

# NATIONAL DIPLOMA: ENGINEERING: CHEMICAL

Qualification code: NDCE03 - NQF Level 6

Campus where offered: Pretoria Campus (day classes)

Last year of new intake: 2019

Teach-out (phase-out) date: 31 December 2024

Students registered for this qualification should complete their studies according to the teach-out date prescribed for the qualification, subject to the stipulations of Regulation 3.1.11 and 3.1.13 in the Students' Rules and Regulations.

Information on phased-out programmes can be obtained from the TUT website, [www.tut.ac.za](http://www.tut.ac.za).

## CURRICULUM

Consult the 2019 Faculty Prospectus for the full contents of the qualification.

### FIRST YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
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#### FIRST SEMESTER

<b>CET201T</b>	<b>Chemical Engineering Technology II</b>		
CET20XT	Chemical Engineering Technology: Chemical Principles II	(0,050)	
CHE141B	Chemistry IA (offered in both semesters)	(0,133)	
COS101T	Communication Skills I	(0,043)	
CSK101B	Computer Skills I	(0,083)	
DCE111T	Drawing: Chemical Engineering I	(0,108)	
MAT171T	Mathematics I	(0,083)	
PHU161B	Physics IA	(0,133)	

TOTAL CREDITS FOR THE SEMESTER: 0,633

#### SECOND SEMESTER

<b>CET201T</b>	<b>Chemical Engineering Technology II</b>		
CET20YT	Chemical Engineering Technology: Metallurgical Principles II	(0,050)	Chemical Engineering Technology: Chemical Principles II Chemistry IA Mathematics I Physics IA
EPH201T	Engineering Physics II	(0,068)	Physics IA
ICH231T	Inorganic Chemistry II	(0,083)	Chemistry IA
MAT271B	Mathematics II	(0,083)	Mathematics I
OCH221T	Organic Chemistry II	(0,083)	Chemistry IA
PCB221T	Physical Chemistry II (offered in both semesters)	(0,083)	Chemistry IA

TOTAL CREDITS FOR THE SEMESTER: 0,450

TOTAL CREDITS FOR THE FIRST YEAR: **1,083**



**SECOND YEAR**

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
<b>FIRST SEMESTER</b>			
CET33AT	Chemical Engineering Technology IIIA	(0,100)	Chemical Engineering Technology II
CMP33AT	Chemical Plant IIIA	(0,083)	Chemistry IA Mathematics I
CPI201T	Chemical Process Industries II	(0,083)	Inorganic Chemistry II Organic Chemistry II
MSK121T	Management Skills I	(0,136)	
TCE301T	Thermodynamics: Chemical Engineering III	(0,083)	Physical Chemistry II
TOTAL CREDITS FOR THE SEMESTER:		0,485	
<b>SECOND SEMESTER</b>			
CET33BT	Chemical Engineering Technology IIIB	(0,100)	Chemical Engineering Technology IIIA
CMP33BT	Chemical Plant IIIB	(0,083)	Chemical Plant IIIA
CPP301T	Chemical Process Design: Principles III	(0,083)	Chemical Process Industries II Drawing: Chemical Engineering I Mathematics II
PCT301T	Process Control III	(0,083)	Mathematics II
TDA301T	Thermodynamics: Applied III	(0,083)	Thermodynamics: Chemical Engineering III
TOTAL CREDITS FOR THE SEMESTER:		0,432	
TOTAL CREDITS FOR THE SECOND YEAR:		<b>0,917</b>	

**THIRD YEAR**

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
<b>FIRST OR SECOND SEMESTER</b>			
EXP1ECH	Work-Integrated Learning I	(0,500)	
EXP2ECH	Work-Integrated Learning II	(0,500)	Work-Integrated Learning I
TOTAL CREDITS FOR THE THIRD YEAR:		<b>1,000</b>	
TOTAL CREDITS FOR THE QUALIFICATION:		<b>3,000</b>	

**SUBJECT INFORMATION (OVERVIEW OF SYLLABUS)**

Please take note that for the 2020 academic year certain theory modules will be assessed as continuous assessment. Please contact the Academic Department for further information.

