

BEng (Hons) Chemical and Environmental Engineering - E400 (Under Review)

1. Objectives

The Degree Programme has been designed to help meet the future needs of the Mauritian economy. Consumer demand for a variety of processed and convenience foods and drinks including sugar, many based on local agricultural products, are to be anticipated and this will, in turn, create new process industries. The rise in GNP will also lead to the growth of industries providing liquid and gaseous fuels, fertilizers, building materials, rubber and plastics, pharmaceutical and medical products, and speciality chemicals and there will be a role for chemical engineers in all these. The service industries required by an increasingly sophisticated society to supply water, electricity and other forms of energy, effluent and sewage treatment and environmental control will likewise need their share of chemical and process engineers.

The credit system based modular approach of the Degree Programme provides flexibility to students and efficiency in the use of resources.

2. General Entry Requirements

As per General Entry Requirements for Admission to the University for Undergraduate Degrees.

3. Programme Requirements

Credit in Chemistry at SC/ 'O' Level.

2 GCE 'A' Level Passes in Mathematics and Chemistry and preferably one of the following subjects: Physics, Physical Science, Engineering Science, Physics with Chemistry, Design & Technology (Technology).

(i) Minimum Requirements for the Award of Degree

<u>Modules</u>	<u>Credits</u>
Humanities & Management	6
Basic Sciences & Mathematics	9
Engineering	115
TOTAL	130

- For the degree award, all core modules prescribed by the department must be completed.
- Industrial training must be completed satisfactorily for the award of the degree.

(ii) Minimum Requirements for Diploma Award

A student may opt for a Diploma in Chemical and Environmental Engineering provided s/he satisfies the following minimum requirements. The Diploma project would normally be of 8 weeks duration for an input of at least 90 hours.

<u>Modules</u>	<u>Credits</u>
Humanities & Management	3
Basic Sciences & Mathematics	6
Departmental	45
Diploma Project	6
TOTAL	60

5. Programme Duration

	Normal (Years)	Maximum (Years)
Degree:	4	7

6. Credits per Semester: Minimum 9, Maximum 24 subject to Regulation 5.

7. Assessment

As per University regulations on assessment (c.f. section 2.7).

Modules (if any) to be assessed jointly will be indicated prior to delivery of the modules.

Module MECH 1111(1) will be assessed solely by continuous assessment.

8. List of Modules – BEng (Hons) Chemical and Environmental Engineering

<u>CORE MODULES</u>		Hrs/Wk	Credits
		L+P	
BASIC SCIENCES & MATHEMATICS			
MATHS 1111(1)	Mathematics 1	D.E.	3
MATHS 1211(1)	Mathematics 2	D.E.	3
MATH 2101(3)	Mathematics 3	3+0	3
ENGINEERING			
CHE 1102(1)	Chemistry	3+2	4
CHE 1106(3)	Thermodynamics	D.E.+1	3.5
CHE 1206(1)	Basic Chemical Engineering	3+0	3
CHE 2102A(3)	Sugar Technology	3+3	4.5
CHE 2103(3)	Heat Transfer	3+2	4
CHE 2104(3)	Instrumentation & Process Control	3+2	4
CHE 2204(3)	Transport Phenomena	3+0	3
CHE 2205(3)	Reaction Engineering	3+1	3.5
CHE 2206(1)	Introduction to Environmental Engineering	3+2	4
CHE 3101A(3)	Process Design & Simulation 1	3+0	3
CHE 3102(3)	Chemical Process Safety and Loss Prevention	3+0	3
CHE 3103(3)	Unit Operations 1	3+2	4
CHE 3104(5)	Chemical Thermodynamics	3+0	3
CHE 3105(1)	Laboratory Project	0+4	2
CHE 3200	Industrial Training	-	0
CHE 3201(5)	Process Design & Simulation 2	3+2	4

CHE 4208(5)	Unit Operations 2	3+0	3
CHE 4000A(5)	Degree Project	-	12
CHE 4101A(3)	Design Project 1	1+6	4
CHE 4111(5)	Design Project 2	1+8	5
CHE 4103(5)	Cleaner Production Technologies	3+0	3
CIVE 1101(1)	Engineering Materials	3+1	3.5
CHE 1107(1)	Fluid Mechanics 1	3+0	3
CHE 4210(5)	Environmental Management Tools	3+0	3
CSE 1010e(1)	Introduction to Information Technology	O.E.	3
CSE 1020(1)	Computer Programming	2+2	3
ELEC 2211(3)	Control Systems	3+0	3
MECH 1213(1)	Applied Mechanics	3+1	3.5

