International Year One in Engineering

Student Programme Handbook
September Intake 2021-22

CONTENTS

1 PROGRAMME OVERVIEW

1.1 The International Year One in Engineering provides international students who are not yet fully able to meet the linguistic or academic demands of first-year undergraduate study in the University with the opportunity to participate in a first-year degree equivalent programme leading to second year entry.

1.2 The International Year One in Engineering has been designed to meet the specific needs of overseas students whose first language is not English and to prepare students for progression to undergraduate degree programmes in Queen's University Belfast.

1.3 The programme is delivered in a university environment with the language and pastoral support that is necessary to ensure well-being and success, and where the work is focused specifically on preparation for university study.

1.4 Students study a total of 10 subject modules and an English Language and Study Skills module. Each subject module contributes 10 CATS points the English Language and Study Skills module is worth 20 CATS points. Students must attain a total of 120 CATS points in order to be awarded an International Diploma in Engineering from Queen's University Belfast. The English Language and Study Skills module is designed to integrate with, and provide support for, the academic modules. An outline of the programme is shown in Table 1-1.

1.5 The Extended International Year One Programme in Engineering commences with a concentrated period of English for University Study (EUS). This may be one or two terms in duration, depending on the student's English Language ability on entry, and is designed to bring the student to a level equivalent to IELTS 5.5 (EUS score 55%) or higher. Students following the extended programme must achieve this level in order to progress and undertake a further three terms focusing on academic knowledge and study skills, augmented with further development of English grammar and vocabulary. English for University Study does not carry credit and is assessed on a Pass/Fail basis only; however, it is a formal requirement of the course and must be completed satisfactorily.

<table>
<tr><th>Module</th><th>CATS</th><th>Progression Routes</th><th>Progression Requirements</th></tr>
<tr><td>English Language and Study Skills</td><td>20</td><td rowspan="3">BEng or MEng (Stage 2) in

• Aerospace Engineering
• Civil Engineering
• Computer Science
• Computing and Information Technology
• Electrical and Electronic Engineering
• Mechanical Engineering
• Software Engineering
• Software and Electronic Systems Engineering
• Chemical Engineering
• Product Design Engineering
• Environmental and Civil Engineering (MEng only)</td><td rowspan="3"><u>English Language Module</u>
minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components

<u>Academic Modules</u>
<u>To progress to BEng pathways</u>
Minimum average of 60% across all academic modules with passes in 10 out of 10 modules.

<u>To progress to MEng pathways</u>
Minimum average of 70% across all academic modules with passes in 10 out of 10 modules.</td></tr>
<tr><td>Engineering Mathematics 1
Engineering Mathematics 2</td><td>10
10</td></tr>
<tr><td colspan="2">Plus EIGHT of the following modules (depending upon chosen pathway, with each module worth 10 CATS points)

• Aerospace Principles
• Drawing & Design
• Geotechnics
• Civil Engineering Principles
• Mechanical Principles
• Surveying
• Materials and Manufacture
• Structural and Stress Analysis
• Circuit Principles 1
• Circuit Principles 2
• Digital Systems Design
• Computer Programming
• Electrical Power and Machines
• Communications
• Fluid Mechanics
• Dynamics
• Thermodynamics
• Electrical and Electronic Engineering
• Electronic Materials and Devices
• Engineering Design and Practice
• Introduction to Chemical Engineering
• Basic Chemistry I
• Basic Chemistry II
• Heat and Mass Transfer</td></tr>
</table>

Table 1-1 Outline Structure of International Year One in Engineering

2 EDUCATIONAL AIMS OF THE PROGRAMME

2.1 To provide students with a high quality education at undergraduate Year One level.

2.2 To prepare students for progression to Year Two of undergraduate study in engineering or related disciplines at Queen's University Belfast.

2.3 To enhance the subject knowledge, learning skills and English language proficiency of students to enable them to communicate and study engineering and related subjects effectively and confidently at undergraduate level in an English medium university.

2.4 To provide the opportunity for professional recognition by the appropriate engineering institution(s).

2.5 To cultivate a commitment to good practice in academic work.

2.6 To provide students with the necessary personal and key skills to enable them to develop as independent, autonomous learners.

2.7 To give students experience of different approaches to teaching and learning and to the methods that may be used to assess their learning.

2.8 Appendix A summarises the skills that will be developed and learning outcomes attained by studying on the diploma programme.

3 PATHWAYS AND MODULES

3.1 Students will be registered on one of 5 pathways of the International Year One in Engineering: Aerospace Engineering, Chemical Engineering, Civil Engineering, Electrical and Electronic Engineering and Computer Science, or Mechanical and Manufacturing Engineering.

3.2 The International Year One in Engineering is delivered over a minimum of 24 teaching weeks divided across two semesters (see Section 7 Academic Calendar for dates).

3.3 Students study a total of 10 academic subject modules: 5 academic subject modules in Semester 1, according to each pathway (see Table 3-1 Pathway Modules Semester 1), and 5 academic subject modules in Semester 2, according to each pathway (see Table 3-2 Pathway Modules Semester 2)

3.4 The English Language and Study Skills module is taken as a single module delivered across the two semesters.

3.5 The timetabled contact time is (an average of) a minimum of 20 hours per week for the subject modules and (an average of) 4 hours per week for the English Language and Study Skills module.

3.6 Appendix D gives detailed information on the delivery, content, learning outcomes and assessment of each of the academic subject modules listed in Table 3-1 and Table 3-2.

3.7 The module lecturer will further describe and clarify module information and the form and structure of assessments during teaching sessions.

		PATHWAY				
		Aerospace Engineering	**Mechanical & Manufacturing Engineering**	**Civil Engineering**	**Chemical Engineering**	**Electrical & Electronic Engineering and Computer Science**
Module Code	**Module Title**	**SEMESTER 1**				
NTO1001	English Language and Study Skills	▪	▪	▪	▪	▪
NTO1012	Computer Programming					▪
NTO1015	Fluid Mechanics	▪	▪			
NTO1020	Circuit Principles 1					▪
NTO1021	Digital Systems Design					▪
NTO1026	Engineering Mathematics 1	▪	▪	▪	▪	▪
NTO1040	Drawing and Design	▪	▪	▪	▪	
NTO1042	Mechanical Principles	▪	▪	▪		
NTO1043	Materials and Manufacture	▪	▪	▪	▪	
NTO1047	Surveying			▪		
NTO1051	Electronic Materials and Devices					▪
NTO1053	Introduction to Chemical Engineering				▪	
NTO1054	Basic Chemistry 1				▪	

Table 3-1 Pathway Modules Semester 1

		PATHWAY				
		Aerospace Engineering	Mechanical & Manufacturing Engineering	Civil Engineering	Chemical Engineering	Electrical & Electronic Engineering and Computer Science
Module Code	**Module Title**	**SEMESTER 1**				
NTO1001	English Language and Study Skills	▪	▪	▪	▪	▪
NTO1014	Dynamics	▪	▪			
NTO1015	Fluid Mechanics			▪	▪	
NTO1016	Structural and Stress Analysis	▪	▪	▪		
NTO1018	Thermodynamics	▪	▪		▪	
NTO1022	Circuit Principles 2					▪
NTO1024	Electrical Power and Machines					▪
NTO1027	Engineering Mathematics 2	▪	▪	▪	▪	▪
NTO1038	Engineering Design and Practice					▪
NTO1041	Electrical and Electronic Engineering		▪			
NTO1045	Civil Engineering Principles			▪		
NTO1046	Geotechnics			▪		
NTO1050	Aerospace Principles	▪				
NTO1052	Communications					▪
NTO1055	Basic Chemistry 2				▪	
NTO1056	Heat and Mass Transfer				▪	

Table 3-2 Pathway Modules Semester 2

4 MODULE ASSESSMENT

Formative Assessment

4.1 Formative Assessments are any homework or class based exercises which do not count towards your final grade, but which aim to help you monitor your learning and improve your skills in particular areas, or to give you practice for a Summative Assessment.

