BEng (Hons) Chemical Engineering - E404 (Under Review)

1. Introduction

Chemical engineering requires a complete and quantitative understanding of both the engineering and scientific principles underlying technological processes that enables appropriate plant design and practical problem solving in industries. The first three years of this 4-year degree programme provides an in-depth knowledge and understanding of the design, development and operation of chemical processes and plants together with their proper management and optimum resource use; it focuses on specific chemical engineering modules like chemical thermodynamics, heat transfer, mass transfer, unit operations, chemical process design, reaction engineering and process safety. In fourth year, it subsequently provides the learners with the opportunity to apply the knowledge acquired so far in designing a complete commercial chemical processing plant, and to concurrently opt for either the environmental engineering or the energy engineering by acquiring knowledge in specific modules like solid waste engineering, wastewater management and engineering, and industrial ecology, energy engineering/management and renewable energy technologies, and by opting or linking the bachelor degree project to this area.

This programme thus combines the wide range of core chemical engineering modules including those focusing on multidisciplinary knowledge. It includes the essential academic structure to provide the undergraduates with an excellent foundation for careers in the chemical and/or environmental engineering industry. It typically prepares them to meet the challenges in the chemical processing industries such as the sugarcane industry involved in the production of sugar, bioethanol, electricity and other by-products; food and allied industries; textile industry; soap, detergents and paint industries; fertilizer production plants; amongst many others. The programme also extends opportunities in the environmental area, in particular the solid waste, water and wastewater treatment sectors as well as the management of other environmental resources. There is also the option of extending opportunities in the energy area, in particular energy management and renewable energy technologies

2. Objectives

On completion of this programme it is expected that student will be able:

- To master the principles of basic scientific and engineering sciences that underlie modern chemical engineering;
- To inculcate and develop analytical skills pertaining to chemical and environmental engineering;
- To demonstrate a complete understanding for designing integrated chemical processing systems together with its critical elements of sustainability, safety and optimum resource use;
- To apply critical and creative thinking in solving chemical engineering problems;
- To recognize and link the broader context of environment, social, safety and economic issues that affect decision making in chemical engineering;
- To communicate effectively, work in multidisciplinary teams and with observance of professional ethics;
- To recognize and commit to the importance of continued self-improvement and the ability to engage in lifelong learning; and
- To understand the impacts of chemical processing on the environment and develop sustainable solutions through proper waste/resources management and promoting green productivity.

3. General Entry Requirements

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

4. Programme Requirements

GCE 'A' Level Passes in Mathematics, Physics and Chemistry.

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Credit in Chemistry and Physics at SC/'O' Level.

5. Minimum Requirements for Degree Award

For the award of the degree, the following should be met:

- Successful completion of 600 notional hours credits (150 UoM Credits) as per the programme structure;
- Attendance to at least 12 seminars during the course of the programme (i.e. attendance to at least 3 seminars per year);
- Satisfactory completion of vacation training and industrial training;
- Satisfactory performance in each of the Graduate Attributes (GAs) specified against modules in the module specification sheets.

To complete the programme of studies, students are required to perform satisfactorily in the following 11 Graduate Attributes (GAs) which are linked to the modules offered in the programme.

GA 1: Problem solving
GA 2: Application of scientific and engineering knowledge
GA 3: Engineering design
GA 4: Investigations; experiments and data analysis
GA 5: Engineering methods; skills and tools; including Information Technology
GA 6: Professional and technical communication
GA 7: Sustainability and impact of engineering activity
GA 8: Individual; team and multidisciplinary working
GA 9: Independent learning ability
GA 10: Engineering Professionalism
GA 11: Engineering Management

6. Programme Duration

	Normal (Years)	Maximum (Years)
Degree	4	7

7. Classification of Awards

The award classification will be based on the CPA (x) at the end of the Programme of Studies as follows:-

CPA	CLASSIFICATION	
≥ 70	1st Class	with Honours
60 ≤ x < 70	2nd Class 1st Division	
50 ≤ x < 60	2nd Class 2nd Division	
< 50	No Award	

Note: The general University Regulations pertaining to Exit Points would not be applicable to this programme.

8. Pre-requisite (PR)

A student will be allowed to follow module **y** of which module **x** is a pre-requisite (PR) provided the student has passed module **x** with at least a pass grade.