HUMANITIES & MANAGEMENT

COMS 1010(1)	Communication Skills	D.E.	3
--------------	----------------------	------	---

ELECTIVES

ENGINEERING

CHE 3106(5)	Chemical Engineering Economics	3+0	3
CHE 4206(5)	Energy Engineering	3+0	3
CHE 4207(5)	Solid Waste Management	3+0	3
CHE 2207(3)	Fluid Mechanics 2	3+1	3.5
CHE 4109(5)	Wastewater Management	3+1	3.5
CHE 4209(5)	Water Pollution Control	3+0	3
MECH 1111(1)	Engineering Graphics 1	2+2	3
MECH 4163(5)	Operational Research 1	3+0	3
CHE 4105(5)	Quality Systems	3+0	3

BASIC SCIENCES & MATHEMATICS

MATH 1231(1)	Probability and Statistics 1	D.E.	3
--------------	------------------------------	------	---

HUMANITIES & MANAGEMENT

ACF 1000(1)	Accounting for Fin Decision Making	3+0	3
ECON 1015(1)	Economics	3+0	3

NOTE: Engineering Electives

1. Students are required to take at least 15 credits (minimum of 9 credits from Year 4 modules) in the engineering elective category.
2. Students are allowed to choose any elective module contained in GEMs list available at the Faculty's Office. However, the offer of the electives would be subject to availability of resources and existence of a critical mass of demand for the modules. Students are requested to contact their Course Adviser before entering any module under the GEMs in their module registration form.

NOTE: Core module for Diploma

CHE 2000(3) - Diploma Project

9. Programme Plan - BEng (Hons) Chemical and Environmental Engineering

YEAR 1							
Semester 1				Semester 2			
Code	Module	Hrs/Wk L+P	Credits	Code	Module	Hrs/Wk L+P	Credits
CORE				CORE			
MATHS 1111(1)	Mathematics 1	D.E.	3	MATHS 1211(1)	Mathematics 2	D.E.	3
CHE 1102(1)	Chemistry	3+2	4	CSE 1020(1)	Computer Programming	2+2	3
CSE 1010e(1)	Introduction to IT	O.E.	3	MECH 1213(1)	Applied Mechanics	3+1	3.5
CHE 1107(1)	Fluid Mechanics 1	3+0	3	CHE 1206(1)	Basic Chem Engineering	3+0	3
CIVE 1101(1)	Engineering Materials	3+1	3.5	COMS 1010(1)	Communication Skills	D.E.	3
CHE 1106(3)	Thermodynamics	D.E.+ 1	3.5				
ELECTIVE				ELECTIVE			
MECH 1111(1)	Engineering Graphics I*	2+2	3	ACF 1000(1)	Acc for Fin Decision Making	3+0	3
YEAR 2							
Semester 1				Semester 2			
Code	Module	Hrs/Wk L+P	Credits	Code	Module	Hrs/Wk L+P	Credits
CORE				CORE			
MATH 2101(3)	Mathematics 3	3+0	3	ELEC 2211(3)	Control Systems 1	3+0	3
CHE 2102A(3)	Sugar Technology	3+3	4.5	CHE 3103(3)	Unit Operations 1	3+2	4
CHE 2103(3)	Heat Transfer	3+2	4	CHE 2204(3)	Transport Phenomena	3+0	3
CHE 2104(3)	Instr & Process Control	3+2	4	CHE 2206(1)	Intro to Environment Eng	3+2	4
CHE 2205(3)	Reaction Engineering	3+1	3.5	CHE 3105(1)	Lab. Projects	0+4	2

ELECTIVE

ECON 1015(1) Economics 3+0 3

ELECTIVESMATH 1231(1) Probability and Statistics I D.E. 3
CHE 2207(3) Fluid Mechanics 2 3+1 3.5**YEAR 3****Semester 1**

Code	Module	Hrs/Wk L+P	Credits
------	--------	------------	---------

CORE

CHE 3101A(3)	Proc Design & Simulation 1	3+0	3
CHE 3102(3)	Chem Process Safety & Loss Prevention	3+0	3
CHE 4208(5)	Unit Operations 2	3+0	3
CHE 3104(5)	Chemical Thermodynamics	3+0	3
CHE 4101A(3)	Design Project 1	1+6	4