4.2 You will be given feedback on formative coursework that will assist you with your learning. You may be given guidance grades on your performance according to Table 4-1.

Equivalent Percentage Score	Performance Descriptor	Indicative Grade
70+	Excellent	A
60 - 69	Very Good	B
50 - 59	Good	C
40 - 49	Adequate	D
0 - 34	Unsatisfactory/Poor	F

Table 4-1 Formative Assessment Guidance Marking Scale

Summative Assessment

4.3 Summative assessments are those that contribute to the final score of a module. Each subject module will have summative assessments by examination and/or by continuous (coursework) assessment.

4.4 The table in Appendix B gives the weighted contribution of examination, practical and coursework (continuous) assessments to the overall score for each module in . The module lecturer will further describe and clarify the form(s) of continuous assessment and contribution for each module.

Continuous (Coursework) Assessment

4.5 Continuous assessment may take different forms e.g. essays, laboratory reports, written class tests, computer programming assignments, design assignments, engineering drawings or plans, experimental observations, field work, group work, presentations, portfolios or oral tests. There may be one or more continuous assessment component for any module.

4.6 Under normal procedures, students can expect to receive a provisional grade and an overview of their performance in a summative assessed coursework. The grades in Table 4-1 will be used to give an indication of your performance. Numerical marks can only be released after they are approved at the end-of-year examination board by the external examiners.

4.7 Coursework submitted for summative assessment will be retained by teaching staff for the purposes of internal moderation and external review. Students may instead receive a feedback sheet from their module lecturer.

Examination Assessment

4.8 There will be a formal examination session at the end of semester 1 during which modules studied during semester 1 will be examined.

4.9 There will be a formal examination session at the end of semester 2 during which modules studied during semester 2 will be examined and the English Language and Study Skills (ELSS) module will be examined.

5 AWARD CRITERIA AND CLASSIFICATION

5.1 Successful completion of the International Year One in Engineering will result in the award of an International Diploma in Engineering. In order to successfully complete the International Year One in Engineering, students must accumulate 120 CATS points, comprised of 100 CATS points attained through passing 10 academic subject modules of 10 CATS points each, and 20 CATS points awarded for passing the English Language and Study Skills (ELSS) module. Note that these criteria mean you must **PASS ALL MODULES** i.e. you **CANNOT FAIL any module,** if the award is to be given.

5.2 For each academic subject module, candidates must achieve a minimum passing mark of 40% to be awarded the 10 CATS points.

5.3 For the English Language and Study Skills module, candidates must achieve a minimum of 50% overall (equivalent to IELTS 6.0) with a minimum of 40% (equivalent to IELTS 5.5) in all skill components to be awarded the 20 CATS points.

5.4 Candidates are awarded a PASS diploma, a PASS WITH COMMENDATION diploma or a PASS with HIGH COMMENDATION diploma based on the average score across the 10 academic subject modules as summarized in Table 5-1

Diploma Award		**Award Criteria**		
Classification	**CATS points**	**Average score‡**	**Subject Modules**	**ELSS module**
PASS with HIGH COMMENDATION	120	70% to 100%	10 module passes*	Pass†
PASS with COMMENDATION	120	60% to 69%	10 module passes*	Pass†
PASS	120	40%to 59%	10 module passes*	Pass†

* a module pass is a minimum score of 40%

‡ average score calculated across 10 academic subject modules

† ELSS pass is a minimum average of 50% with minimum of 40% in all skill components

Table 5-1 Diploma Award Criteria and Classifications

6 PROGRESSION CRITERIA

6.1 Holders of the International Diploma may progress to Year Two of designated degree programmes at Queen's University Belfast only if they have achieved, as a minimum requirement, the level of performance in both academic modules and English Language and Study Skills, as summarised in Table 6-1.

Progression	English Language and Study Skills Module	Academic Subject Modules
To progress onto BEng/BSc pathways	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A PASS WITH COMMENDATION with a minimum average of 60% across all academic modules with passes in 10 out of 10 modules
To progress onto MEng pathways	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A PASS WITH HIGH COMMENDATION A minimum average of 70% across all academic modules with passes in 10 out of 10 modules

Table 6-1 Summary of Progression Criteria to Year 2 at Queen's University Belfast

6.2 Designated progression degree programmes at Queen's University Belfast with minimum performance requirements in both academic modules and English Language and Study Skills, are listed in Table 6-2 (see next page). Table 6-3 summarises the progression degrees available from each IYOE pathway.

6.3 Holders of the International Diploma in Engineering who do not meet the specified progression requirements for entry to Year Two will be considered for entry to Year One of degree programmes on a case by case basis.

6.4 Students on the extended (4 term or 5 Term) programme will have satisfactorily completed English for University Study (EUS) with a minimum of 55% overall (IELTS 5.5 equivalent), before having progressed to study the academic and English Language and Study Skills module.

Title	Degree	English Language and Study Skills	Academic Modules
Aerospace Engineering	BEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Aerospace Engineering	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Civil Engineering	BEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Civil Engineering	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Chemical Engineering	BEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Chemical Engineering	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Computer Science	BEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Computer Science	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Computing and Information Technology	BSc	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Electrical and Electronic Engineering	BEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Electrical and Electronic Engineering	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Environmental and Civil Engineering	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Mechanical Engineering	BEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Mechanical Engineering	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Product Design Engineering	BEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Product Design Engineering	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Software Engineering	BEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Software Engineering	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Software and Electronic Systems Engineering	BEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with Commendation with a minimum average of 60% and a minimum score of 40% in all 10 specified pathway academic modules
Software and Electronic Systems Engineering	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules
Structural Engineering with Architecture	MEng	minimum of 50% overall (equivalent to IELTS 6.0) with minimum of 40% (equivalent to IELTS 5.5) in all components	A Pass with High Commendation with a minimum average of 70% and a minimum score of 40% in all 10 specified pathway academic modules

Table 6-2 Designated Degree Progression Routes and Requirements

IYOE Pathway	**Year 2 Progression Degrees**
Aerospace Engineering	BEng Aerospace Engineering MEng Aerospace Engineering
Chemical Engineering	BEng Chemical Engineering MEng Chemical Engineering
Civil Engineering	BEng Civil Engineering MEng Civil Engineering MEng Environmental and Civil Engineering MEng Structural Engineering with Architecture
Electrical and Electronic Engineering and Computer Science	BEng Computer Science BEng Electrical and Electronic Engineering BEng Software Engineering BEng Software and Electronic Systems Engineering BSc Computing and Information Technology MEng Computer Science MEng Electrical and Electronic Engineering MEng Software Engineering MEng Software and Electronic Systems Engineering
Mechanical and Manufacturing Engineering	BEng Mechanical Engineering BEng Product Design Engineering MEng Mechanical Engineering MEng Product Design Engineering

Table 6-3 Pathway Progression Routes

7 ACADEMIC CALENDAR

Semester Dates

7.1 The 2021-22 academic year for students beginning their academic studies on the International Year One in Engineering in September 2021 is organised across 2 semesters. The beginning and end dates of the semesters are given in Table 7-1 (page 12).