The syllabus content is subject to change to accommodate industry changes. Please note that a more detailed syllabus is available at the Department or in the study guide that is applicable to a particular module. On 01 October 2019, the syllabus content was defined as follows:

**C****CHEMICAL ENGINEERING TECHNOLOGY IIIA (CET33AT)****1 X 3-HOUR PAPER****(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Combined mass and energy balances, introduction to heat and mass transfer, fluid dynamics, pressure drops in pipes (Bernoulli's equation) and humidity. (Total tuition time: ± 60 hours)



**CHEMICAL ENGINEERING TECHNOLOGY IIIB (CET33BT)** **1 X 3-HOUR PAPER**  
*(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)*  
Gas absorption, distillation, evaporation, drying and filtration. (Total tuition time: ± 60 hours)

**CHEMICAL ENGINEERING TECHNOLOGY: CHEMICAL PRINCIPLES II (CET20XT)** **1 X 3-HOUR PAPER**  
*(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)*  
Understanding the units and dimensions of the British, SI and American engineering systems. Converting one set of units to another. Defining a mole and converting from moles to mass and the reverse for any chemical compound, given the molecular weight. Writing and balancing chemical reaction equations. Calculating the stoichiometric quantities of reactants and products, given the chemical reaction. Understanding the mass conservation law. Calculating material balances for systems without chemical reactions. Calculating material balances for systems with chemical reactions. (Total tuition time: ± 60 hours)

**CHEMICAL ENGINEERING TECHNOLOGY: METALLURGICAL PRINCIPLES II (CET20YT)** **1 X 3-HOUR PAPER**  
*(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)*  
Ideal gas equation of state, PVT behaviour and cubic equations of state, energy balances and first law of thermodynamics, steam tables, phase changes and humidification processes, state properties and process changes, mixing and solution processes, effect of reactions on material and energy balances. (Total tuition time: ± 60 hours)

**CHEMICAL PLANT IIIA (CMP33AT)** **1 X 3-HOUR PAPER**  
*(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)*  
Corrosion, materials technology, water treatment, mechanical separation, equipment, size reduction, material handling and storage and environmental protection. (Total tuition time: ± 60 hours)

**CHEMICAL PLANT IIIB (CMP33BT)** **1 X 3-HOUR PAPER**  
*(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)*  
Piping, pumps, compressors, fans, heat exchangers, combustion, mixing and cooling towers. (Total tuition time: ± 60 hours)

**CHEMICAL PROCESS DESIGN: PRINCIPLES III (CPP301T)** **1 X 3-HOUR PAPER**  
*(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)*  
Process design development. Flow diagrams. (Total tuition time: ± 60 hours)

**CHEMICAL PROCESS INDUSTRIES II (CPI201T)** **1 X 3-HOUR PAPER**  
*(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)*  
Coal processing (compulsory). Petroleum refining (compulsory). Synthetic rubber. Plastics, paper and pulp. Sugar refining. Agrochemicals. Iron and steel (compulsory). Heavy chemicals (compulsory). (Total tuition time: ± 60 hours)

**CHEMISTRY IA (CHE141B)** **1 X 3-HOUR PAPER**  
*(Subject custodian: Department of Chemistry)*  
Matter and energy: atomic structure, chemical bonding, periodic table and nomenclature of inorganic compounds. Chemical equations and stoichiometry. Solutions. Acids, bases and salts. Chemical reactions. Chemical equilibrium. Electrochemistry and redox theory. Introduction to inorganic and organic chemistry. Practical: experiments based on the theory, with the emphasis on basic laboratory techniques. (Total tuition time: ± 60 hours)

**COMMUNICATION SKILLS I (COS101T)** **CONTINUOUS ASSESSMENT**  
*(Subject custodian: Department of Applied Languages)*  
Communication theory, non-verbal communication (body language). Oral presentations, interviews, developing leadership and participation skills. Technical reports and correspondence. (Total tuition time: ± 64 hours)

**COMPUTER SKILLS I (CSK101B)** **CONTINUOUS ASSESSMENT**  
*(Subject custodian: End User Computing Unit)*  
Students have to acquire theoretical knowledge (computing fundamentals) and practical skills as an end-user in operating systems and MS Office Suite applications (MS Word, MS Excel and MS PowerPoint) on an introductory level. Students will do online and computer-based tests. The modules are mapped with SAQA and IC3 Essential Skills for Digital Literacy (International certification). Open labs are available for additional practice time. (Total tuition time: ± 40 hours)



**D**

**DRAWING: CHEMICAL ENGINEERING I (DCE111T)** **1 X 3-HOUR PAPER**  
(*Subject custodian: Department of Mechanical and Mechatronics Engineering*)  
Printing, freehand sketches, types of lines, construction of scales. Geometric construction of arcs and tangency, locus applications: i.e. ellipse, parabola, involute, archimedean spiral. Orthographic projections, isometric drawing, sectioning. Surface development, construction of fasteners, and detailed working drawing. (Total tuition time: ± 60 hours)

