

# BACHELOR OF ENGINEERING TECHNOLOGY IN CHEMICAL ENGINEERING

Qualification code: BPHE20 – NQF Level 7 (420 credits)

SAQA ID: 110058, CHE NUMBER: H/H16/E110CAN

Campus where offered:

Pretoria Campus

## REMARKS

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

• **APPLICANTS WITH A SENIOR CERTIFICATE OBTAINED BEFORE 2008:**

**Admission requirement(s):**

A Senior Certificate with a matriculation endorsement or an equivalent qualification, with a C symbol at Standard Grade or a D symbol at Higher Grade for English, and B symbols at Standard Grade or C symbols at Higher 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**.

**Recommended subject(s):**

None.

• **APPLICANTS WITH A NATIONAL SENIOR CERTIFICATE OBTAINED IN OR AFTER 2008:**

**Admission requirement(s):**

A National Senior Certificate or an equivalent qualification, with a bachelor's degree endorsement, or an equivalent qualification, with an achievement level of at least 4 for English (home language or first additional language) and 5 for Mathematics or Technical Mathematics, and 5 for Physical Sciences or Technical Sciences.

**Selection criteria:**

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

**Recommended subjects:**

Engineering Graphics and Design and Mechanical Technology.

• **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 endorsement, issued by the Council for Quality Assurance in General and Further Education and Training (Umalusi) with at least a 50% (APS of 4) for English, 50% for Life Orientation (excluded for APS calculation), and 60% (APS of 5) for Mathematics and Science, and 60% (APS of 5) for any other three compulsory vocational subjects.

**Selection criteria:**

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

**Recommended subject(s):**

None.



- **APPLICANTS WITH A NATIONAL N CERTIFICATE/NATIONAL SENIOR CERTIFICATE AS PUBLISHED IN REPORT 191: N3 (NQF LEVEL 4):**

**Admission requirement(s):**

A National Senior Certificate or a National N Certificate with languages as published in Report 191: N3 (NQF Level 4) issued by both the Department of Higher Education and Training (DHET) and the Council for Quality Assurance in General and Further Education and Training (Umalusi), with at least 50% for English, Mathematics N3, Engineering Sciences N3 and any other two additional subjects.

**Selection criteria:**

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

**Recommended subject(s):**

None.

- **APPLICANTS WITH A N6 CERTIFICATE IN A RELATED ENGINEERING FIELD AS PUBLISHED IN REPORT 191: N6:**

**Admission requirement(s):**

A N6 Certificate in a related Engineering field as published in Report 191: N6 issued by both the Department of Higher Education and Training (DHET) and the Council for Quality Assurance in General and Further Education and Training (Umalusi), with an average of at least 60% for the qualification, and successful completion of an English Language Proficiency Assessment (done by the University).

**Recommended subject(s):**

None.

- **APPLICANTS WITH QUALIFICATIONS ON THE HIGHER EDUCATION QUALIFICATION SUB-FRAMEWORK (HEQSF) OFFERED BY UNIVERSITIES OF TECHNOLOGY:**

The applicant will be considered for admission to the programme, if any of the following qualifications has been completed:

- Higher Certificate in Chemical Engineering (NQF Level 5 - 140 credits): with an average of at least 60% for the qualification.
- Advanced Certificate in Chemical Engineering (NQF Level 6 - 140 credits): with an average of at least 60% for the qualification.
- Diploma in Chemical Engineering (NQF Level 6 - 280 credits): with an average of at least 55% for the qualification.
- National Diploma: Engineering: Chemical (NQF Level 6 - 3,000 credits): with an average of at least 55% for the qualification.

*b. Assessment Procedure:*

No further assessment will be done (except for candidates with a N4 Certificate). Applicants who achieve the minimum APS will be considered until the programme complement is full. All completed applications received within the published due dates will be ranked. After consideration of the Departmental Student Enrolment Plan, only the top ranking applicants will be selected. Once a programme is full, a waiting list will be in place to provide an opportunity for applicants to fill places of those who did not register on time. Applicants will be informed of their status per official letter from the Office of the Registrar, alternatively, they can check their application status on the TUT website, [www.tut.ac.za](http://www.tut.ac.za).

*c. Recognition of Prior Learning (RPL), equivalence and status:*

See Chapter 30 of Students' Rules and Regulations.

*d. Intake for the qualification:*

January only.



