistics	July 2020
Physical chemistry 2	July 2020
Pulp & paper technology 1	July 2020
Chem Eng technology 2	July 2020
Engineering physics 2	July 2020
Pulp & paper chemistry 2	July 2020
Chem Eng technology 301 – transfer processes	January 2021
Chem Eng technology 302 – unit Operations	January 2021
Pulp & paper technology 2	January 2021
Pulp & paper chemistry 3	January 2021
Applied Thermodynamics 3	January 2021
Pulp & paper technology 3	July 2021
Chemical plant 301	July 2021
Chemical plant 302	July 2021
Management skills 1	July 2021
Process control 3	July 2021
Pulp & paper practice 1	January 2023
Pulp & paper practice 2	January 2023
Pulp & paper practice 3	January 2023

ECE. 6.3 PROMOTION TO HIGHER LEVEL

I. In order to gain promotion from Semester I to Semester II, students must pass Chemistry I and either Mathematics I OR Physics I, and at least one other Level I course.

II. In order to gain promotion from Semester II to Semester III or IV, students must pass Chemical Engineering Technology II and at least two other Level II courses.

ECE. 6.4 Important information for current and prospective students (effective as of January 2018):

The current National Diploma: Pulp and Paper Technology will be phased out starting in 2019 to allow for the introduction of the new Diploma in Pulp and Paper Technology. The last cohort of first-time entering students admitted to this National Diploma qualification will be in January 2019. 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
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Mathematics 1	January 2020
Physics 1	January 2020
Communication skills 1	January 2020
Computer skills 1	January 2020
Intro to pulp and paper making	January 2020
Quality assurance & statistics	July 2020
Physical chemistry 2	July 2020
Pulp & paper technology 1	July 2020
Chem Eng technology 2	July 2020
Engineering physics 2	July 2020
Pulp & paper chemistry 2	July 2020
Chem Eng technology 301 – transfer processes	January 2021
Chem Eng technology 302 – unit Operations	January 2021
Pulp & paper technology 2	January 2021
Pulp & paper chemistry 3	January 2021
Applied Thermodynamics 3	January 2021
Pulp & paper technology 3	July 2021
Chemical plant 301	July 2021
Chemical plant 302	July 2021
Management skills 1	July 2021
Process control 3	July 2021
Pulp & paper practice 1	January 2023
Pulp & paper practice 2	January 2023
Pulp & paper practice 3	January 2023

No student may register for Pulp and Paper Practice 1, 2 or 3 unless they have completed the following prerequisites.

Pulp & Paper Practice 1 (P1)

Pre-requisites: Complete ALL Diploma subjects BEFORE commencing Pulp & paper practice 1

Pulp & Paper Practice 2 (P2)

Pre-requisites: Complete Pulp & paper practice 1.

Pulp & Paper Practice 3 (P3)

Pre-requisites: Complete Pulp & paper practice 2.

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

ECE 7 BACHELOR OF TECHNOLOGY: PULP AND PAPER TECHNOLOGY

ECE 7.1 ENTRANCE REQUIREMENTS

In order to register for the BTech: Pulp and Paper, a candidate must have one of the following:

(a) A University of Technology (formally Technikon) National Diploma in Engineering or Science, or

(b) A University degree in Engineering or Science, or

(c) (i) An N6 Diploma in Pulp or Paper, or

(ii) An N6 in an Engineering field plus N4 Pulp or Paper, plus Fluid Mechanics III and Thermodynamics III from a University of Technology (this will require that the candidate will have to have completed Mechanics I, Thermodynamics II and Fluid Mechanics II. At UNISA credit for Mechanics I will be granted to candidates who have passed Engineering Science N4 and Mechanotechnics N5 with at least 50%; credit for Fluid Mechanics II will be granted to candidates who have passed Fluid Mechanics N5 and N6 with at least 50%; credit for Thermodynamics II will be granted to candidates who have passed Power Machines N5 and N6 with at least 50%; for credits from other institutions contact the institution concerned), or

(d) A Government Certificate of Competency.

Prospective students with qualifications in other disciplines must present their qualifications and work experience, together with a letter from their employer motivating their registration on the BTech: Pulp and Paper.

ECE 7.2 COURSE STRUCTURE

The BTech: Pulp & Paper comprises both a theoretical and research component and is offered part-time only at pulp and paper industry facilities country-wide. Normally, only students who are already employed in the industry will be permitted to register. The minimum time for completion of the program is two years.