**E**

**ENGINEERING PHYSICS II (EPH201T)** **1 X 3-HOUR PAPER**  
(*Subject custodian: Department of Physics*)  
Electronics, nuclear physics, electric and magnetic fields and forces, heat transfer, properties of electromagnetic waves, quantum mechanics. Practical: experiments related to the theory. (Total tuition time: ± 75 hours)

**I**

**INORGANIC CHEMISTRY II (ICH231T)** **1 X 3-HOUR PAPER**  
(*Subject custodian: Department of Chemistry*)  
Introduction to chemical bonding and an advanced study of ionic bonding. Chemical reactions in aqueous and non-aqueous solutions. Redox chemistry. Interpretation of oxidation state diagrams. Descriptive inorganic chemistry. Practical inorganic chemistry. (Total tuition time: ± 60 hours)

**M**

**MANAGEMENT SKILLS I (MSK121T)** **1 X 3-HOUR PAPER**  
(*Subject custodian: Department of Management and Entrepreneurship*)  
Self-management, organisational environment, introduction to leadership and management principles. (Total tuition time: ± 60 hours)

**MATHEMATICS I (MAT171T)** **1 X 3-HOUR PAPER**  
(*Subject custodian: Department of Mathematics and Statistics*)  
Basic mathematics. Differentiation. Integration. Matrices and determinants. Vectors. Data handling. Complex numbers or mensuration. (Total tuition time: ± 60 hours)

**MATHEMATICS II (MAT271B)** **1 X 3-HOUR PAPER**  
(*Subject custodian: Department of Mathematics and Statistics*)  
Revision of differentiation. Differentiation of functions with more than one variable. Further integration. Numerical methods. First-order ordinary differential equations. Matrices (Gauss elimination). (Total tuition time: ± 60 hours)

**O**

**ORGANIC CHEMISTRY II (OCH221T)** **1 X 3-HOUR PAPER**  
(*Subject custodian: Department of Chemistry*)  
Aliphatic hydrocarbons. Benzene. Alkyl and aryl halides. Alkanols and alkoxy alkanes. Phenols. Alkanals and alkanones. Carboxylic acids and derivatives. Amines. Practical organic chemistry. (Total tuition time: ± 60 hours)

**P**

**PHYSICAL CHEMISTRY II (PCB221T)** **1 X 3-HOUR PAPER**  
(*Subject custodian: Department of Chemistry*)  
Gases (ideal and non-ideal). Liquid surface tension, viscosity, additive properties. Chemical kinetics. Chemical equilibrium. Colloids. Colligative properties of solutions. Electrochemistry. Practical physical chemistry. (Total tuition time: ± 60 hours)



**PHYSICS IA (PHU161B)****1 X 3-HOUR PAPER****(Subject custodian: Department of Physics)**

Basic mathematics for physics, measurements, kinematics in one and two dimensions, Newton's laws of motion, dynamics of uniform circular motion, work, energy and power, impulse and momentum, rotational kinematics, rotational dynamics, fluids, temperature and heat, the ideal gas law and kinetic theory, thermodynamics, electric forces and electric fields, electric potential energy and the electric potential, electric circuits, geometric optics – reflection of light: mirrors, refraction of light: lenses and optical instruments. Practical work. (Total tuition time: ± 60 hours)

**PROCESS CONTROL III (PCT301T)****1 X 3-HOUR PAPER****(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Process and instrumentation diagram, instrumentation, control, typical control systems, alarm and safety, Hazop studies. (Total tuition time: ± 60 hours)

**T****THERMODYNAMICS: APPLIED III (TDA301T)****1 X 3-HOUR PAPER****(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Heating and expansion. Nozzles. Refrigeration and cooling. Steam generation theory. Laboratory work. Combustion engines. (Total tuition time: ± 60 hours)

**THERMODYNAMICS: CHEMICAL ENGINEERING III (TCE301T)****1 X 3-HOUR PAPER****(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Introduction. First and second law of thermodynamics. Heat capacity. Real gases. Thermodynamic relations. Properties of mixtures. Absorption. Enthalpy. Entropy (processes: spontaneous, reversible and irreversible). Free energy. Ellingham diagram for oxides and sulphides. Chemical equilibrium. Principles of phase equilibrium. Construction of phase diagrams: binary and free energy. (Total tuition time: ± 60 hours)

**W****WORK-INTEGRATED LEARNING I (EXP1ECH)****WORK-INTEGRATED LEARNING****WORK-INTEGRATED LEARNING II (EXP2ECH)****WORK-INTEGRATED LEARNING****(Subject custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Students must complete a work-related project at the employer that has been approved by the University. (Total tuition time: six months)