9. Assessment and Pass Requirements

The assessment mode for each module will be based on one or a combination of the following:

- Examination.
- Continuous assessment (class tests, assignments, practicals and oral presentations).
- Report assessment (for Design Project, Final Year Project, Vacation Training and Industrial Training).
- Mini Design Projects
- Attendance to seminars.

In order to pass a module a student must obtain an examination mark of at least 40% and a final mark of at least 50%.

Calculation of the final mark: The continuous assessment must account for no less than 30% and for no more than 50% of the final mark, with the exception of modules like design and degree projects. Certain modules are assessed on the basis of 100% Continuous Assessment. The specific details and/or formula for the calculation of the final mark are given in the Module Specification Sheet (MSS) of each module.

Students have to retake both continuous assessment and exams in the failed module except in case of Resit Examinations; See provisions for Resit Examinations at Section 10. Students passing failed modules will score maximum marks of 50% in these modules but will have the failed marks not counted in the computation of the CPA.

If the student's CPA is between 40 and 50, he/she fails the year. However, student will be eligible to repeat the year and will maintain credits and marks for individual modules where the mark scored is 50% or above. If the CPA is less than 40, the registration will be terminated.

Rules in Cases of Unsatisfactory Performance of GAs

The GAs and assessment criteria are specified against modules in the module specification sheets (MSS).

A student must comply with the sub-minimum requirements in sub-divisions of certain modules. For such modules these specific requirements are given in the MSS of the module. These sub-minima include the achievement of GAs that are assessed in the module.

The following Rules will apply in cases of unsatisfactory performance of GAs.

(i) GAs assessed in the written examination.

A student failing the assessment of a GA in a written examination will be deemed to have failed the module. The student will have to retake the module next time it is offered. However, a Resit examination may be granted for the module only if a pass mark of at least 50% has been obtained; See the rules for Resit examinations at Section 10(iii).

(ii) GAs assessed in coursework, e.g., mini-project work.

A student not satisfying a GA may be given an extension by the lecturer and moderator prior to the written examination to amend and resubmit the coursework for clearing the GA. In case the student still fails to satisfy the GA in the re-submission, he/she may be awarded Grade N in the module and will have to do a new coursework in the next academic year, provided he/she has scored a minimum of 50 % in the overall module mark.

In case a student fails the module, that is, scored less than 50 % in the overall module mark, he/she will be awarded Grade F and has to retake the whole module the next time it is offered.

(iii) GAs (other than GA 6) assessed in the Final Year Project.

If a candidate fails to satisfactorily clear any GA (other than GA 6) in the Final Year Project, the Board of Examiners may consider one of the following:

- For a project/dissertation with possibility of amendments, award the student Grade N in the module and grant the student an extension period of up to 3 months to amend the work related to the GA, and resubmit for clearing the GA;
- For a project/dissertation with recommendations for a new submission, award the student Grade F in the module and student will have to undertake a new project in the following academic year.

(iv) GA 6 assessed in the Design Project and/or Final Year Project.

For a student failing to satisfactorily clear GA 6 in the Design Project and/or Final Year Project, the Board of Examiners may consider awarding the student Grade N and granting the student an extension period of up to 3 months to amend the components of the work related to this GA, and resubmit the Design Project and/or Final Year Project for a reassessment, provided that the student has scored a minimum of 50 % in the overall module mark.

In case a student fails the module, that is, scored less than 50 % in the overall module mark, he/she will be awarded Grade F and has to retake the Design Project and/or Final Year Project the next time it is offered.

(v) GA 3 assessed in the Design Project.

A student failing GA 3 will be awarded Grade F in the design project and will have to retake the module the next time it is offered.

The detailed assessment mode for each module is given in the MSS.

10. Resit Examinations

If a student obtains a CPA of at least 50 but has not passed all the modules, a Resit examination may be granted for failed modules by the Board of Examiners provided that:

(i) A minimum of 40% has been obtained in continuous assessment.
(ii) A Final mark of at least 40% has been achieved in the failed modules which exclude assessment of GAs;
(iii) A pass mark has been achieved but the required sub minimum for passing an Graduate Attribute has not been obtained.