ELECTIVE

CHE 3106(5) Chem Eng Economics 3+0 3

Semester 2

Code	Module	Hrs/Wk L+P	Credits
------	--------	------------	---------

CORE

CHE 3201(5)	Proc Design & Simulation 2	3+2	4
CHE 3200	Industrial Training	-	0

YEAR 4**Semester 1**

Code	Module	Hrs/Wk L+P	Credits
------	--------	------------	---------

CORE

CHE 4000A(5)	Degree Project	-	-
CHE 4103(5)	Cleaner Production Technologies	3+0	3
CHE 4111(5)	Design Project 2	1+8	5

ELECTIVES

CHE 4109(5)	Wastewater Management	3+1	3.5
MECH 4163(5)	Operational Research 1	3+0	3
CHE 4105(5)	Quality Systems	3+0	3

Semester 2

Code	Module	Hrs/Wk L+P	Credits
------	--------	------------	---------

CORE

CHE 4000A(5)	Degree Project	-	12
CHE 4210(5)	Environmental Management Tools	3+0	3

ELECTIVES

CHE 4206(5)	Energy Engineering	3+0	3
CHE 4207(5)	Solid Waste Management	3+0	3
CHE 4209(5)	Water Pollution Control	3+0	3

NOTE 1: * Module to be assessed by continuous assessment**NOTE 2:** Year 1 students will be required to follow AUTOCAD during the Semester 1 Year 1 vacation

10. Outline Syllabus

This outline syllabus is not prescriptive and is intended to serve as a guide only.

Note: Pre-requisite (PR); Pre-requirement (PQ).

ACF 1000(1) - ACCOUNTING FOR FINANCIAL DECISION MAKING

The Role of Accounting Information; Recording and Summarising Transactions; Accounting Concepts & Preparing Final Accounts; Adjustments to Final Accounts; Capital v/s Revenue Expenditure; Bank Reconciliation Statement; Accounting Ratios; Accounting for Internal Decision Making Techniques; Elements of Cost; Costing Methods & Techniques; Decision Making Techniques; Accounting for Manufacturers; Budgets.

CIVE 1101(1) - ENGINEERING MATERIALS (L/P - 3.5)

Properties of Materials - Hydraulic and Bituminous Binders; Plastics; Glass; Ceramics and Composite Materials. Materials Science - Crystal Structure; Plastic Deformation; Properties and Behaviour of Materials.

CHE 1102(1) - CHEMISTRY (L/P - 4)

Physical Chemistry. Molecular Structure, Spectroscopy, Non Electrolyte Solutions, Ionic Equilibria. Organic Chemistry: Structure and Bonding, Stereochemistry, Reaction Mechanisms.

CHE 1106(3) - THERMODYNAMICS (L/P - 3.5)

Thermodynamics System and Properties of Substances. First and Second laws and their Applications. Enthalpy and Auxiliary functions. Work, Heat and Power Cycles. Use of Relevant Tables e.g. Steam, Psychometric Charts.

CHE 1107(1) - FLUID MECHANICS 1 (L - 3)

Fundamental concepts relating to fluids. Fluids in equilibrium. Principles of fluid motion. Introduction to energy and momentum principles.

CHE 1206(1) - BASIC CHEMICAL ENGINEERING (L - 3)

Units, dimensions and dimensional analysis. Material and Energy Balances. Process Flow Sheets using Autosketch. Basic heat and mass transfer. Basic Reaction Engineering.

CHE 2102A(3) - SUGAR TECHNOLOGY (L/P - 4.5)

Basic physico-chemical principles underlying the extraction of sugar. Fundamental principles of sugar manufacture. Energy Management in Sugar Manufacture. Methods of Analysis applicable to the Sugar Industry.

CHE 2103(3) - HEAT TRANSFER (L/P - 4) (PR: CHE 1106(3))

Fundamentals of heat transfer. Differential equations of heat transfer. Steady-state conduction. Convective heat transfer. Radiation heat transfer. Heat-Transfer Equipment.

CHE 2104(3) - INSTRUMENTATION AND PROCESS CONTROL (L/P - 4)

Measurements, instrumentation and signal transmissions. Introduction to Process control. Steady State Analysis.

CHE 2204(3) - TRANSPORT PHENOMENA (L - 3)

Transfer Mechanisms, Properties and Analogies. Mass, Momentum and Energy Balances. Velocity, Temperature and Concentration Profiles. Application of Principles to Simple Design Problems.

CHE 2205A(3) - REACTION ENGINEERING (L/P - 3.5) (PR: CHE 1206(1))

Theory of chemical reactions: Arrhenius theory, collision theory, absolute reaction rate theory. Rate and classification of reactions. catalytic and enzymatic reactions. Interpretation of kinetic data. Introduction to batch and flow reactor design. Plug flow reactors. Multiple reactor system.