The theoretical component is presented in the form of fourteen modules. The modules are clustered into Subjects, as follows:

Subject Offering

SUMMARY OF PROGRAMME: B Tech: Pulp and Paper Technology - BTPPTI

Subject Offering	Code	Semester	Assessment	Method NQF Level	Pre-requisite	Co-requisite
Paper Industry, Fibres & Pulping IV (5 Modules)	PIFP401	1	Examination	7		
Unit Operations of Paper Making IV (6 Modules)	UOPM401	1	Examination	7		
Environmental Factors & Corrosion Control IV (Module 10)	EFCC401	2	Examination	7		
Paper Production, Properties and End Uses IV (Module 13)	PPRE401	2	Examination	7		
Paper Industry: Quality Assurance IV (Module 14)	QAPI401	2	Examination	7		
Paper Industry Research Project	PIRP401	2	Continuous assessment	7		

PIFP401- Paper Industry, Fibres & Pulping IV, comprising:

Module 1 industry, resources & fundamentals.
Module 3 pulping.
Module 5 pulping.
Module 7 .
Module 8 fibre processing.

UOPM401- Unit Operations of Paper Making IV, comprising:

Module 2 - Stock Preparation
Module 4 - Wet End Operations
Module 6 - Wet End Chemistry
Module 9 - Pressing
Module 11 - Drying
Module 12 - Finishing Operations

The subjects Paper Industry, Fibres and Pulping (PIFP401) and Unit Operations of Papermaking (UOPM401) will be offered in the first year of the program, and the remaining subjects viz. EFCC401, PPRE401, QAPI401 and PIRP401 will be offered in the second year.

ECE 7.5 ASSESSMENT

a) The subjects PIFP401 and UOPM401 shall be assessed by completion of a variety of individual and group assignments, case studies, presentations, tests and a final examination as detailed in the relevant Study Guide.

The final mark will be calculated as follows:

Course mark:	Assignments 40 %,
	Tests (2 hrs, minimum of 2) 20%,
	Total course mark60%
	Final examination 40%

b) The subjects EFCC401, PPRE401, QAPI401 will be assessed by completion of individual and group assignments, case studies or presentations, and a final examination as detailed in the relevant Study Guide.

The final mark will be calculated as follows:

Course mark:	Assignments 40%
	Final examination60%

c) A minimum of 40% must be achieved in each type of assessment and an overall average of 50% is required to pass the subject. Students will be given opportunities to resubmit assessments, subject to conditions laid out in the Study Guide. In accordance with Rule G12, a minimum course/year/semester mark of 40% must be achieved in order to qualify to write the examination. A distinction will be granted if a mark of 75% or more is achieved as the final result.

d) The subject PIRP401 is assessed by means of continuous assessment. Formative assessment will consist of a research proposal, presentations and progress reports. Final Summative assessment is by means of a written research report and an oral audio-visual presentation. These count 67% and 33% respectively. The assessment of the project PIRP401 will be completed by the end of October each year. Students who have failed the subject will be given the opportunity to resubmit the relevant components for re-assessment by the end of January of the following year.

ECE 7.6 EXAMINATIONS

Examinations for the subjects PIFP401, UOPM401 and PPRE401 will be written in the year-end examination period.

Examinations for the subjects QAPI401 and EFCC401 will be written in the mid-year examination period:

Supplementary examinations for which a student may be eligible in terms of Rule G13 (3), will be written in July (for mid-year examined subjects) and in December for year-end examined subjects.

A student must obtain a final mark of at least 45% to qualify for a supplementary examination.

A student who is unable to write an examination as a result of urgent work commitments will be permitted to write a special examination, which will coincide with the supplementary examination. The student must apply in writing in advance of the main examination session, and Rules G13 (4) and G13 (3) will apply.

All examinations for this course will consist of written paper/s of at least three (3) hours total duration.

ECE 7.9 SUBSEQUENT REGISTRATIONS

7.9.1 As per Rule G17, the maximum duration of study after initial registration shall not exceed twice the minimum period of registered study.

7.9.2 A student wishing to appeal to the Faculty of Engineering, Science & the Built Environment against the application of the above rule must submit a statement explaining the reasons for the appeal to the Faculty Officer within 10 days of the student being officially notified in writing that he/she is not permitted to re-register. No appeals will be considered after this.

ECE 7.10

Important information for current and prospective students (effective as of January 2019):

Due to phase out of non HEQSF aligned programmes by the Department of Higher Education, the last registration for 1st time entering students into the B. Tech Pulp and Paper Technology will be January 2019.