7.2 A calendar representation of the academic year is given in Table 7-2 (page 13).

Term Dates and Attendance

7.3 Whilst the academic calendar of INTO Queen's and Queen's University Belfast currently operates according to the 2 semester structure shown in Table 7-1 (page 12), the enrolment and attendance terminology used for INTO programmes still refers to a traditional "3 term" academic year. Term start and end dates in Table 7-1 are determined by both holiday periods and by semester dates.

7.4 Students are expected to attend INTO Queen's University Belfast between the beginning and end dates of each term in Table 7-1 (page 12) *inclusively* i.e. students are expected to be present for classes and assessment or examination sessions from the first day of the beginning of each term and to attend for classes and assessment or examination sessions until the last day of each term, unless there is a set vacation period in the middle of a term.

		Begins	Ends	
Semester 1	**Induction 1 week**	Monday 13 September 2021	Friday 17 September 2021	Term 1
	Teaching 5 weeks	Monday 20 September 2021	Friday 22 October 2021	
	Study Week 1 week	Monday 25 October 2021	Friday 29 October 2021	
	Teaching 6 weeks	Monday 1 November 2021	Friday 10 December 2021	
	Revision Week	Monday 13 December 2021	Friday 17 December 2021	
	Christmas Vacation 3 weeks	Monday 20 December 2021	Friday 7 January 2022	
	Assessment 1 week	Monday 10 January 2022	Friday 14 January 2022	Term 2
Semester 2	**Teaching 4 weeks**	Monday 17 January 2022	Friday 11 February 2022	
	Study Week 1 week	Monday 14 February 2022	Friday 17 February 2022	
	Teaching 7 weeks	Monday 21 February 2022	Friday 08 April 2022	
	Easter Vacation 2 weeks	Monday 11 April 2022	Friday 22 April 2022	
	Assessment 2 weeks	Monday 25 April 2022	Friday 06 May 2022	Term 3
	Resit Examinations 1 week	Monday 30 May 2022	Friday 03 June 2022	

Table 7-1 Semester and Key Dates 2021-22

Academic Year Week	W/C	
1	**13-Sep**	**Induction**
2	**20-Sep**	S1-W1
3	**27-Sep**	S1-W2
4	**04-Oct**	S1-W3
5	**11-Oct**	S1-W4
6	**18-Oct**	S1-W5
7	**25-Oct**	Reading Week
8	**01-Nov**	S1-W6
9	**08-Nov**	S1-W7
10	**15-Nov**	S1-W8
11	**22-Nov**	S1-W9
12	**29-Nov**	S1-W10
13	**06-Dec**	S1-W11
14	**13-Dec**	Revision Week
15	**20-Dec**	**Christmas**
16	**27-Dec**	**Christmas**
17	**03-Jan**	**Christmas**
18	**10-Jan**	**Exams**
19	**17-Jan**	S2-W1
20	**24-Jan**	S2-W2
21	**31-Jan**	S2-W3
22	**07-Feb**	S2-W4
23	**14-Feb**	Reading Week
24	**21-Feb**	S2-W5
25	**28-Feb**	S2-W6
26	**07-Mar**	S2-W7
27	**14-Mar**	S2-W8
28	**21-Mar**	S2-W9
29	**28-Mar**	S2-W10
30	**04-Apr**	S2-W11
31	**11-Apr**	**Easter**
32	**18-Apr**	**Easter**
33	**25-Apr**	**Exams**
34	**02-May**	**Exams**

Table 7-2 Academic Calendar 2021-22

Bank and Public Holidays

7.5 National holidays are called "Bank and Public Holidays". The centre will be closed on the dates of the Bank and Public holidays listed in Table 7-3.

Bank and Public Holiday	Date
Christmas Day	Monday 27 December 2021*
Boxing Day	Tuesday 28 December 2021*
New Year's Day	Monday 03 January 2022^
St Patrick's Day	Thursday 17 March 2022
Good Friday	Friday 15 April 2022
Easter Monday	Monday 18 April 2022
Early May Bank Holiday	Monday 02 May 2022
July Holidays	Tuesday 12 and Wednesday 13 July 2022
* Christmas Day and Boxing Day fall on Saturday 25 December and Sunday 27 December therefore Monday 27 December and Tuesday 28 December are substitute days. ^ New Year's Days falls on Saturday 01 January therefore Monday 03 January is a substitute day	

Table 7-3 Bank and Public Holidays 2020-21

8 ACADEMIC TUTORIALS

8.1 As an INTO student you will be allocated a personal Academic Tutor for the duration of your programme. Your Academic Tutor will meet with you a number of times each semester, either individually or as part of a small group of tutees, to advise and guide you.

8.2 It is intended that your tutorial sessions will help you:

- Become a more effective, independent and confident self-directed learner.
- Understand how you are learning and relate your learning to a wider context.
- Articulate your personal goals and evaluate progress towards your achievement.
- Encourage a positive attitude to learning throughout life

8.3 The aim is to help you to begin your studies, to reflect on and learn from feedback you receive, and to become more aware of your own learning style, strengths and weaknesses. Your tutor will discuss your progress and to give you any help or advice on matters relating to your studies or preparing for your university programme.

8.4 The tutorials are not a confidential discussion. In order to support you and give you the best possible advice your tutor may need to share information with other relevant members of staff such as the Programme Manager or the Welfare Officer.

8.5 Your tutor will contact you with times and dates of meetings. Table 8-1 Semester 1 Academic Tutorial Schedule outlines an example schedule, showing the number and timings of academic tutorial meetings. It is important that you attend all scheduled meetings with your tutor.

Week 1-2	Overview of the tutorials process You will find out who your tutor is and they will contact you.
Week 2-4	First group meeting with tutor
Week 6-8	First individual meeting with tutor Bring all assignment feedback sheets and completed tutorial sheet

Table 8-1 Semester 1 Academic Tutorial Schedule

Week 1-2	Second individual meeting with tutor- post exam results
Week 5-8	Third individual meeting with tutor Discussion on progress and exam/assignments marks to date Bring all assignment feedback sheets and examination results Bring all assignment feedback sheets and completed tutorial sheet Discussion on progression options/predicted grades

Table 8-2 Semester 2 Academic Tutorial Schedule

8.6 If you have any problems with the process, please contact your Personal tutor or the Programme Manager.

9 STAFF CONTACT DETAILS

Title	Name		Role	email
Mr	Liam	O'Hagan	Academic Director	l.ohagan@qub.ac.uk
Dr	Paul	McCourt	Programme Manager	paul.mccourt@qub.ac.uk
Dr	Philip	Gillespie	Subject Lecturer	p.gillespie@qub.ac.uk
Dr	Jane	Rogers	Subject Lecturer	j.rogers@qub.ac.uk
Mr	Glenn	McSpadden	Subject Lecturer	g.mcspadden@qub.ac.uk
Dr	Erell	Bonnot	Subject Lecturer	e.bonnot@qub.ac.uk
Dr	Ryan	McFadden	Subject Lecturer	r.mcfadden@qub.ac.uk
Ms	Aine	McComb	Head of Student Services	a.mccomb@qub.ac.uk
Dr	David	Bandy	Academic Planning and Policy Manager	d.bandy@qub.ac.uk
Ms	Ciara	Murray	Progression Officer	ciara.murray@qub.ac.uk

Table 9-1 Staff Contact Details

10 GENERAL INFORMATION

10.1 The programme is subject to the University General Regulations http://www.qub.ac.uk/directorates/AcademicAffairs/GeneralRegulations/

10.2 The information in this section is taken from the QUB International student's handbook. Further information can be obtained from the International Office at Queen's University Belfast.