Resit examinations do not apply to final year Project/Dissertation/Mini-Project Portfolio/Industrial Training and to modules assessed solely by continuous assessment.

11. Duration of examinations

16 NH credits modules shall have 3-hour examination papers. 12 NH credits and 8 NH credits modules shall have 2-hour examination papers.

12. Termination of Registration

Termination of registration will occur in the following circumstances:

- If the CPA is less than 25 at the end of Semester 1, Level 1.
- If the CPA is less than 40 at the end of an academic year.
- If the student fails to obtain credit in a module which he/she is repeating. This excludes Resit examinations.
- If the student does not pass all the modules for 1st, 2nd and 3rd years in a total of five years.

13. Unless otherwise decided by Faculty Board, the following will apply for:

Progression from lower level to higher level

First Year to Second Year
A student should not have failed more than two modules to be able to register for Second Year modules. If any of the failed modules is a Pre-requisite(s) for a Second Year module, then the candidate cannot register for the PR-linked Second Year module until the Pre-requisite(s) is passed.

Second Year to Third Year
A student **must** have passed all prescribed First Year modules. In addition, the student should not have failed more than two modules of the prescribed second year modules to be able to register for Third Year modules. If any of the failed modules is a Pre-requisite(s) for a Third Year module, then the candidate cannot register for the PR-linked Third Year module until the pre-requisite is passed.

Third Year to Fourth Year
A student **must** have passed all prescribed second year modules. In addition, the student should not have failed more than two modules of the prescribed **Third Year** modules to be able to register for Fourth Year modules. If any of the failed modules is a pre-requisite for a Fourth Year module, then the candidate cannot register for the PR-linked Fourth Year module until the pre-requisite is passed.

Note: **If a student is not proceeding to the next level, s/he is deemed to repeat the year, even if the CPA ≥ 50**.

14. Registration for Modules in a Higher Year of study for Repeating Students

If a student is repeating a year and the CPA is above 45, the student may be allowed to register for a maximum of two modules per semester from the higher year of study. The student will need to make a request to the Dean of Faculty. The student cannot register for a module of a higher year of study if a timetable clash occurs with a module of a previous year which has not yet been passed and which is prescribed for his or her field of study. Moreover, registration for modules is subject to pre-requisites being met.

15. Self-Development

This refers to directly supervised work in terms of hours/week. It includes practicals, tutorials, seminars, visits, mini-projects, oriented-discussion, coached group-work, presentations and other structured activities associated to enhancing the engineering application abilities and professional and personal attributes of the students. Such supervised work is included in the time-table.

16. BEng (Hons) Chemical Engineering Programme Structure

Year 1 - Semester 1

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
MATH 1162(1)	Mathematics for Engineers 1	3+2	4	16	
PHYSI 1111(1)	Physics for Engineers 1	3+2	4	16	
CHEM 1103(1)	Chemistry for Engineers	3+2	4	16	
ENGG 1103(1)	Professional Communication for Engineers	2+2	3	12	
CHE 1105(1)	Basic Chemical Engineering	3+2	4	16	
Sub-Total			**19**	**76**	

Year 1 - Semester 2

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
MATH 1262(1)	Mathematics for Engineers 2	3+2	4	16	
ENGG 1202(1)	Material Science and Engineering	3+2	4	16	
MECH 1210(1)	Introduction to Mechanics	3+2	4	16	
CHE 1203(1)	Fluid Mechanics 1	2+2	3	12	
CHE 1208(1)	Thermodynamics 1	2+2	3	12	
CHE 1204(1)	Green Chemistry	2+2	3	12	
CHE 1300	Vacation Training for Chemical Engineers				
Sub-Total			**21**	**84**	

Year 2 - Semester 1

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
MATH 2162(3)	Mathematics for Engineers 3A	3+2	4	16	
CHE 2105(3)	Fluid Mechanics 2	2+2	3	12	CHE 1203(1)
CHE 2106(3)	Environmental Engineering	2+2	3	12	
CHE 2107(3)	Heat Transfer	2+2	3	12	
CHE 2108(3)	Process Instrumentation	2+2	3	12	
CHE 2109(3)	Legal Aspects for Chemical Engineers	1.5+1	2	8	
Sub-Total			**18**	**72**	