Notwithstanding all the current rules (both General rules and Departmental rules) that regulate this degree, 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
Paper Industry, Fibres and Pulping	January 2020
Unit Operations of Papermaking	January 2020
Environmental Factors and Corrosion Control	January 2021
Quality Assurance in the Paper Industry	January 2021
Paper Industry Research Project	January 2021
Paper Production, Properties and End Uses	July 2021

8 SYNOPSIS OF SUBJECTS

Below is a brief description of the subjects for the National Diploma chemical engineering practice, B Tech B Eng Tech programmes in Chemical Engineering and Pulp and Paper. Detailed information for all these subjects are to be found in the Study Guidelines that are issued to students at the beginning of each course. The study guidelines will include information regarding: credit value, duration (lectures, practicals and tutorials), assessment methods, outcomes and content.

Experiential Learning (EXCE101 AND EXCE201)

In addition to the normal academic requirements, the following projects/assignments have to be done in an industrial environment: PFDs, PIDs, material and energy balances, Hazop studies, design/performance analysis/rating of process equipment (at least one heat transfer and one mass transfer operation), elementary design of piping systems, and consideration of safety, health and environmental issues.

BATCHELOR OF TECHNOLOGY: CHEMICAL ENGINEERING

Heat & Mass Transfer IV (CHTE401)

Heat transfer via conduction, convection and radiation. Heat transfer with change in Phase, transport anologies, mass transfer, heat transfer from extended surfaces, Transport anologies, Mass transfer.

Fluid Flow IV (CETE401)

Properties of fluids, Incompressible Newtonian flow, Incompressible non-Newtonian flow, Pumping of liquids, Series and parallel arrangement of pumps, Compressible flow, non-Newtonian mixing, Two-phase gas liquid flow, Fluidisation and Unsteady state. Channel flow.

Unit Operations (CTEC401)

Theory and design of Binary and multi-component distillation systems. Determine minimum reflux ratio, top and bottom temperatures of multi-component systems. Introduction to residue curves. Design and optimisation of Evaporators and crystallises. Design of gas absorption systems. Continuous and unsteady state drying. All topics covered require spreadsheet solutions.

Reactor Technology IV (RTEC401)

Design and analysis of isothermal and non-isothermal batch and flow reaction systems Kinetics of catalytic systems and design of heterogeneous reaction systems. Residence time distribution in real reactors and the effect on reaction yields. Multiple reaction systems and conditions/models for optimum yields. Non-elementary and enzymatic reactions.

Chem Plant Design IV (CEPD401)

Full scale plant design on a real industrial application done over a period of one year. A final design report by the student would include process selection and specification, generation of proposed process PFD and prides, material and energy balance, Hazop analysis using PC Hazop, specifications and detailed design of all major process units including detailed modelling and simulation of reaction systems and determination of optimum reaction conditions. Complete design simulation done on Chemcad and CCTherm. Aspects of project management and economics also included.

Project IV (PRCE401)
Industrial or laboratory project done over a period of one year. This subject introduces the student to the methodology of research and development. The work performed by the student must include the following: defining a problem/project, literature survey, planning and execution of experimental work, analysis of data and results.

Process Control IV (PCCR402)
Introduction to advanced control configurations. Application of control configuration. Process optimisation and stability using control configurations. Software application to process modelling and simulation. Linearisation of process systems.

Process Equipment Design IV (CHPD401)
Shell and tube heat exchanger design: 1-2 exchangers, 2-4 exchangers, vaporisers, condensers. Plate and frame heat exchanger design. Hydraulic design of packed and tray columns. Pinch analysis: Thermal and water pinch.

Production Engineering in the Chemical Industry IV (PECI401)
Forecasting, Linear Programming, Advanced optimisation techniques, Decision-making, Reliability theory, Uncertainty, Project management, Quality Management.

BACHELOR OF ENGINEERING TECHNOLOGY IN CHEMICAL ENGINEERING

Engineering Mathematics 1A (EMTA101): Numbers and Algebra, Areas and Volumes, Trigonometry, Graphs, Complex Numbers, Calculus-differentiation, Calculus-Integration.

Engineering Chemistry 1A: Atomic structure and periodic table, introduction to elements, compounds and atomic structure. Types of bonding ; Ionic and covalent bonding. Nomenclature of ionic and covalent compounds Ionisation energy, electronegativity and electron affinity reactions and stoichiometry, moles, percent composition, empirical formulae, limiting reactant and percentage yield. Concentration units and solution chemistry, neutralisation reactions. Types of reactions – synthesis, decomposition, single replacement, double replacement using solubility chart), and redox. Properties of s and p block elements. Hydrogen, groups 1, 2, 13 (Al,B), 14 (C,Si), 15 (N,P), 16 (O,S), 17 (F, Cl, Br, I) Introduction to organic chemistry

Cornerstone (CSTN101): Introduction to cornerstone and the common set of values, Introduction to journeys, Historical events, Diversity, social groups and the Bill of Rights, Social identities, structure and agency, Issues of gender, HIV/AIDS and society.