Access to University Services

10.3 Students have access to the INTO Queen's Student Support Services as well as the University Health and Counselling Services, Students' Union, University Careers Service and Student Support Services. Students have access to all University libraries, University open access computer facilities and other resources at the INTO Centre.

Library Information

10.4 The University has a number of major libraries which registered students may use. As well as this, the individual schools and institutes have their own collections. Most of the books and pamphlets in the Library can be borrowed, but some categories of material are not available on loan.

10.5 In addition to its traditional libraries, the University also has its purpose built interdisciplinary McClay Library specifically designed to meet the needs of undergraduate students. In addition to providing multiple copies of recommended textbooks and course reading, a large number of the study places are equipped with PCs. The computing facilities enable students to use computer-based learning materials; commonly used software such as word processing, spreadsheets and database packages; bibliographic databases; electronic journals and other full-text material; access to the Library's CD-ROM network; and access to the Internet.

10.6 All books and journals in all branches of the Library are included in the Library's computer catalogue. There are dedicated terminals in all the branches and the catalogue is also accessible over the campus network. The Library also makes available a range of electronic information services for the retrieval of bibliographic, statistical and other data.

10.7 The University has six libraries, the opening hours of which are generally between 8.30am and 10.00 pm during the week and extended hours during the examination period. For further information please visit: www.qub.ac.uk/lib/

Computing Facilities

10.8 All international students will have access to email. You will be given your username and password to access your account when you register. This service is free. You can use any of the Student Computer Centres around the University to access the Internet. Assistance on using the Internet is provided at Orientation and daily in the Computer Centres.

10.9 Central computing facilities for students are provided in Student Computer Centres. There are thirteen Student Computer Centres with a total of 660 PCs all of which operate Windows NT. The majority of the Centres are within easy access of the central campus with 240 PCs in the Seamus Heaney Library. All students have access to e-mail and the Internet and have their own filestore account on the campus network. In addition to these central facilities, many schools have their own computing facilities. The University extensively uses email and the Web to communicate with, and provide information to, students. All Elms Village accommodation has internet access.

10.10 Computer Based Learning (CBL) materials are available on all the systems in the Student Computer Centres to help students become familiar with the core IT products. They include Introduction to PCs, Windows, Word, Excel, Access and PowerPoint.

10.11 During semester the Student Computer Centres are normally open from 9.00 am to 9.30 pm or 11.30 pm from Monday to Friday, with a number open on Saturday and Sunday.

Equipment and facilities for disabled students

10.12 The University has developed specialised Assistive Technology provisions for students with disabilities over recent years. The main facilities are as follows:

10.13 A dedicated equipment facility located in one of the Student Computer Centres. Students can make use of up-to-date technology (including CCTVs, scanners with synthesised speech and Braille printing options and associated PC hardware and software).

10.14 In the University's network of seven Student Computer Centres located throughout the campus over 600 work stations are available to any member of the academic community. Specialised software is available at all these locations to enlarge text and graphics on all existing installed packages. Specific software facilities are also available for use by those with visual impairment and dyslexia who have typing, spelling and reading difficulties.

10.15 IT provisions for deaf and hard of hearing students are housed in a new "Hearing Enhancement Technology Room", sited at the centre of the campus. Facilities include the following: a desktop PC, offering access to email, the Internet and standard applications; a laptop PC which can be borrowed, offering standard applications and the package HI LINC (designed to let deaf and hard of hearing students receive information in lectures simultaneously with other hearing students); printing and photocopying facilities; a minicom; an amplified handset; hearing-aid related supplies including batteries and a spare Phonic Ear Personal FM; a portable loop; and a monitor and video unit (suitable for playing and recording subtitled videos). A stock of video materials for use as courseware is also being developed.

APPENDIX A Skills And Learning Outcomes

Learning Outcomes: Cognitive Skills/ Intellectual Qualities			
	Typically, holders of qualification will have acquired knowledge and understanding of:	**Teaching/Learning Methods and Strategies**	**Methods of Assessment**
	a. interpreting criteria and specifications and planning their implementation; b. identifying, analysing and solving a range of engineering problems using appropriate techniques and principles; c. formulating solutions to problems through the synthesis of ideas from a range of sources; d. assessing the implications, risks or safety considerations involved in the construction & design process in specific situations and conditions; e. assessing and analysing problems that involve a degree of complexity, taking account of conflicting priorities and the wider impacts and limitations in decision	Student's cognitive skills are developed through lectures, workshops, laboratory classes, individual project work, team-working exercises, and design exercises.	Assessment is done using a mix of examinations, class tests, laboratory reports, and coursework.
Learning Outcomes: Knowledge and Understanding			
	On the completion of this course successful students will be able to understand:	**Teaching/Learning Methods and Strategies**	**Methods of Assessment**
	a. the key concepts, theories, principles and processes involved in engineering; b. the techniques, methods, materials, product and practices, including the regulatory framework, codes and standards, employed in engineering; c. the wider context in which the Engineering profession operates.	Students' acquisition of core knowledge and understanding is achieved primarily through lectures, tutorials, laboratory and design classes, and workshops, and is supported by independent study	Assessment is done using a mix of examinations, class tests, laboratory reports, and coursework.
Learning Outcomes: Transferable Skills (Professional/Practical Skills)			
	Typically, holders of the qualification will have acquired knowledge and understanding of:	**Teaching/Learning Methods and Strategies**	**Methods of Assessment**
	a. experimental laboratory, practical and field work using relevant test and measurement apparatus; b. using a range of general and engineering specific software.	The teaching of the majority of the transferable skills forms an integral part of the overall learning and teaching process on the degree pathway.	The assessment of the majority of the transferable skills forms an integral part of the overall assessment of the degree pathway. Team-working skills, written communication skills, and oral communication skills are assessed directly. Practical skills in the use of Information Technology are not formally assessed, although the development of IT skills are integral to the learning and teaching process underpinning the degree programme