CHE 2206(1) - INTRODUCTION TO ENVIRONMENTAL ENGINEERING (L/P - 4)

Environmental Systems overview. Fundamental principles of Environmental Engineering.

CHE 2207 (3) - FLUID MECHANICS 2 (L/P - 3.5) (PR: CHE 1107(1))

The momentum equation and its application. The energy equation and its application. Flow in pipelines and open channels. Rotodynamics. Dimensional analysis and similarity.

CHE 3101A(3) - PROCESS DESIGN AND SIMULATION 1 (L - 3) (PR: CHE 2204(3))

Fundamentals of simulation and design of selected separation equipment.

CHE 3102(3) - CHEMICAL PROCESS SAFETY AND LOSS PREVENTION (L - 3)

Accidents on industrial premises. Accidents in chemical plants. Fires and explosions in chemical plants. Type of fire in chemical plant. Safety management.

CHE 3103(3) - UNIT OPERATIONS 1 (L/P - 4)

Unit operations relevant to the sugar manufacturing process and other chemical industries.

CHE 3104(5) - CHEMICAL THERMODYNAMICS (L - 3) (PR: CHE 1106(3))

Partial molar quantities, Gibbs-Duhem Equation in multicomponent systems. Phase rule and equilibria and thermodynamics of solutions. Activity coefficients, fugacity, reaction equilibria. Thermodynamics analysis of processes.

CHE 3105(1) - LABORATORY PROJECT (P - 2)

Hands-on experience on chemical engineering equipment.

CHE 3106(5) - CHEMICAL ENGINEERING ECONOMICS (L - 3)

Principles of economic analysis of chemical engineering processes. Project development; evaluation and commercialisation; legal financial aspects.

CHE 3200 - INDUSTRIAL TRAINING (P - 0)

Industrial Training of around 20 weeks.

CHE 3201(5) - PROCESS DESIGN & SIMULATION 2 (L/P - 4) (PR: CHE 3101(3))

Introduction to design of equipment. Simulation of chemical engineering equipment using a simulation package.

CHE 4000A(5) - DEGREE PROJECT (P - 12)

Project related to Sugar Engineering or Energy and Environmental Engineering.

CHE 4101A(3) - DESIGN PROJECT 1 (L/P - 4)

Problem definition, Preliminary Report: Introduction, Process consideration, Mass Balances, Energy Balances, Preliminary Design, Control Strategy, Preliminary Hazop, Basis for Detailed Design.

CHE 4103(5) - CLEANER PRODUCTION TECHNOLOGIES (L - 3) (PR: CHE 2206(1))

Fundamentals of ecological sustainable production processes. Process modifications and waste minimisation techniques for cleaner production.

CHE 4105(5) - QUALITY SYSTEMS

Introduction to Quality Management Systems, ISO 9000, OHSAS 18001 (Occupational Health and Safety Management Systems), Internal Auditing, Problem Solving, Introduction to Statistical Process Control, Quality Control Tools, Sampling Plans, Continuous Improvement, Benchmarking, Total Quality Management.

CHE 4109(5) - WASTE WATER MANAGEMENT (L/P - 3.5)

Physical, chemical and biological characteristics of wastewater. Water pollution surveys. Measurement of flow rate of wastewater. Water re-cycling and re-use in chemical and other industries. Reduction of water pollution-at-source. Wastewater segregation. Wastewater treatment.

CHE 4111(5) - DESIGN PROJECT 2 (L/P - 5)

Redefining Basis for Detailed Design, (Material & Energy Balances), Detailed Design of at least 2 Equipment by each candidate, Detailed Hazop around a major Unit operation, Detailed PI, Equipment Schedule & Costing.

CHE 4206(5) - ENERGY ENGINEERING (L - 3)

Energy sources and utilisation, Energy technologies and environmental implications of energy production and use. Conventional and emerging techniques for energy production and conservation. Energy management and economic considerations.

CHE 4207(5) - SOLID WASTE MANAGEMENT (L - 3) (PR: CHE 4103(5))

Waste minimisation. Materials Recovery. Recycling. Incineration. Composting. Landfilling. Legislation.

CHE 4208(5) - UNIT OPERATIONS 2 (L - 3) (PR: CHE 3103(3))

Design principles applicable to distillation, liquid-liquid extraction, leaching, filtration.