Engineering Physics 1A: Units, Physical Quantities, Vectors, Equilibrium of a particle, Newton's Second Law, Gravitation, Work and Energy, Impulse and Momentum, Torque, Elasticity, Periodic Motion

Chemical Engineering Fundamentals 1A: Basic Chemical Engineering Concepts Units and dimensions, Introduction to material and energy balances, Chemical industry in KZN and SA , Problem Solving

Technical Literacy: The differences between language usage in academic, technical and common environments, Referencing, spreadsheets, pictorial representation of data, Word processing, Experimental methods scientific methods, Planning and documenting experiments Technical Report writing, Standards (ISO, SABS, etc.)

Engineering Mathematics 1B (EMTB101): Differentiation, Integration, Linear Algebra, Statistics and Probability

Engineering Physics 1B Thermodynamics, Mechanical Waves, Vibrating Bodies, Acoustic Phenomena, Coulomb's Law, Current, Resistance and Capacitance

Engineering Chemistry 1B: Chemical Bonding, Chemical Reactions in aqueous and Non-Aqueous Solutions, Gases, Liquids, Electrochemistry, Chemical equilibrium, Colligative properties of solutions, Reaction kinetics, Colloids

Chemical Engineering Fundamentals 1B: Material and energy balances for single and multiple unit processes, with and without chemical reactions, including recycle, bypass and purge streams, and Simultaneous material and energy balances for systems

Chemical Engineering Design 1: Sustainable Development , Engineering Graphics, Professional Practice, Ethics, Workshop practice, Application of Computers to Chemical Engineering Design, Design Project 1

Computer Applications 1A: Theory of computers, Microsoft Office Word, Excel

Engineering Chemistry 2A: Alkanes and Cycloalkanes, Radical Reactions, Ionic Reaction, Alkenes and Alkynes, Alcohols and Ethers, Alcohols and Carbonyl , Aromatic Compounds, Electrophilic Aromatic Substitution, Aldehydes and Ketones, Carboxylic Acids and their derivatives

Computer Applications 2A: Advanced Excel , Chemical Engineering application software, programming with VBA and Matlab

Process Fluid Flow: Fluid statics and dynamics principles, Incompressible Newtonian and Non-Newtonianflow in pipes and channels, Pumps, Mixing, Flow of compressible flow in pipes

Engineering Mathematics 2A: Advanced Calculus, Differential Equations

Principles of Management: Working environment**,** principles of general management, Human resource management, Impact of employment relations and labour legislation on an organistation, Managing people and teams, Law of contracts, Managing technology and innovation

Chemical Engineering Design 2A: Plant Design Aspects, Design Project 2, Application of Computers to Chemical Engineering Design

Chemical Engineering Laboratory 1A: Chemical Engineering Laboratory Practice, various practical in fluid flow and heat transfer

Applied Thermodynamics: First Law and Second Law of Thermodynamics, The Working Fluid, The Heat Engine cycle, Nozzles, and Roto-dynamic Machinery, Positive Displacement Machines, Refrigeration and Heat pumps

Transfer Processes: Conduction and Convection, Thermal Radiation, Double-Pipe and Shell-and-Tube Heat Exchangers, Steady State Molecular Diffusion, Convective Mass Transfer, Mass Transfer Across An Interface

Applied Statistics: Discrete Random Variables And Probability, Continuous Random Variables And Probability Distributions, Joint Probability Distributions And Random Samples, The Analysis Of Variance., Multifactor Analysis of Variance, Simple Linear Regression and Correlation, Nonlinear and Multiple Regression.

Process Safety and Occupational Health: Occupational Health and Safety Legislation relevant to the chemical industry , Chemical Plant Safety, Handling, transport and storage of bulk chemicals, Hazard and Risk assessment, Fault Tree Analysis, Audits, Incidents and Emergency Planning

Chemical Engineering Design 2B: Design of heat and mass transfer equipment Application of Computers to Chemical Engineering Design

Chemical Engineering Laboratory 1B: Various practicals in thermodynamics, mass transfer and process control

French for Sciences and Technology 1: Pragmatic, linguistic and cultural components

Mandarin for Sciences and Technology 1: Pragmatic, linguistic and cultural components

French for Sciences and Technology 2: Pragmatic, linguistic and cultural components

Mandarin for Sciences and Technology 2: Pragmatic, linguistic and cultural components

Project Management: Modern project planning methods, tools, analyses and computer applications, Oral and written communication of project planning, project implementation, Support of the operational systems.