APPENDIX B Pathway Modules

B.1 Aerospace Engineering Pathway

YEAR	SEMESTER	MODULE CODE	MODULE TITLE	CATS POINTS (CREDITS)	STATUS	ASSESSMENT	
						% COURSEWORK	% EXAMINATION
1	1 and 2	NTO1001	English Language and Study Skills	20	Compulsory	40	60
	2	NTO1014	Dynamics	10	Compulsory	20	80
	1 or 2	NTO1015	Fluid Mechanics	10	Compulsory	40	60
	2	NTO1016	Structural and Stress Analysis	10	Compulsory	20	80
	1 or 2	NTO1018	Thermodynamics	10	Compulsory	20	80
	1	NTO1026	Engineering Mathematics 1	10	Compulsory	20	80
	2	NTO1027	Engineering Mathematics 2	10	Compulsory	40	60
	1 or 2	NTO1040	Drawing and Design	10	Compulsory	100	0
	1	NTO1042	Mechanical Principles	10	Compulsory	40	60
	1 or 2	NTO1043	Materials and Manufacture	10	Compulsory	40	60
	1 or 2	NTO1050	Aerospace Principles	10	Compulsory	20	80

B.2 Civil Engineering Pathway

YEAR	SEMESTER	MODULE CODE	MODULE TITLE	CATS POINTS (CREDITS)	STATUS	ASSESSMENT	
						% COURSEWORK	% EXAMINATION
1	1 and 2	NTO1001	English Language and Study Skills	20	Compulsory	40	60
	1 or 2	NTO1015	Fluid Mechanics	10	Compulsory	40	60
	2	NTO1016	Structural and Stress Analysis	10	Compulsory	20	80
	1	NTO1026	Engineering Mathematics 1	10	Compulsory	20	80
	2	NTO1027	Engineering Mathematics 2	10	Compulsory	40	60
	1 or 2	NTO1040	Drawing and Design	10	Compulsory	100	0
	1	NTO1042	Mechanical Principles	10	Compulsory	40	60
	1 or 2	NTO1043	Materials and Manufacture	10	Compulsory	40	60
	1 or 2	NTO1045	Civil Engineering Principles	10	Compulsory	40	60
	1 or 2	NTO1046	Geotechnics	10	Compulsory	40	60
	1 or 2	NTO1047	Surveying	10	Compulsory	40	60

B.3 Chemical Engineering Pathway

YEAR	SEMESTER	MODULE CODE	MODULE TITLE	CATS POINTS (CREDITS)	STATUS	ASSESSMENT	
						% COURSEWORK	% EXAMINATION
1	1 and 2	NTO1001	English Language and Study Skills	20	Compulsory	40	60
	1 or 2	NTO1018	Thermodynamics	10	Compulsory	20	80
	1	NTO1026	Engineering Mathematics 1	10	Compulsory	20	80
	2	NTO1027	Engineering Mathematics 2	10	Compulsory	40	60
	1 or 2	NTO1040	Drawing and Design	10	Compulsory	100	0
	1	NTO1042	Mechanical Principles	10	Compulsory	40	60
	1 or 2	NTO1043	Materials and Manufacture	10	Compulsory	40	60
	1 or 2	NTO1053	Introduction to Chemical Engineering	10	Compulsory	20	80
	1 or 2	NTO1054	Basic Chemistry I	10	Compulsory	20	80
	1 or 2	NTO1055	Basic Chemistry II	10	Compulsory	20	80
	1 or 2	NTO1056	Heat and Mass Transfer	10	Compulsory	40	60

B.4 Electrical and Electronic Engineering and Computer Science Pathway

YEAR	SEMESTER	MODULE CODE	MODULE TITLE	CATS POINTS (CREDITS)	STATUS	ASSESSMENT	
						% COURSEWORK	% EXAMINATION
1	1 and 2	NTO1001	English Language and Study Skills	20	Compulsory	40	60
	1	NTO1012	Computer Programming	10	Compulsory	50	50
	1	NTO1020	Circuit Principles 1	10	Compulsory	40	60
	1 or 2	NTO1021	Digital System Design	10	Compulsory	40	60
	2	NTO1022	Circuit Principles 2	10	Compulsory	40	60
	2	NTO1024	Electrical Power and Machines	10	Compulsory	40	60
	1	NTO1026	Engineering Mathematics 1	10	Compulsory	20	80
	2	NTO1027	Engineering Mathematics 2	10	Compulsory	40	60
	1 or 2	NTO1038	Engineering Design and Practice	10	Compulsory	100	0
	1	NTO1051	Electronic Materials & Devices	10	Compulsory	40	60
	2	NTO1052	Communications	10	Compulsory	40	60

B.5 Mechanical and Manufacturing Engineering Pathway

YEAR	SEMESTER	MODULE CODE	MODULE TITLE	CATS POINTS (CREDITS)	STATUS	ASSESSMENT	
						% COURSEWORK	% EXAMINATION
1	1 and 2	NTO1001	English Language and Study Skills	20	Compulsory	40	60
	2	NTO1014	Dynamics	10	Compulsory	20	80
	1 or 2	NTO1015	Fluid Mechanics	10	Compulsory	40	60
	2	NTO1016	Structural and Stress Analysis	10	Compulsory	20	80
	1 or 2	NTO1018	Thermodynamics	10	Compulsory	20	80
	1	NTO1026	Engineering Mathematics 1	10	Compulsory	20	80
	2	NTO1027	Engineering Mathematics 2	10	Compulsory	40	60
	1 or 2	NTO1040	Drawing and Design	10	Compulsory	100	0
	1 or 2	NTO1041	Electrical & Electronic Engineering	10	Compulsory	20	80
	1	NTO1042	Mechanical Principles	10	Compulsory	40	60
	1 or 2	NTO1043	Materials and Manufacture	10	Compulsory	40	60

APPENDIX C Module Specifications

NTO1001 English Language and Study Skills

Level Undergraduate

Credits 20

Course Components

Lecture Required

Tutorial Required

Enrolment information

Runs for the duration of the Programme

September intake and January intake

Contact Teaching Methods

Lecture – 32 hours

Tutorial – 16 hours

Assessment

Continuous assessment – 40%; Exam – 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and tutorials. Completed assignments and exams.

Course Content

This module is divided into the following topics in order to help achieve the module learning outcomes:

- Academic Writing
- Academic Reading
- Listening & Note-Taking
- Independent Learning & Study Skills
- Speaking & Presentation Skills

Learning Outcomes

- Use a satisfactory range of sentence and grammatical structures and vocabulary; register and style appropriate to task at this level.
- Organise, structure, revise, edit and proof-read an academic text.
- Incorporate in-text citation and bibliographical referencing adhering to academic conventions.
- Understand the issue of plagiarism and how this can be avoided.
- Read and understand academic texts appropriate to the subject discipline.
- Use appropriate reading strategies.
- Evaluate and think critically about a range of source materials.
- Follow the structure of an academic lecture, identify main points and key information.
- Demonstrate effective note-taking skills and the ability to synthesise in a verbal or written summary.
- Develop spoken grammar and vocabulary with regard to both academic and social situations.
- Prepare and deliver an oral presentation suitable for an undergraduate study environment.
- Actively engage in seminar, tutorial and group discussions.
- Be aware of levels of formality in spoken English.
- Effectively manage time.
- Recognise learning requirements and engage in active learning strategies to meet these.
- Develop understanding of Western culture for living and studying in the UK.

Learning Outcomes

On completion of this module, students should be able to:

- Demonstrate English language ability with an average mark of no less than 50% in the final combination of both coursework and INTO ELSS examinations (equivalent to IELTS 6.0),
- With no sub-skill (reading, writing, listening and speaking) below 40% (equivalent to IELTS 5.5).