- e. *Minimum duration:*  
Three years.
- f. *Presentation:*  
Day classes. Working students with a National Diploma will be permitted to register for certain modules on a block-mode basis.
- g. *Re-registration:*  
A student may re-register for the module Investigative Project only with the permission of the Head of the Department. The purpose of the re-registration is to provide students with an opportunity to complete the project only, and not to redo it, should they fail the module.
- h. *Exclusion and readmission:*  
See Chapter 2 of Students' Rules and Regulations.

Key to asterisks:

\* Modules are offered in block mode. Full details on the offering is available from the department.

## CURRICULUM

### FIRST YEAR

CODE	MODULE	NQF-L	CREDIT	PREREQUISITE MODULE(S)
COL105X	Computer Literacy	(5)	(5)	
COS105X	Communication Skills	(5)	(6)	
EGH105B	Engineering Graphics	(5)	(14)	
EMA105B	Engineering Mathematics I	(5)	(28)	
INL125C	Information Literacy (block module)	(5)	(1)	
LFS125X	Life Skills (block module)	(5)	(2)	

### FIRST SEMESTER

CF1115B	Chemical Engineering Fundamentals I	(5)	(14)	
GPS115B	General Physics	(5)	(14)	
MSC115B	Material Science	(5)	(14)	

### SECOND SEMESTER

CF2115B	Chemical Engineering Fundamentals II	(5)	(14)	Chemical Engineering Fundamentals I
ORH115B	Organic Chemistry	(5)	(14)	
PHC115B	Physical Chemistry	(5)	(14)	

TOTAL CREDITS FOR THE FIRST YEAR: **140**

### SECOND YEAR

CODE	MODULE	NQF-L	CREDIT	PREREQUISITE MODULE(S)
EMA206B	Engineering Mathematics II*	(6)	(14)	Engineering Mathematics I
PAS206B	Probability and Statistics*	(6)	(14)	Engineering Mathematics I

### FIRST SEMESTER

CH1216B	Chemical Engineering Thermodynamics I	(6)	(14)	Chemical Engineering Fundamentals II Physical Chemistry
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HMT216B	Heat and Mass Transfer Processes	(6)	(14)	Chemical Engineering Fundamentals II
PFF216B	Process Fluid Flow*	(6)	(14)	Chemical Engineering Fundamentals II General Physics
SCP216B	Scientific Computing*	(6)	(14)	
<b>SECOND SEMESTER</b>				
CH2216B	Chemical Engineering Thermodynamics II	(6)	(14)	Chemical Engineering Thermodynamics I
CHP216B	Chemical Process Technology	(6)	(14)	Chemical Engineering Fundamentals II
CPO216B	Chemical Process Optimisation and Control*	(6)	(14)	Engineering Mathematics I
UNO216B	Unit Operations	(6)	(14)	Heat and Mass Transfer Processes
TOTAL CREDITS FOR THE SECOND YEAR:			<b>140</b>	

### THIRD YEAR

CODE	MODULE	NQF-L	CREDIT	PREREQUISITE MODULE(S)
IPJ307B	Investigative Project* (on completion of all first- and second-year modules)	(7)	(28)	
IPJ317R	Investigative Project* (re-registration) (first-semester module)	(7)	(0)	
<b>FIRST SEMESTER</b>				
CEE317B	Chemical Engineering Design I (Equipment)*	(7)	(14)	Chemical Engineering Thermodynamics II
CR1317B	Chemical Reaction Engineering I*	(7)	(14)	Chemical Engineering Thermodynamics II
EES317B	Environmental Engineering and Process Safety*	(7)	(14)	Engineering Mathematics I
PRY317B	Particle Technology*	(7)	(14)	Engineering Mathematics I
<b>SECOND SEMESTER</b>				
CEL317B	Chemical Engineering Design II (Plant)*	(7)	(14)	Chemical Engineering Design I (Equipment)*
CR2317B	Chemical Reaction Engineering II*	(7)	(14)	Chemical Reaction Engineering I
EPR317B	Engineering Practice*	(7)	(14)	
FUE317B	Fuel Technology*	(7)	(14)	Chemical Engineering Thermodynamics II Organic Chemistry
TOTAL CREDITS FOR THE THIRD YEAR:			<b>140</b>	
TOTAL CREDITS FOR THE QUALIFICATION:			<b>420</b>	