Reaction Engineering: Mole Balances, Conversion and Reactor Sizing, Rate Law and Stoichiometry, Isothermal Reactor Design, Collection and Analysis of Rate Data, Multiple Reactions, Non-elementary Reaction Kinetics

Unit Operations: Psychrometry, Drying, Single and Multi-effect Evaporation, Leaching, Adsorption

Multistage Operations: Phase Equilibria, Distillation of binary and multi-component mixtures, Gas absorption, Liquid-Liquid Extraction

Chemical Engineering Design 3A: Thermal performance calculations using LMTD and NTU concepts, Detailed Equipment Design: Shell and tube Heat exchangers, Extended Heat Transfer Surfaces, Plate-and-frame heat exchangers, , Mass transfer Equipment design.

Chemical Engineering Laboratory 2A: Various practicals in particle technology, reaction engineering and unit operations

Particle Technology: Characterisation of particles, Size reduction, Storage and transport of solids, Solid-liquid separation processes

Environmental Engineering: Environmental and Safety Legislation, Sustainable Development, Fundamentals of Toxicology, Water, Air and Land pollution, Environmental Impact Assessment, Waste Minimization and Cleaner Production, Life Cycle Analysis, BACT

Chemical Thermodynamics: Properties of Pure Fluid, Heat Effects, Thermodynamic Properties of Real Fluids, Properties of Mixtures

Process Control: Process Instrumentation, Process and Instrumentation Diagrams, Control theory, Controller tuning and stability, Control strategies, Alarms, interlocks and safety trips, HAZOP

Chemical Engineering Design 3B: Preliminary plant Design, Storage and fluid handling, Pinch Technology, Reactor design

Chemical Engineering Laboratory 2B: Investigative technical project in a particular field in chemical engineering

NATIONAL DIPLOMA: PULP AND PAPER TECHNOLOGY

Chemistry I (CHEM102)

General Chemistry: Matter and energy; Chemical equations and stoichiometry; Solutions; Acids, bases and salts; Chemical reactions; Chemical equilibrium; Electrochemistry and Redox equations. Organic Chemistry: Hydrocarbons, Alkyl halide, Alcohol, Ether, Aldehyde, Ketone, Carboxylic Acid and its derivatives, Aromatic compounds. Practicals related to theory emphasising basic laboratory techniques.

Mathematics I (MATH101)

Algebra; Trigonometry; Calculus (Differentiation; Integration); Graphs; introduction to Matrices.

Physics I (PYSC105)

Introduction to vectors; Motion on a straight line; Projectile motion; Newton's laws; Work and energy; Impulse and momentum; Equilibrium - statics; Rotational motion; Elasticity; Static fluids; Dynamic fluids; Dynamic fluids; Heat, temperature and expansion; Heat transfer; First and second laws of thermodynamics; Electrostatics; Electricity; Magnetism; Electromagnetic induction; Basic electronics; Nature and propagation of light; Mirrors; Lenses; Prisms; Illumination; Interference, diffraction and polarisation; Introduction to nuclear physics; Practical physics.

Communication Skills I (COSK101)

Communication theory; Oral presentation; Technical writing skills; Group communications skills.

Computer Skills (COMS101)

Overview of computer concepts, input to computers, processing, outputs, auxiliary storage, communications, program development. Practical applications associated with word processing and spreadsheet usage.

Introduction to Pulp and Paper Making (IPPM101)
History of papermaking; markets and stakeholders; sources of fibrous raw materials; overview of wood yard operations; common pulping processes; overview of the papermaking process; mill utilities**.**

Quality Assurance and statistics: Introduction to quality, Total quality management-principles and practises, total quality management-tools and techniques, control charts for variables, control charts for attributes, fundamental of probability, Lot-by-lot acceptance sampling by attributes, Reliability.

Physical Chemistry II (PHCH201)
Gases: ideal and non-ideal; Liquids: surface tension, viscosity, additive properties; Chemical kinetics; Chemical equilibrium; Colloids; Colligative properties of solutions; Electrochemistry.

Pulp and Paper Technology I (PPPT101)
Woodyard operations; mechanical pulping processes; cleaning and screening technology; stock preparation and de-inking; refining.

Chemical Engineering Technology II (CENT201)
Students learn how to formulate and solve material balances, energy balances and combined material and energy balances for single unit chemical processes and multiple unit chemical processes including recycle, bypass and purge streams.

Engineering Physics II (EPHY201)
Transfer of heat; Electrical principles; Nuclear reactions; Hydrostatics; Hygrometry.

Transfer Processes III (CENT314)
Evaluation of flow systems for incompressible and compressible fluids involving a trial and error approach based upon assumed pipe sizes or flow rates. Steady state heat transfer involving one-dimensional plane, cylindrical and spherical walls without heat generation. Thermal design and evaluation of double-pipe and shell-and-tube heat exchangers. Molecular diffusion in gases and liquids.

