

## NATIONAL DIPLOMA: ENGINEERING: CHEMICAL

### Qualification code: NDCE03 - NQF Level 6

Campus where offered: Pretoria Campus

#### Important notification to new applicants:

Students who intend to enrol for this qualification for the first time in 2017 or thereafter, should note that it will not be possible to continue with any Baccalaureus Technologiae as from 2020, since it is being replaced by qualifications aligned with the newly-implemented Higher Education Qualification Sub-Framework. Potential students are advised to consult the University's website for any new qualifications which might not be published in this Prospectus.

### REMARKS

a. *Admission requirement(s) and selection criteria:*

#### • **FOR APPLICANTS WHO OBTAINED A SENIOR CERTIFICATE BEFORE 2008:**

##### **Admission requirement(s):**

A Senior Certificate or an equivalent qualification, with a D symbol (50 – 59%) at Higher Grade or a C symbol (60 – 69%) at Standard Grade for English and C symbols (60 – 69%) at Higher Grade or B symbols (70 – 79%) at Standard Grade for Mathematics and Physical Science.

##### **Selection criteria:**

To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least **28**.

##### **Assessment procedure:**

Applicants with a combined score of less than 10 for Mathematics and Physical Science and an APS of between 23 and 27 will write an Academic Placement Test before final acceptance. All applications will then be ranked according to APS achieved.

#### • **FOR APPLICANTS WHO OBTAINED A NATIONAL SENIOR CERTIFICATE IN OR AFTER 2008:**

##### **Admission requirement(s):**

A National Senior Certificate with a bachelor's degree or a diploma endorsement, or an equivalent qualification, with an achievement level of at least 4 for English (home language or first additional language), 4 for Mathematics and 3 for Physical Sciences.

Applicants who do not meet the requirements for Mathematics and/or Physical Sciences, may enrol for Mathematics N4 and/or Engineering Sciences N4 at any Technical and Vocational Education and Training (TVET) college, and if these are successfully passed at a performance level of at least 60%, they may re-apply for admission to the University.

Applicants who do not meet the above criteria for Mathematics and/or Physical Sciences for admission to the National Diploma, may enrol for: Mathematics N3/N4 and/or Engineering Sciences N3/N4, or Mathematics, Physical Sciences and Process Chemistry, as presented as part of the National Certificate Vocational (NCV) at NQF Level 4, at any Technical and Vocational Education and Training (TVET) College. If these subjects are successfully passed at a performance level of at least 60%, they may re-apply for admission to the qualification at the University.

##### **Selection criteria:**

To be considered for this qualification, applicants must have an Admission Point Score (APS) (APS) of at least **23**.



**Assessment procedure:**

Applicants with a final combined score of 10 and more for Mathematics and Physical Sciences and an APS of 28 and more will be ranked according to APS achieved. Those with a combined score of less than 10 for Mathematics and Physical Sciences and an APS of between 23 and 27 will write an Academic Placement Test before final acceptance. All applications will then be ranked according to APS achieved.

After consideration of the Departmental Student Enrolment Plan (SEP), only the highest performing applicants will be selected. Applicants will be informed immediately of their acceptance into the programme.

- **FOR APPLICANTS WHO OBTAINED A QUALIFICATION FROM TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) COLLEGES (PREVIOUSLY KNOWN AS FET COLLEGES):**

**Applicants with a National Certificate (Vocational) at NQF Level 4:****Admission requirement(s):**

A National Certificate (Vocational) at NQF Level 4 with a bachelor's degree or a diploma endorsement, issued by the Council for Quality Assurance in General and Further Education and Training (Umalusi), with at least 50% (APS of 4) for English and Mathematics, and at least 60% (APS of 5) for Physical Sciences/Applied Engineering Technology and any other two vocational subjects.

**Selection criteria:**

To be considered for this qualification, applicants must have an Admission Point Score (APS) of at least 23.

**Applicants with a National N Certificate as published in Nated 191: N3 (NQF Level 4) and N4/N5/N6 (NQF Level 5):**

A National Senior Certificate or a National N Certificate as published in Nated 191: N3 (NQF Level 4) and N4/N5/N6 (NQF Level 5) issued by the Council for General and Further Education and Training (Umalusi), with at least 50% (APS of 4) for English and 60% (APS of 5) for Mathematics N3 and Engineering Sciences N3.

Applicants will be exempted from certain subjects on the grounds of N4/N5/N6 subjects passed (a minimum of 50% of the qualification's subjects). Exemption will be granted for equivalent engineering subjects (including Mathematics and Engineering Sciences), successfully passed with at least 60% (APS of 5).

- b. *Minimum duration:*  
Three years.
- c. *Presentation:*  
Day classes. Classes and assessments may take place on Friday afternoons and/or Saturdays. Certain subjects are offered at the location (Arcadia and Pretoria campuses) determined by the Head of the Department.
- d. *Intake for the qualification:*  
January only.
- e. *Exclusion and readmission:*  
See Chapter 2 of Students' Rules and Regulations.
- f. *Recognition of Prior Learning (RPL), equivalence and status:*  
See Chapter 30 of Students' Rules and Regulations.
- g. *Accreditation by professional body:*  
This qualification has been accredited by the Engineering Council of South Africa (ECSA).



- h. **Practicals:**  
It is compulsory for students to attend the practical classes. Students must pass the practical component of a subject to be admitted to the examination.
- i. **Personal protective equipment:**  
Students are required to wear laboratory coats and other applicable protective gear during practicals. Students must purchase their own safety equipment and clothing.
- j. **Textbooks:**  
Additional textbooks and other educational material will be required.
- k. **Work-Integrated Learning I and II:**  
Students may enrol for only one subject during any of the Work-Integrated Learning periods, provided that the Work-Integrated Learning provider agrees to such an arrangement in writing. If the subject is the last and outstanding subject and the student has written the final exam within the past two years, the student may apply for an exit examination. See Chapter 5 of the Students' Rules and Regulations for more information.
- l. **Waiving of prerequisite subjects:**  
Prerequisites will only be waived in highly exceptional cases, based on a motivation by the Head of the Department and approved by the Executive Dean (prerequisite subjects published in Report 151 are excluded).
- m. **Subject credits:**  
Subject credits are shown in brackets after each subject.

## CURRICULUM

**SUBJECTS ARE ONLY OFFERED IN THE SEMESTER AS INDICATED BELOW. SUBJECTS PRINTED IN BOLD ARE NOT FOR REGISTRATION PURPOSES.**

### FIRST YEAR

CODE	SUBJECT	CREDIT	PREREQUISITE SUBJECT(S)
<b>FIRST SEMESTER</b>			
<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)
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### FIRST SEMESTER

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

### SECOND SEMESTER

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: **0,917**

## THIRD YEAR

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

EXP1ECH	Work-Integrated Learning I	(0,500)	
EXP2ECH	Work-Integrated Learning II	(0,500)	Work-Integrated Learning I

TOTAL CREDITS FOR THE THIRD YEAR: **1,000**

TOTAL CREDITS FOR THE QUALIFICATION: **3,000**



## SUBJECT/MODULE INFORMATION (OVERVIEW OF SYLLABUS)

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 subject. On 13 October 2017, the syllabus content was defined as follows:

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**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), 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, 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 Chemical, Metallurgical and Materials 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, 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)