## 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 module. At time of publication, the syllabus content was defined as follows:

### C

#### **CHEMICAL ENGINEERING DESIGN I (EQUIPMENT) (CEE317B) 1 X 3-HOUR PAPER** *(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)*

Heat exchangers - advanced design; Vapor-Liquid Separators - enhanced distillation and batch distillation design; Vapor-Liquid Separators - absorber design; Vapor-Liquid Separators - extraction column design; Solid-Liquid Separators - membrane separator design; Solid-Liquid Separators - crystalliser design. (Total tuition time: ± 60 hours)

#### **CHEMICAL ENGINEERING DESIGN II (PLANT) (CEL317B) 1 X 3-HOUR PAPER** *(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)*

Nature of chemical process design and process economics; Optimisation methods applied in process design; Review of thermodynamic models and selection algorithm; Reactor and separator selection; Advanced distillation methods; Heat integration; and Plant Design Project. (Total tuition time: ± 60 hours)

#### **CHEMICAL ENGINEERING FUNDAMENTALS I (CF1115B) 1 X 3-HOUR PAPER** *(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)*

Introduction to chemical engineering calculations, Chemical engineering profession, units and dimensions, conversion, system of units, numerical calculations and estimation, validating results, dimensional homogeneity and dimensionless quantities; process data representation and analysis; Processes and process variables, mass, volume, flow rate, chemical composition, pressure, temperature; Material balances, balance on batch and steady-state processes, balance calculations, balances on multiple-unit processes, recycle and bypass, chemical reactions stoichiometry, balances on reactive processes, and combustion. (Total tuition time: ± 60 hours)

#### **CHEMICAL ENGINEERING FUNDAMENTALS II (CF2115B) 1 X 3-HOUR PAPER** *(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)*

Energy and energy balances, forms of energy, energy balances on closed, open systems, tables of thermodynamic data, energy balance procedures, mechanical energy balances; Energy balances on non-reactive processes, elements of energy balance calculations, heat capacities, phase change operations, Energy balances on reactive processes, heats of reaction, and reactive processes balances. (Total tuition time: ± 60 hours)

#### **CHEMICAL ENGINEERING THERMODYNAMICS I (CH1216B) 1 X 3-HOUR PAPER** *(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)*

Introductory concepts of thermodynamic systems, variables and significance of chemical engineering thermodynamics; properties of pure substance; first law of thermodynamics/heat and work; second law of thermodynamic/entropy. (Total tuition time: ± 60 hours)

#### **CHEMICAL ENGINEERING THERMODYNAMICS II (CH2216B) 1 X 3-HOUR PAPER** *(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)*

Volumetric properties of pure fluids; Heat effects; Thermodynamics properties of fluids; Vapour/liquid equilibrium (VLE): introduction; Solution thermodynamics: theory; Solution thermodynamics: application; and Chemical reaction equilibrium. (Total tuition time: ± 60 hours)

#### **CHEMICAL PROCESS OPTIMISATION AND CONTROL (CPO216B) 1 X 3-HOUR PAPER** *(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)*

Introduction to process control and instrumentation; Theoretical model of chemical processes; Modelling for process control; Analysis of the dynamic behaviour; Overview of control system design; Analyses, design, tuning of feedback control system and frequency response analysis. (Total tuition time: ± 60 hours)



**CHEMICAL PROCESS TECHNOLOGY (CHP216B) 1 X 3-HOUR PAPER**

**(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Introduction to chemical and clean coal technologies; Renewable energy technologies processes; Petroleum refining; Pulp and paper manufacturing; Mineral processing; Bulk chemicals production. (Total tuition time: ± 60 hours)

**CHEMICAL REACTION ENGINEERING I (CR1317B) 1 X 3-HOUR PAPER**

**(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Mole balances; Conversion and reactor sizing; Rate laws and stoichiometry; Isothermal reactor design; Collection and analysis of rate data; Multiple reactions. (Total tuition time: ± 60 hours)

**CHEMICAL REACTION ENGINEERING II (CR2317B) 1 X 3-HOUR PAPER**

**(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Steady-state non-isothermal reactions; Catalysis and catalytic reactions; Mass transfer resistances effects in heterogeneous reactions; Non-ideal reactors. (Total tuition time: ± 60 hours)