Unit Operations III (CENT324)
Humidification and dehumidification of air-water systems. Material and energy balances with recycle and by-pass loops together with component and element balances. Drying rates and predicted of transfer coefficients. Single stage evaporation. Material and heat balances; boiling-point-rise; enthalpy-concentration charts. Counter current and co-current leaching.

Pulp and Paper Technology II (PPPT201)
Chemical pulping processes; recovery of chemicals used in chemical pulping processes; wet end operations; pulp and paper drying.

Pulp and Paper Chemistry III (PPPC201)
Structure of wood and fibres; fibre bonds; properties and end uses of pulp and paper; factors influencing pulp and paper properties; optical properties of paper; water supply and treatment; boiler feed water treatment: water pollution abatement.

Thermodynamics: Applied III (TDYA301)
Introduction to heat, work, and the system; units; the state of the working fluid; reversibility; reversible work. The First Law of Thermodynamics including conservation of energy; the non-flow equation; the steady flow equation. Liquid, vapour, and gas; the use of vapour tables; the perfect gas. Reversible non-flow processes; reversible adiabatic non-flow process; polytrophic processes. The heat engine; entropy; the T-s diagram; reversible processes on the T-s diagram. The Carnot cycle; absolute temperature scale; the Carnot cycle for a perfect gas; the constant pressure cycle. The Rankine cycle; Rankine cycle with superheat; the enthalpy-entropy chart (h-s chart); dryness fraction of wet steam; steam condensers; modern boiler plant; calculations for boiler efficiency and equivalent evaporation. Nozzle; critical pressure ratio; maximum mass flow or choked flow; nozzles off the design pressure ratio; nozzle efficiency; the steam nozzle; approximations for the steam nozzle. Classification of steam turbines; the impulse turbine; turbine blade height; impulse-reaction turbine.

Chemical Plant 301 (CHPL314)
Handling and storage of solids. Introduction to size reduction, size reduction equipment and calculations. Corrosion in various Forms and Corrosion prevention. Theory and application of cooling towers. Application on use of steam and steam plant calculations. Combustion, and combustion of different fuels. Alternate and renewable energy.

Chemical Plant 302 (CHPL324)
Hydrocyclones, membranes, gas cleaning. Thickening, Filtration, pumps and piping, valves, design of mixers, water pollution, air pollution, treatment processes of solids and gases.

Pulp and Paper Technology III (PPPT301)
Bleaching of pulp; finishing and converting processes; coating technology; printing technology

Pulp and Paper Chemistry III (PPPC301)
Chemistry of pulping processes; chemistry of chemical recovery processes; wet end chemistry.

Management Skills (MASK101)
Human relations in organisations; Principles and practice of management; Project management; Work-study: Industrial legislation; Basic principles of the law of contract; Types of business; financial management; Marketing; Business decisions.

Process Control III (PCCR301)
Block diagrams, process flow diagrams and P&I diagrams, explaining the preparation of flowsheets with due regard to safety, the efficient utilisation of energy and materials. Open and closed loops P, PI, PD, PID control with emphasis on the reaction curve and ultimate period method. Cascade control, ratio control, selective control systems, split range control, distillation and reactor control. Various levels, pressure temperature and flow measurement devices. Use of guidewords with a case study on PCHazop.

Pulp and Paper Practice I, II and III (PPPR101, 201 and 301)
The student will be expected to go through a structured training program at a pulp or paper mill. This training program will include, but not be limited to the following topics: first aid, flow diagram interpretation, monitoring of process plant, laboratory work, plant maintenance practices, plant operation and troubleshooting, drawing of process flow diagrams, material and energy balances and optimization projects. The student will need to maintain a logbook as evidence of this training.

B. TECH: PULP & PAPER TECHNOLOGY

Paper Industry, Fibres and Pulping IV (PIFP401)
Overview of the South African and International Pulp and Paper Industry. Fibre resources for paper making, forest operations, growth of trees and effects on paper products, fibre morphology and the relationship to paper properties. The chemistry of wood, chemical pulping, chemical recovery and bleaching systems. Other fibre resources, bagasse, kenaf etc. Analysis procedures for pulps.
Wood Processing, debarking, chipping. Chemical pulping equipment and operations based on Kraft pulping and recovery; different techniques for other chemical pulping processes. Semi-chemical pulping operations. Mechanical pulping processes with emphasis on Ground wood (Stone & Pressure), TMP and CTMP, Bleaching of Chemical Pulps, sequences, equipment and effluents. Whitening of Mechanical pulps. Pulp screening and cleaning. Secondary fibre operations, pulping. De-inking, fractionation. Finishing of pulps, lapping, drying and baling.