Skills

The student should be able to:

- An understanding of the main methods to improve theory and practice in the English Language
- An ability to analyse and interpret information from a variety of sources
- A degree of independence in the planning and organisation of their studies
- Written and spoken communication skills such as essay writing and presenting orally
- Confidence in participating in and presenting group work

NTO1012 – Computer Programming (10 CATS)

Level: Undergraduate

Credits 10

Course Components

Lecture - Required; Laboratory - Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture: 12 hours

Laboratory: 36 hours

Assessment

Continuous assessment 50%

Exam 50%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and laboratories. Completed assignments and exams.

Course Content

- Introductory Programming Concepts
- Mathematical Operations and Functions
- Input and Output
- Conditional Statements
- Loops
- Arrays
- Strings
- Functions
- Pointers
- Structures

Learning Outcomes

Be able to:

- Create, compile and verify the functionality of programs written in the C programming language
- Declare and use variables of different types in assignment statements and in expressions with mathematical operators and library functions and apply precedence and associativity rules
- Control output from and input to a program
- Use if, if-else statements and switch statements in simple and nested forms and apply precedence and associativity rules when combining relational expressions with logic operators in conditional expressions
- Use for loops, while loops and do-while loops in simple and nested form
- Declare 1-dimensional and 2-dimensional arrays and exploit loops to access array elements
- Declare and define functions, call functions to pass arguments to a function and return a variable from a function
- Declare and assign pointer variables, use the indirection operator with pointer variables and use pointers to declare arrays and manipulate array elements
- Demonstrate the purpose of structures to aggregate meaningfully connected variables and be able to define new structures tags, declare structure variables and access individual members of a structure

Skills

- Be able to write, compile, run and test programmes written in the C language
- Gain experience in software development for engineering applications using an integrated development environment
- Be able to confidently debug a program for compilation and to attain correct functionality
- Be able to select programming language constructs and data structures to develop efficient solutions to well-defined problems
- Implement a structured C program with appropriate allocation of functions
- Appropriately comment and document a programme

NTO1014 – Dynamics (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture – required

Tutorial – required

Enrolment information

Typically offered Second Semester

September intake and January intake

Contact Teaching Methods

Lecture – 34 hours

Tutorial - 10 hours

Laboratory – 4 hours

Assessment

Continuous assessment – 20 %

Exam – 80%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and seminars. Completed assignments and exams.

Course Content

- The module will cover the following topics:
- Introductory topics
- Mathematical modelling
- Basic concepts
- Kinematics
- Rectilinear motion
- Curvilinear motion
- Circular motion
- Kinetics
- Newton's second law
- Principle of work and energy
- Conservation of energy
- Impulse and momentum of linear and rotary systems
- Conservation of energy
- Variable mass problems
- Moments of inertia
- Calculation of moments of inertia
- Parallel and perpendicular axis theorems
- Damped and undamped vibration
- Dynamic Balancing
- Understand the causes of undesirable vibrations in rotating machinery
- Understand the causes of static and dynamic unbalance
- Be able to carry out basic dynamic balancing of rotating machinery
- Introduction to vibrations
- Types of vibration: free and forced

Learning Outcomes

On completion of this module, students should be able to:

- Model an engineering dynamics problem using appropriate assumptions and mathematical techniques.
- Apply Newton's laws of motions and the principles of kinematics to problems of motion.
- Apply the principles of rotational dynamics to the solution of engineering problems.
- Describe basic vibration theory
- Apply the principles of work, energy and power to the solution of engineering problems.
- Apply the principles of impulse and momentum to the solution of engineering problems.
- Be able to carry out basic dynamic balancing.

Skills

- This module aims to provide the student with a fundamental understanding of Engineering Dynamics. Upon completion of this module students will possess the knowledge and ability to analyse fundamental engineering dynamic systems in terms of forces, inertia, torques, moments, energy and power.

NTO1015 – Fluid Mechanics (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required

Tutorial Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture – 32 hours

Tutorial – 16 hours

Assessment

Continuous assessment – 40%

Exam – 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and seminars. Completed assignments and exams.

Course Content

- Definition of a fluid including: definition of density, unit weight, specific gravity, pressure, compressibility.
- Definition of viscosity: dynamic viscosity and kinematic viscosity.
- Definition of Newtonian and non Newtonian fluids: Rheological diagram
- Fluid Statics: Pascal's principle and hydrostatic equation. Principles of pressure measurement.
- Manometry and electrical transducers.
- Basic fluid flow: Dimensionless numbers. Importance of Reynolds number. Laminar and turbulent flow. Boundary layers. Basic definitions of an Ideal fluid, a real fluid, laminar flow, turbulent flow, steady flow, unsteady flow, uniform and non uniform flow.
- Definitions of: Volume flow rate, mass flow rate.
- Continuity equation and Bernoulli's equation.
- Application of Bernoulli's equation: including a Venturi meter.
- Flow through an orifice. Pitot tube.
- Forces in pipes: Minor losses: loss coefficient, energy losses due to sudden enlargement, exit loss. Gradual enlargement, sudden contraction gradual contraction, entrance losses, losses due to bends.
- Energy losses due to friction: Darcy's equation. Friction loss in laminar and turbulent flow. Friction factor. Moody's diagram
- Dimensional analysis: Basic principles using the Indicial method
- Application of dimensional analysis: For example, the drag force exerted by a fluid flowing on a body.

Learning Outcomes

On completion of this module, students should be able to:

- Describe the basic terminologies of properties of fluids
- Describe the fundamental principles of fluid statics and dynamics
- Apply the principles of conservation of mass, momentum and energy to the solution of one dimensional problems in fluid mechanics
- Develop understanding of the practical relevance of fluid mechanics in engineering applications

Skills

- The student should develop mathematical skills in engineering and the ability to derive basic laws/principles in fluid mechanics. The assignment work will develop planning and self-management skills. The tutorials will help to develop understanding of the theory and the application to practical problems

NTO1016 – Structural & Stress Analysis (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required

Tutorial Required

Enrolment information

Typically offered Second Semester

September intake and January intake

Contact Teaching Methods

Lecture – 32 hours

Tutorial – 16 hours

Assessment

Continuous assessment – 20%; Exam – 80%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and tutorials. Completed assignments and exams.

Course Content

- Beams: Sign conventions; shear force diagrams, bending moment diagrams, point loads, UDL's, relationship between shear force and bending moment.
- Stress concentration factors: Factors of safety related to notch sensitivity, surface finish, component design and allowable stresses.
- Calculation of second moments of area 1: Calculation of neutral axis for standard and non-standard shapes. Second moment of area of rectangles, circular sections, tubes, hollow sections, T-sections, I-sections, polar second moment of area.
- Calculation of second moments of area 2: structures with multiple section shapes, e.g. circular handrail, rectangular base of a footbridge.
- Bending: Stresses in beams at the outer fibres and at any point in the beam cross section under bending. Relationship between bending stress, moment and geometry of deformation.
- Torsion: The Elastic-Torque relationship. Calculate torsional stresses in solid and hollow sections. Calculate the polar second moment of area. Practical examples may include: gear shafts, ships propeller shafts, car drive shafts, etc.
- Elastic deflections: Standard solutions, direct integration, discontinuous loads, moment area method.
- Plane stress and strain: Principal values, Mohr's circle for stress and strain, stress strain relationships.
- Buckling of columns and struts: Introduction and overview; Buckling of columns and struts, Euler buckling equation, use of standard cases.
- Thin walled pressure vessels: Cylindrical, spherical, hoop and longitudinal stresses.
- 3-Pin Arch basics: Analyse forces and reactions in a basic 3-Pin Arch system.