**COMMUNICATION SKILLS (COS105X) 1 X 2-HOUR PAPER**

**(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

To identify and apply basic competencies related to communicating in a technical or engineering environment. These competencies include presenting technical information to a variety of audiences, preparing technical reports, participating constructively in formal meetings and preparing a variety of business and technical documents. (Total tuition time: ± 40 hours)

**COMPUTER LITERACY (COL105X) CONTINUOUS ASSESSMENT**

**(Module custodian: End User Computing Unit)**

Students have to acquire foundational knowledge in Computing Fundamentals, essential digital skills in key applications based on Ms Office Suite (i.e. MS Word, MS Excel, MS PowerPoint, MS Visio Professional and MS Access) and network basics (i.e. MS Outlook and Internet). A complete syllabus and module outlines are described in the study guide. Students will do online exams that are mapped with SAQA and IC3 Essential Skills for Digital Literacy (International Certification). (Total tuition time: not available)

**E**

**ENGINEERING GRAPHICS (EGH105B) CONTINUOUS ASSESSMENT**

**(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Introduction to graphics communication. Dimensioning and tolerance practices. Geometrical construction. Pictorial projections. Interpenetration and development. Machine drawings. Civil drawings including electrical diagrams. (Total tuition time: ± 90 hours)

**ENGINEERING MATHEMATICS I (EMA105B) 2 X 2-HOUR PAPERS**

**(Module custodian: Department of Mathematics and Statistics)**

Mathematical software, Trigonometry, geometry, functions, complex numbers, vector algebra, matrices and transformations, single variable differentiation and integration, partial differentiation, Multiple integrals, Line and surface integrals, introduction to differential equations. Matrix operations, Systems of equations, Linear spaces and transformations and Eigenvalue problems (Total tuition time: ± 190 hours)

**ENGINEERING MATHEMATICS II (EMA206B) 1 X 3-HOUR PAPER**

**(Module custodian: Department of Mathematics and Statistics)**

Differential Equations: The modelling process; First-order linear ordinary differential equations; Higher-order differential equations; Laplace transforms; Systems of linear first-order differential equations; Numerical solutions of ordinary differential equations; Sturm-Liouville problems; Partial differential equations. (Total tuition time: ± 60 hours)

**ENGINEERING PRACTICE (EPR317B) 1 X 3-HOUR PAPER**

**(Module custodian: Department of Electrical Engineering)**

Engineering Communication; Project Management; Management and Ethics; Contracts and Intellectual Property; Entrepreneurship. (Total tuition time: ± 95 hours)



**ENVIRONMENTAL ENGINEERING AND PROCESS SAFETY (EES317B) 1 X 3-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Introduction to graphics communication. Dimensioning and tolerance practices. Geometrical construction. Pictorial projections. Interpenetration and development. Machine drawings. Civil drawings including electrical diagrams. (Total tuition time: ± 90 hours)

**F****FUEL TECHNOLOGY (FUE317B) 1 X 3-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Coal Technology (solid fossil fuel); Petroleum and gas technology (liquid fossil fuel and gas); Combustion technology; Fuel cells and hydrogen technology; Nuclear technology; and Renewable energy technology. (Total tuition time: ± 60 hours)

**G****GENERAL PHYSICS (GPS115B) 1 X 3-HOUR PAPER****(Module custodian: Department of Physics)**

Motion along straight line: displacement, velocity, acceleration. Projectile motion in two dimensions and three dimensions. Force and Newton's Laws, friction, circular motion. Impuls and momentum, elastic and inelastic collisions. Rotation, kinetic energy, torque. Temperature, heat and first law of thermodynamics. Oscillations and waves. (Total tuition time: ± 90 hours)

**H****HEAT AND MASS TRANSFER PROCESSES (HMT216B) 1 X 3-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Fundamentals of heat transfer; Steady state one dimensional and multiple dimensions conduction; Condensation and boiling heat transfer; Mass transfer. (Total tuition time: ± 60 hours)

**I****INFORMATION LITERACY (INL125C) CONTINUOUS ASSESSMENT****(Module custodian: Directorate of Library and Information Services)**

Introduction of information literacy. Development of a search strategy and application of a search string to search engines and academic databases. Evaluation of information sources. Ethical and legal use of information. (Total tuition time: ± 10 hours)