Unit Operations of Papermaking IV (UOPM401)
Preparation of the fibres for making paper; refining, cleaning, de-aeration, dilution, Control systems for fibre preparation. Control of water around the wet end of the paper/board machine. Wet end chemistry and adhesives. Head box operations. Forming section and dewatering of the matt. Pressing. Drying, surface coating and sizing. Calendering. Winding & Finishing. Wrapping, Packing and Despatch.

Paper Production, Properties and End Uses IV PPRE401
Application of the unit operations in making different grades of paper, specifically newsprint, mechanical writing, writings, linerboards, boxboard, tissue, fluting. Development of the specific properties required for these products, strength, optical, and surface properties. Use of recycled fibres.

Quality Assurance in the Pulp & Paper Industry IV QAPI401
Basic statistics, significance testing, regression analysis, sampling systems and techniques, statistical process control.

Environmental Factors and Corrosion Control IV EFCC401
Pollution Control in the paper industry, air pollution, water pollution, control and treatment techniques. Disposal of solids and liquid wastes. Machine house environment. Corrosion control in the paper industry, materials of construction, corrosion systems, stainless steels.

Paper Industry Research Project PIRP401
The student must conduct a practical research project in a paper industry context. The results of the research work must be communicated in a written project report and an oral audio-visual presentation.

9 BACHELOR OF ENGINEERING TECHNOLOGY:CHEMICAL ENGINEERING

This is a 420 credit qualification which is primarily professionally oriented. The learning programme consists of a coherent assembly of knowledge areas associated with chemical engineering practice, these include: mathematics, natural sciences, engineering sciences, design and synthesis, computing and IT, and relevant complementary studies. This assembly of knowledge areas provides a viable platform for further studies and lifelong learning, and will produce graduates who can function in today's fast changing, dynamic and evolving industrial marketplace.

Their broad training in natural and mathematical sciences, coupled with a strong foundation in chemical engineering principles, will produce graduates that are highly numerate and have skills in problem solving, team working, communication and Information Technology. This qualification is designed to provide the graduate with knowledge and attributes to work in a diverse spectrum of industries including the chemical, petrochemical, pulp and paper, polymer, mining, water and waste water treatment, energy, food, and pharmaceutical industries. The key attributes of the graduates of this qualification are:

- The ability to apply established and newly developed engineering technology to solve *broadly-defined* problems and develop components, systems, services and processes.
- They provide leadership in the application of technology in safety, health, engineering and commercially effective operations and have well-developed interpersonal 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.
- A specialized understanding of engineering sciences with a deep underlying knowledge of specific technologies together with financial, commercial, legal, social and economic, health, safety and environmental matters.

This qualification provides the educational base for the registration as a candidate Professional Engineering Technologist with the Engineering Council of South Africa (ECSA) and is recognized internationally through the Sydney Accord.

ECE 9.1 Minimum Admission Requirements

The minimum entry requirement is the National Senior Certificate or the National Certificate (Vocational) with appropriate subject combinations and levels of achievement as defined in the *Government Gazette*, Vol 751, No 32131 of 11 July 2008, and in the *Government Gazette,* Vol. 533, No. 32743, November 2009. In addition the minimum admission requirements, rule G7, is stipulated in the DUT General Rules Handbook.

In addition to the above, the following are required for admission into Chemical Engineering:

Compulsory Subjects	NSC	SC		NCV Level 4
	Rating	HG	SG	
English	4	C	B	60%
Mathematics	4	C	B	70%
Physical Science	4	C	B	70%
Life Orientation				60%
				+ 2 vocational subs

1) National Senior Certificate Requirements:

1. The subject NSC Mathematical Literacy will not be accepted as a substitute for the subject NSC Mathematics.

2. The exit certificate of the candidate must qualify the candidate for degree study at an institution of higher learning.

2) National Certificate Vocational Level 4:
The 3 vocational subjects must be relevant to the field of chemical engineering, one of which must be Physical Science or equivalent.

3) A student has to obtain a combined subminimum of 120% for Mathematics and Physical Science in addition to the entrance requirements above.