Learning Outcomes

On completion of this module, students should be able to:

- Analyse a beam system and determine shear force and bending moments.
- Define the mechanism behind crack propagation.
- Analyse a component and determine the factor of safety.
- Determine the position of the neutral axis and derive the second moment of area of simple shapes and multi-shape sections.
- Calculate the bending stress at various points in the beam cross section.
- Define the Elastic-Torque stress relationships.
- Analyse torsional stresses in solid and hollow circular section bars.
- Analyse a dual stress system in order to determine the principal stresses, using Mohr's circle.
- Define the basic principles behind stresses induced in pressure vessels.
- Calculate the longitudinal and hoop stress in a thin pressurised cylinder.
- Analyse the forces and reactions in a basic 3-Pin Arch system.

Skills - The student should be able to:

- Describe the fundamentals of stress analysis and their applications in engineering.
- Solve problems involving stresses and strains in engineering materials.

Have the ability to predict the strength of a basic structural system

INTO1018 – Thermodynamics (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture – required

Tutorial – required

Enrolment information

Typically offered Second Semester

September intake and January intake

Contact Teaching Methods

Lecture – 34 hours

Tutorial - 10 hours

Laboratory – 4 hours

Assessment

Continuous assessment – 20 %

Exam – 80%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and seminars. Completed assignments, pre-lab and post-lab reports and exams.

Course Content

The module will cover the following topics:

- Introductory topics
- Introduction to subject
- Definitions: Pressure, temperature, volume, density, systems, process, heat, work etc.
- The first law of thermodynamics
- Heat and energy
- Conservation of energy
- Closed systems
- Open systems
- The second law of thermodynamics
- Entropy
- Clausius and Kelvin-Plank formulations of second law
- Properties of gases
- Ideal and perfect gases
- Real gases
- Mixtures of gases: Dalton's law, Raoult's Law
- Phase and state changes
- Evaporation, sublimation, fusion
- Phase diagrams
- Steam tables
- Vapour power cycles
- Carnot cycle
- Rankine cycle
- Otto cycle

Learning Outcomes

On completion of this module, students should be able to:

- State fundamental definitions in Thermodynamics
- Apply the first law of Thermodynamics to simple engineering systems
- Describe the difference between closed and open systems and be able to carry out calculations on relevant examples
- Describe the second law of Thermodynamics and the concept of entropy
- Describe the properties of gases and be able to use relevant laws which apply to engineering systems
- Describe the properties of steam
- Use steam tables and the ideal gas law to perform calculations
- Describe various applications of gases and vapour in power cycles and be able to carry out calculations

Skills

This module aims to provide the student with a fundamental understanding of thermodynamics. Upon completion of this module students will possess the knowledge and ability to analyse basic systems using the laws of thermodynamics and the properties of gases and vapours, as well as to apply general physical chemistry laboratory skills associated to the Thermodynamics.

NTO1020 - Circuit Principles 1 (10 CATS)

Level: Undergraduate

Credits: 10

Course Components

Lecture – required

Tutorial – required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture – 30 hours

Tutorial - 12 hours

Laboratory – 6 hours

Assessment

Continuous assessment – 40 %

Exam – 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and seminars. Completed assignments and exams.

Course Content

Introductory topics

- System of units
- Voltage and Current Concept
- The Ideal Basic Circuit element/symbols
- Conventional Current Flow Convention
- Power and Energy

DC circuit theory

- Ohm's Law
- Calculate total resistance of networks in series, parallel and combinations

Kirchhoff Laws

- Kirchhoff's Current and Voltage laws
- Application of Kirchhoff's voltage and current laws to a resistive circuit

Thevenin's theorem

- Express Thevenin's theorem as a means of simplifying linear circuits
- Calculate Thevenin equivalent voltage and resistance of simple circuits, including bridges

Superposition theorem

- Express the superposition theorem as a means of simplifying linear circuits
- Apply the superposition theorem to simple circuit analysis

Norton's theorem

- Express Norton's theorem as a means of simplifying linear circuits
- Calculate Norton's equivalent cuurent and resistance of simple circuits, including bridges

Maximum Power Transfer theorem

- Express the maximum power theorem as a means of optimising power transfer
- Use the maximum power transfer theorem to calculate power transfer

Capacitors

- Capacitor values
- Charging and discharging of a capacitor

Inductors

- series, parallel and series/parallel combinations of inductors
- concept of inductive energy storage

Learning Outcomes

Be able to explain fundamental concepts associated with, and solve problems on:

- Fundamental DC circuit theory
- The solution of DC network problems
- The characteristics of resistors, capacitors and inductors in circuits

Skills

- To introduce the students to the concept of simple circuit elements in electrical and electronic systems, with DC excitation.
- To provide a solid grounding of theory in the mathematical analysis of circuits.
- To offer illustrative practical applications of theoretical concepts

NTO1021 – Digital System Design (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture - Required; Laboratory - Required

Enrolment information

Typically offered Second Semester

Contact Teaching Methods

Lecture 32 hours

Tutorial 8 hours

Laboratory 8 hours

Assessment

Continuous assessment 40%

Exam 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and laboratories. Completed assignments and exams.

Course Content

Number Systems and Codes

- Decimal, Binary and Hexadecimal
- Binary Codes
- Binary Addition and Subtraction

Combinational Logic Circuits

- Logic Operations and Logic Gates
- Boolean Algebra and De Morgan's Theorem
- Logic Function Representations
- Logic Function Manipulation and Minimisation
- Karnaugh Maps
- Functional Components and Circuits
- Implementations of Logic Functions

CMOS Implementation

- Logic operations
- Logic Expressions

Synchronous Sequential Logic Circuits

- Latches and Flip-Flops
- Finite Sate Machines
- Registers and Counters

Physical Circuit Issues

- Propagation Delays
- Noise margins

Learning Outcomes

Be able to:

- Perform conversions between number systems used in digital systems
- Analyse and synthesis logic diagrams and truth tables
- Manipulate combinational logic expressions of logic variables and logic operators using Boolean algebra and De Morgan's theorem
- Minimise logic functions using Boolean algebra and Karnaugh maps
- Implement combinational logic functions using logic gates, multiplexors or programmable logic
- Analyse and synthesise Moore or Mealy synchronous finite state machines and synchronous counters
- Assess the impact of physical parameters on circuit performance
- Analyse and synthesise CMOS implementation of logic operations and expressions

Skills

- Use of computers as tools in the design process
- Ability to design simple combinational and sequential logic circuits
- Ability to implement digital circuits using logic gates

NTO1022 - Circuit Principles 2 (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture – required

Tutorial – required

Enrolment information

Typically offered Second Semester

September intake and January intake

Contact Teaching Methods

Lecture – 30 hours

Tutorial - 12 hours

Laboratory – 6 hours

Assessment

Continuous assessment – 40 %

Exam – 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and seminars. Completed assignments and exams.