Year 2 - Semester 2

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
MATH 2262(3)	Mathematics for Engineers 4A	3+2	4	16	
CHE 2208(3)	Thermodynamics 2	2+2	3	12	CHE 1208(1)
CHE 2209(3)	Renewable Energy Technologies	2+2	3	12	
CHE 2210(3)	Mass Transfer	2+2	3	12	MATH 1162(1)
CHE 2211(3)	Process Control	2+2	3	12	
CHE 2212(3)	Research and Statistical Methods	2+2	3	12	
Sub-Total			**19**	**76**	

Year 3 - Semester 1

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
CHE 3107(5)	Unit Operations 1	2+2	3	12	CHE 2210(3); CHE 2107(3)
CHE 3108(5)	Chemical Engineering Economics	2+2	3	12	
CHE 3109(5)	Chemical Thermodynamics	2+2	3	12	CHE 2208 (3)
CHE 3110(5)	Chemical Process Safety and Risk Management	2+2	3	12	
CHE 3111(5)	Reaction Engineering 1	2+2	3	12	CHE 1208(1)
CHE 3112(5)	Chemical Process Technologies	2+2	3	12	CHE 2107(3); CHE 2210(3)
CHE 3113(5)	Design Process	1.5+1	2	8	
Sub-Total			**20**	**80**	

Year 3 - Semester 2

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
CHE 3212(5)	Unit Operations 2	2+2	3	12	CHE 2107(3); CHE 2210(3)
CHE 3213(5)	Design Project 1	1+4	3	12	CHE 3113(5)
CHE 3214(5)	Quality Systems	3+2	4	16	
CHE 3215(5)	Chemical Process Design and Simulation	2+2	3	12	CHE 1105(1)
CHE 3216(5)	Reaction Engineering 2	2+2	3	12	CHE 3111(5)
CHE 3220	Industrial Training				
Sub-Total			**16**	**64**	

Year 4 – Yearly Module

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
CHE 4200Y(5)	Degree Project		10	40	

Students are required to register for either **Option A or Option B** (applicable for both Semesters 1 and 2). Option A and Option B will be offered subject to having a critical mass of students and subject to the approval of the Dean.

Year 4 - Semester 1

Option A: Environmental Engineering

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
CHE 4100(5)	Design Project 2	1+8	5	20	CHE 3213(5)
ENGG 4102(5)	Sociology for Engineers	1.5+1	2	8	
CHE 4106(5)	Wastewater Management	2+2	3	12	CHE 2106(3)
CHE 4107 (5)	Industrial Ecology	3+2	4	16	CHE 2106(3)
Sub-Total			14	56	

Option B: Energy Engineering

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
CHE 4100(5)	Design Project 2	1+8	5	20	CHE 3213(5)
ENGG 4102(5)	Sociology for Engineers	1.5+1	2	8	
CHE 4108(5)	Energy Engineering	3+2	4	16	CHE 2208(3)
CHE 4110(5)	Refrigeration and Air Conditioning	2+2	3	12	CHE 2208 (3)
Sub-Total			**14**	**56**	

Year 4 - Semester 2

Option A: Environmental Engineering

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
MECH 4201(5)	Engineering Professionalism	2+2	2	8	
CHE 4201(5)	Petrochemical Engineering	2+2	3	12	CHE 3107(5)
CHE 4203(5)	Solid Waste Management	3+2	4	16	CHE 2106(3)
CHE 4211(5)	Water Pollution Control	3+2	4	16	CHE 2106(3)
Sub-Total			**13**	**52**	

Option B: Energy Engineering

Module Code	Module Name	L+SD	UoM Credits	Notional Hours Credits	Pre-requisites
MECH 4201(5)	Engineering Professionalism	2+2	2	8	
CHE 4201(5)	Petrochemical Engineering	2+2	3	12	CHE 3107(5)
CHE 4212(5)	Applied Renewable Energy Technologies	3+2	4	16	CHE 2209 (3)
CHE 4213(5)	Energy Management	3+2	4	16	CHE 2208(3)
Sub-Total			**13**	**52**	

[L: Lecture; T: Tutorial; P: Practical; SD: Self Development]

Total Notional Hours Credits (NHC): 600
Total UoM Credits: 150

This Programme has been amended as follows:

Year programme was launched: 2019

Years programme was previously revised: 2020,2021