

BACHELOR OF ENGINEERING TECHNOLOGY IN CHEMICAL ENGINEERING

BengTech (Chemical Engineering) - NQF Level 7 (420 credits)

Qualification code: **BPHE20**

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

Campus where offered:

Pretoria Campus

REMARKS

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

• **FOR PPLICANTS 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.

• **FOR 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.

• **FOR 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.



- **FOR 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.

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

Admission requirement(s):

An 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.

- **FOR 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(s):*

No further assessment will be done (except for candidates with an N6 Certificate (see above)). Applicants who achieve the minimum APS will be considered until the programme complement is full. Acceptance is subject to available capacity according to the Student Enrolment Plan (SEP). 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.

- 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. *Presentation:*
Day classes.
- f. *Minimum duration:*
Three years.
- g. *Exclusion and readmission:*
See Chapter 2 of Students' Rules and Regulations.
- h. *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 final project only, and not to redo the whole module, should they fail the module.

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
HMT216B	Heat and Mass Transfer Processes	(6)	(14)	Chemical Engineering Fundamentals II



PFF216B	Process Fluid Flow	(6)	(14)	Chemical Engineering Fundamentals II General Physics
SHM216B	Scientific Computing	(6)	(14)	
SECOND SEMESTER				
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:			140	

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, see paragraph h)	(7)	(0)	
FIRST SEMESTER				
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
SECOND SEMESTER				
CEL317B	Chemical Engineering Design II (Plant)	(7)	(14)	Chemical Engineering Design I (Equipment)
CR2317B	Chemical Reaction Engineering II	(7)	(14)	Chemical Reaction Engineering I
EHE317B	Engineering Practice	(7)	(14)	
FUE317B	Fuel Technology	(7)	(14)	Chemical Engineering Organic Chemistry Thermodynamics II
TOTAL CREDITS FOR THE THIRD YEAR:			140	
TOTAL CREDITS FOR THE QUALIFICATION:			420	



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 notional time: 140 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 notional time: 140 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 notional time: 140 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 notional time: 140 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; and second law of thermodynamic/entropy. (Total notional time: 140 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 notional time: 140 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 notional time: 140 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; and Bulk chemicals production. (Total notional time: 140 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; and Multiple reactions. (Total notional time: 140 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 notional time: 140 hours)

COMMUNICATION SKILLS (COS105X) 1 X 2-HOUR PAPER

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

The purpose of this module is 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 notional time: 60 hours)

COMPUTER LITERACY (COL105X) CONTINUOUS ASSESSMENT

(Module custodian: End User Computing Unit)

This module provides foundational knowledge in computing fundamentals, essential digital skills in key applications based on MS Office Suite and network basics (i.e. MS Outlook and Internet). Online exams are mapped with End-User Computing: SAQA 49077 (61591) Core Element as well as Internet and Computing Core Certification. (IC3). (Total notional time: 50 hours)

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 notional time: 140 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 notional time: 280 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; and Partial differential equations. (Total notional time: 140 hours)

ENGINEERING PRACTICE (EHE317B) CONTINUOUS ASSESSMENT

(Module custodian: Department of Electrical Engineering)

Engineering Communication; Project Management; Management and Ethics; Contracts and Intellectual Property; and Entrepreneurship. (Total notional time: 140 hours)



ENVIRONMENTAL ENGINEERING AND PROCESS SAFETY (EES317B) **1 X 3-HOUR PAPER**
(Module custodian: Department of Chemical, Metallurgical and Materials Engineering)
Environmental laws related to air, water and solid wastes; Process safety; Air pollution control; Water and wastewater treatment; Solid waste management; and Waste minimisation. (Total notional time: 140 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 notional time: 140 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. Impulse and momentum, elastic and inelastic collisions. Rotation, kinetic energy, torque. Temperature, heat and first law of thermodynamics. Oscillations and waves. (Total notional time: 140 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; and Mass transfer. (Total notional time: 140 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 notional 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 conclusions/make recommendations based on the project, produce a report of the completed work; Project communication, audiences, scientific and technical prose, short talks and poster; and Investigative research. (Total notional time: 280 hours)

L

LIFE SKILLS (LFS125X) **CONTINUOUS ASSESSMENT**
(Module custodian: Directorate of Student Development and Support)
Personal, socio-emotional and academic skills development for students in higher education. This module includes: 1. Intra- and interpersonal skills (e.g. emotional intelligence, relationships, and conflict management); 2. General study skills (e.g. time management, goal setting, learning styles); 3. Health and wellness (e.g. HIV/AIDS, GBV issues, substance abuse); 4. Student life and adjustment (e.g. identity development, adjusting to a higher education environment); and 5. Financial management. (Total notional 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; and composites and advanced materials. (Total notional time: 140 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; and Introduction to electro-analytical methods. (Total notional time: 140 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; and Membrane separation processes. (Total notional time: 140 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; and kinetics of photochemical processes. (Total notional time: 140 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; and Statistical Inference. (Total notional time: 140 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; and Mixing of Newtonian liquids in tanks. (Total notional time: 140 hours)

S**SCIENTIFIC COMPUTING (SHM216B)****CONTINUOUS ASSESSMENT****(Module custodian: Department of Electrical Engineering)**

Scientific computing and programming environment. Fundamentals of programming: Selection and loop statements. Use-defined functions. Input, output and graphics. Engineering application case studies and simulations. (Total notional time: 140 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; and Extraction; Leaching. (Total notional time: 140 hours)