ECE 9.2 Programme Structure

Modules	Code	Semester	Credits	NQF Level	Pre-requisites	Co-requisites
Year 1 Semester 1						
Engineering Mathematics 1A	EMTA101	1	12	5		
Engineering Chemistry 1A	ENCA101	1	12	5		
Cornerstone 101	CSTN101	1	12	5		
Engineering Physics 1A	EPHA101	1	12	5		
Chemical Engineering Fundamentals 1A	CEFA101	1	12	5		
Technical Literacy	TCHL101	1	8	5		
Year 1 Semester 2						
Engineering Mathematics 1B	EMTB101	2	12	5		
Engineering Physics 1B	EPHB101	2	12	5		
Engineering Chemistry 1B	ENCB101	2	12	5		
Chemical Engineering Fundamentals 1B	CEFB101	2	12	5		
Chemical Engineering Design 1	CEDS101	2	12	5		

Computer Applications 1A	CMAP101	2	12	5		
Year 2 Semester 1						
Engineering Chemistry 2A	ENCM201	3	12	6	Engineering Chemistry 1A Engineering Chemistry 1B	
Computer Applications 2A	CMAP201	3	12	6	Computer Applications 1A	
Process Fluid Flow	PFFL101	3		6	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	
Engineering Mathematics 2A	EMTH201	3	12	6	Engineering Mathematics 1A Engineering Mathematics 1B	
Principles of Management	PCPM101	3	8	6		
Chemical Engineering Design 2A	CEDA201	3	12	6	Chemical Engineering Design 1 Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	Process Fluid Flow
Chemical Engineering Laboratory 1A	CELA101	3	8	6	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	Process Fluid Flow
Year 2 Semester 2		3				
Applied Thermodynamics	APTH101	4	12	6	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	
Transfer Processes	TRFP101	4	12	6	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	
Applied Statistics	APPS101	4	8	6		
Process Safety and Occupational Health	PSOH101	4	12	6		
Chemical Engineering Design 2B	CEDB201	4	12	6	Chemical Engineering Design 1 Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	Applied Thermodynamics Transfer Processes
Chemical Engineering Laboratory 1B	CELB101	4	8	6	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	Applied Thermodynamics Transfer Processes
French for Sciences and Technology 1	FRST101	4				
Mandarin for Sciences and Technology 1	MNST101	4				
Year 3 Semester 1						
Project Management	PMNM101	5	8	7		
Reaction Engineering	RCNE101	5	12	7	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B Engineering Mathematics 2A	
Unit Operations	UNOP101	5	12	7	Chemical Engineering	

					Fundamentals 1A Chemical Engineering Fundamentals 1B	
Multistage Operations	MSOP101	5	12	7	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	
Chemical Engineering Design 3A	CEDA301	5	16	7	Chemical Engineering Design 2A Chemical Engineering Design 2B Transfer Processes Fluid Flow	Unit Operations Multistage Operations Reaction Engineering
Chemical Engineering Laboratory 2A	CELA201	5	8	7	Chemical Engineering Laboratory 1A Chemical Engineering Laboratory 1B	Unit Operations Multistage Operations Reaction Engineering
French for Sciences and Technology 2	FRST201	5				
Mandarin for Sciences and Technology 2	MNST201	5				
Year 3 Semester 2						
Particle Technology	PTCT101	6	12	7	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	
Environmental Engineering	ENVN101	6	12	7	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B Process Safety and Occupational Health	
Chemical Thermodynamics	CTHM101	6	12	7	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B	
Process Control	PCSC101	6	12	7	Chemical Engineering Fundamentals 1A Chemical Engineering Fundamentals 1B Engineering Mathematics 2A	
Chemical Engineering Design 3B	CEDB301	6	16	7	Chemical Engineering Design 2A Chemical Engineering Design 2B Transfer Processes Fluid Flow	Process Control Chemical Thermodynamics Particle Technology
Chemical Engineering Laboratory 2B	CELB201	6	8	7	Chemical Engineering Laboratory 1	Process Control Chemical Thermodynamics Particle Technology

ECE 9.3. In modules where Exit Level Outcomes (ELO) are assessed, the student must meet both the academic and the ELO requirements, as specified in the relevant study guide, in order to pass the subject.

ECE 9.4. In order to progress from one study level to the next, a student would need to accumulate a minimum number of credits as indicated with the table below. Students achieving below the threshold would be considered as making unsatisfactory academic progress and would be excluded.

END OF YEAR	MINIMUM CREDITS
1	84 at NQF level 5
2	168 credits: 140 credits at NQF level 5 plus 28 credits at NQF level 6
3	252 credits: 140 credits at NQF level 5 and 112 credits at NQF level 6
4	336 credits: 140 credits at NQF level 5 plus 140 credits at NQF level 6 plus 56 credits at NQF level 7

ECE. 9.5 Promotion to a Higher Level

In addition to the prerequisites, co-requisites, requirements of the individual modules, and the minimum credit accumulation as specified in the table under ECE. 2.3, the student:

a. Must register a failed module in the following year.

b. Can register for 3rd year modules only if all 1st year modules are passed.

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