CHE 4209(5) - WATER POLLUTION CONTROL (L - 3) (PR: CHE 4109(5))

Operation of physical, chemical and biological wastewater treatment systems and their design. Advanced wastewater treatment processes. Design of facilities for the treatment, handling and disposal of sludge. Natural treatment systems. Wastewater reclamation and re-use in chemical and other industries.

CHE 4210(5) - ENVIRONMENTAL MANAGEMENT TOOLS (L - 3)

Environmental Impact Assessment (EIA). Environmental Performance Evaluation (ISO 14031). Environmental Management in Industry with special emphasis on Chemical Industries. ISO 14000 standards. Environmental Management Systems (EMS)/ Environmental Auditing.

COMS 1010(1) - COMMUNICATION SKILLS

Writing skills, non-verbal communication, modes of speech delivery and presentation aids, speeches, perception and listening skills, business and technical writing.

CSE 1010e(1) - INTRODUCTION TO INFORMATION TECHNOLOGY

IT and Computers; Stepping in the Computer; Input and Output Devices; Secondary Storage; Programming; Systems Software; Applications Software; Systems Development; Computer Networks; The internet; Computer Security; Software Utilities; Issues and Trends in IT.

CSE 1020(1) - COMPUTER PROGRAMMING

Basic types; arithmetic & logical operators and expressions; decision and loop structures; arrays (one-dimensional and two-dimensional); functions; value and reference parameters; files: creation, opening, writing, closing; introduction to structures data types.

ECON 1015(1) - ECONOMICS

Microeconomics: Economics and the economy; Demand, supply and the market; Elasticity concept; Theory of consumer choice; Theory of supply: costs and production; Market Structure; Labour market; Introduction to Welfare Economics.

Macroeconomics: Introduction, National income accounting; the determination of national income equilibrium; Aggregate demand; Fiscal policy and Foreign trade; Money and Banking; Monetary and fiscal policy; Unemployment; Inflation; Economic Growth.

ELEC 2211(3) - CONTROL SYSTEMS 1 (L - 3)

Modelling of Single Input Single Output Systems. Time and Frequency Domain Analysis. Stability.

MATH 1231(1) - PROBABILITY AND STATISTICS I (PR: A-LEVEL MATHS)

Elementary probability. Conditional probability. Discrete and continuous distributions. The Central Limit Theorem. Introduction to Linear Regression. Estimation and Hypothesis testing.

MATH 2101(3) - MATHEMATICS 3

Complex variables. Laplace and Fourier Transforms. Fourier series. Numerical solutions of differential equations.

MATHS 1111(1) - MATHEMATICS 1 (PR: A-LEVEL MATHEMATICS)

Calculus of one and several variables. Polar coordinates. Complex numbers. Hyperbolic functions. Limits. Ordinary differential equations.

MATHS 1211(1) - MATHEMATICS 2 (PR: A-LEVEL MATHEMATICS)

Matrix Algebra: Matrices and determinants. Solution of linear systems of equations. Eigenvalues and eigenvectors. Infinite Series: Comparison test and Ratio test for non-negative series. Vector Algebra: Scalar

and vector products, triple products. Vector equations. Vector Analysis: Gradient, divergence and curl. Line and multiple integrals. Green's theorem in the plane, Divergence theorem and Stokes' theorem.

MECH 1111(1) - ENGINEERING GRAPHICS I (L/P - 3)

Introduction to Drawing Office Practice, BS 308, etc; Geometrical constructions; Blending of curves; Linkages, Locus, Ellipse, cycloid, epicycloid, etc; Introduction to development (Prisms, cylinders, etc); Orthographic Projection (systems of projection); Dimensioning and Tolerancing; Sections and sectional views. Introduction to isometric projection; Standard Parts (Threading, Fasteners, etc); Assembly Drawing.

MECH 1213(1) - APPLIED MECHANICS (L/P - 3.5)

Statics; Dynamics; Friction; Work Power and Energy; Direct Stress and Strain; Shear and Torsion; Shear Force & Bending Moment.

MECH 3137(5) - QUALITY AND RELIABILITY 1 (L - 3)

Principles of Quality Assurance, Relation to Design, Development, Manufacturer and User Products and Services. Management Aspects of Reliability, Basic Statistics, Reliability Engineering.

MECH 4163(5) - OPERATIONS RESEARCH 1 (L/P - 3)

Linear Programming Techniques, Forecasting Techniques, Decision & Utility, Theory, Advanced Inventory model, JIT Systems, Scheduling of Manufacturing & Service Systems, Queuing Theory, Network Models.