**INVESTIGATIVE PROJECT (IPJ307B/IPJ317R) PROJECT ASSESSMENT****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Chemical engineering research; Research Proposal; Formulate the project (proposal), Describe and justify the theoretical framework and methodology to address the project, introduction, abstract, main body, conclusion and recommendations, tables figures, graphs, illustrations, references, appendices, writing the first draft, revising the first, content and structure, scientific and technical prose, Conducting and managing project; Data Analysis, statistical analysis of data and display; Software support for various writing and graphic tasks; Use of Microsoft Power Point; and poster and feasibility report; Technical report writing (Final report); analyse the information gained/result of the project, draw conclusion / make recommendations based on the project, produce a report of the completed work; Project communication, audiences, scientific and technical prose, short talks and poster; Investigative research. (Total tuition time: not available)

**L****LIFE SKILLS (LFS125X) CONTINUOUS ASSESSMENT****(Module custodian: Directorate of Student Development and Support)**

Academic, personal and socio-emotional skills development for students in higher education. Personal and social dimensions address: Effective planning and self-management (goal setting and time management); Adjusting to university life (student life, diversity and change); Intra- and interpersonal skills development (conflict management, self-esteem, relationship management); Effective living (healthy living, HIV education, substance abuse). Academic dimension addresses: Academic skills for university (e.g. critical thinking, creativity, managing assignments and assessments). (Total tuition time: ± 20 hours)



**M****MATERIAL SCIENCE (MSC115B)****1 X 3-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Introduction to materials science and engineering; atomic structure and interatomic bonding; Crystalline solids: structure and imperfections; mechanical properties and failure; Processing and applications of metals; ceramics: structure, properties, processing and applications; polymer material science; composites and advanced materials. (Total tuition time: ± 60 hours)

**O****ORGANIC CHEMISTRY (ORH115B)****1 X 3-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Introduction to organic chemistry, organic molecules, classes, nomenclature, structures, bonding and simple reactions; mechanisms of reactions of organic compounds - stereochemistry, resonance, nucleophilic additions and substitutions, elimination reactions; hydroxyl 1 group - alcohol and phenols, carbonyl group - aldehydes and ketones structure, carboxylic acid derivatives - anhydrides acid halides esters and amide, amino group - amines, structure; fats and oils, amino acids, proteins, carbohydrates, natural products; chromatography - principles and methods with special emphasis on planar chromatography; liquid extraction and solid phase extraction, comparison of traditional and modern extraction procedures; Introduction to electro-analytical methods. (Total tuition time: ± 60 hours)

**P****PARTICLE TECHNOLOGY (PRY317B)****1 X 3-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Particle size analysis; Size reduction, Flow past immersed bodies; Mechanical-physical separation process; drying; Membrane separation processes. (Total tuition time: ± 60 hours)

**PHYSICAL CHEMISTRY (PHC115B)****1 X 3-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Chemical equations, stoichiometry, acids and bases; Chemical kinetics, equilibrium and aqueous solutions; Kinetic-molecular theory of gases; Thermochemistry: properties of the Gibbs functions; chemical potential; fugacity; changes of state; Equilibria: chemical and electrochemical; Quantum mechanics; Basic principles of photochemistry; kinetics of photochemical processes. (Total tuition time: ± 60 hours)

**PROBABILITY AND STATISTICS (PAS206B)****1 X 3-HOUR PAPER****(Module custodian: Department of Mathematics and Statistics)**

Data Handling; Combinatorics; Probability and Probability Models; Normal Distribution and Sampling; Statistical Inference. (Total tuition time: ± 80 hours)

**PROCESS FLUID FLOW (PFF216B)****1 X 3-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Fluid statics and dynamics principles; Incompressible flow in pipes and channels for Newtonian and non-Newtonians; Flow of compressible fluids in pipes; Two-phase flow; Pumps and valves; Mixing of Newtonian liquids in tanks. (Total tuition time: ± 60 hours)

**S****SCIENTIFIC COMPUTING (SCP216B)****CONTINUOUS ASSESSMENT****(Module custodian: Department of Electrical Engineering)**

Scientific programming environment and software; Selection and loop statements; Data structures; Input, output and graphics; Engineering applications, case studies and simulations. (Total tuition time: ± 60 hours)





**UNIT OPERATIONS (UNO216B)****1 X 3-HOUR PAPER****(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)**

Psychometrics charts and cooling towers; Distillation; Adsorption; Drying; Extraction; Leaching. (Total tuition time:  $\pm$  60 hours)