Course Content

Single-phase AC Theory

- Sinusoidal and non-sinusoidal waveforms
- Amplitude, Period, Frequency
- Instantaneous, peak/peak-to-peak
- Root mean square (rms)

AC Circuit Analysis

- Concept of Phasors
- Express sinusoidal waveforms as phasors
- Express sinusoidal waveforms on the complex plane
- Use phasors and complex notation to perform the addition/subtraction of sinusoidal waveforms with different phase angles

Reactance, Impedance and Admittance

- Concept of capacitive reactance XC, inductive reactance XL and impedance Z
- Concept of conductance G, susceptance B and admittance Y
- Calculate admittance and impedance of RLC circuits in series, parallel and combinations
- Determine P, I, V, R, X, Z and Y of RLC circuits using both complex and phasor notations.

4Mutual inductance

- *Concept of Mutual inductance*
- *Relate inductances and mutual inductance*
- *coupling coefficient*

Transformers

- *Transformer action*
- *Applications*
- *Losses*

Frequency Response

- Low Pass and High Pass Filters
- Bass-pass and Band-stop Filters
- Passband, stopband and cutoff frequency

Transient Circuit Analysis

- Variable frequency AC Circuits
- Bandwidth
- Quality Factors
- Appreciate the effect of frequency on reactance, impedance and phase
- Explain resonant frequency using phasor diagram
- Calculate resonant frequency from XC = XL and $1/(2\pi \sqrt{(LC)})$

Learning Outcomes

On completion of this module, students should:

- have a strong grasp on the fundamental mathematical concepts pertaining to AC sine wave circuits
- be able to understand fundamental concepts associated with, and solve problems on:
    - Fundamental AC circuit theory
    - phasors
    - Transient circuit analysis
    - Filters and frequency response analysis

Skills

- To introduces the students to electrical and electronic systems excited by sine waves
- To provide a solid grounding of theory in the mathematical analysis of AC circuits
- To offer illustrative practical applications of theoretical concepts

NTO1024 – Electrical Power and Machines (10 CATS)
Level Undergraduate

Credits 10

Course Components

Lecture Required; Laboratory Required

Enrolment information

Typically offered: Second Semester

September intake and January intake

Contact Teaching Methods

Lecture 32 hours

Tutorial 8 hours

Laboratory 8 hours

Assessment

Continuous assessment 40%; Exam 60%

Prerequisites: None**; Co-requisites:** None

Compulsory elements

Attendance at all lectures and laboratories.

Completed assignments and exams.

Course Content

Electromechanical Conversion

- Torque Production in Simple DC motor
- Induced Voltage in Simple AC Generator
- Motional EMF and Equivalent Circuit

Brushed DC Machine

- Construction and Components
- Speed-Torque Performance
- Self, Series and Shunt Configurations
- Efficiencies of DC Machine

Synchronous AC Generator

- Construction and Components
- Frequency Control

Conventional Power Generation

- Coal-Fired Steam Power Plants
- Combined Cycle Gas Turbines
- Combined Heat and Power
- Transmission and Distribution

Renewable Power Generation

- Wind Power Systems
- Hydro Power Systems
- Solar Power Systems

Demand and Generation

- Variability of Demand
- Matching Generation to Demand

Distributed Generation

- Concept and Benefits
- Overview of Technologies

Power Systems

- Real, Reactive and Apparent Power
- Power Factor Correction
- Three Phase Systems

Learning Outcomes

Be able to

- Describe machines that convert mechanical energy to electrical energy and vice versa.
- Solve problems involving control of speed, voltage and frequency of electrical machines
- Describe the principles of operation of major renewable and non-renewable power generation systems.
- Solve problems and perform basic analytical tasks related to electrical power systems

Skills

Be able to carry out practical tasks in a laboratory comprising measurement related to electrical engineering and making a viable discussion on the outcome.

NTO1026– Engineering Mathematics1 (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required

Tutorial Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture – 32 hours

Tutorial – 16 hours

Assessment

Continuous assessment – 20%; Exam – 80%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and seminars. Completed assignments and exams.

Course Content

- Preliminaries of calculus: Algebra, exponents, factorisation, exponential functions and logarithms, line and circle geometry, trigonometry and trigonometric functions and identities, degrees and radians
- Introduction to limits: Limits of a function, limits of sums, differences, products and quotients. Infinite limits and indeterminate forms
- Fundamental differentiation concepts: Finding derivatives using limits, L'Hospital's rule, standard derivatives of polynomials and common functions (exponentials, logarithms, trigonometric, ...etc)
- Advanced differential rules: Product and quotient rules, chain rule, implicit differentiation, higher order derivatives
- Applications of differentiation: Rate of change (e.g. velocity), derivative as a gradient of a tangent, equations of tangent and normal
- Further Applications of differentiation: First derivative test, concavity test, stationary points: maxima, minima, points of inflexion, second derivative test, centre and radius of curvature.
- Introduction to integration: Antiderivatives, definite and indefinite integration, standard integral forms
- Integration rules: Integration by parts, integration by partial fraction expansion, integration of trigonometric functions,
- Further integration rules: Integration by substitution (algebraic and trigonometric)
- Application of integration: Areas under and between curves, volumes of solids of revolution, centroid and centre of gravity
- Numerical integration: Midpoint rule, Trapezoidal rule and Simpson's rule.

Learning Outcomes

On completion of this module, students should be able to:

- Understand the fundamental concepts of calculus
- Determine the limit of functions
- Evaluate the derivatives of common functions
- Understand and interpret the derivative for various applications
- Evaluate the integrals of common functions
- Apply integration techniques, for example; to determine Areas, volumes, centroids or centres of gravity
- Use numerical integration techniques

Skills

The student should be able to:

- Describe and formulate a problem, provide a solution, analyse and interpret the data and adjust the model when required.
- Demonstrate the capability of understanding the basic areas of mathematics and be able to use the required knowledge in various applications.
- Use the acquired mathematical knowledge in various engineering applications.

NTO1027 – Engineering Mathematics 2 (10 CATS)

Level Undergraduate

Credit 10

Course Components

Lecture Required

Tutorial Required

Enrolment information

Typically offered Semester 2

September and January Start

Contact Teaching Methods

Lectures and Tutorials – 48 hours

Assessment

Coursework – 40%; Final exam – 60%

Exam Session: Two-hour closed-book examination preceded by 10 minutes reading time

Prerequisites: Engineering Mathematics 1 (Semester 1)

Co-requisites: None

Compulsory elements

Attendance at all lectures and tutorials. Coursework submission and end of module exam.

Course Content

Matrices and Linear Equations

- Common matrix notations, special types of matrices,
- Matrix arithmetic
- Determinant and its properties
- The inverse of a square matrix
- Properties of the transpose and the inverse
- Solve linear simultaneous equations using
  - Cramer's rule
  - Gaussian elimination
  - Matrix method

Eigenvalues and Eigenvectors

- Definition and significance of eigenvalues and eigenvectors
- The characteristic equation
- Method of Faddeev
- Properties of eigenvalues; eigenvalues of the inverse, the transpose, special types of matrices

Complex Numbers

- Imaginary numbers; integer powers of j
- Cartesian (real-imaginary) form of complex numbers
- Argand diagram
- Addition, subtraction, multiplication and division of complex numbers in real-imaginary form
- Polar and exponential forms of complex numbers
- De Moivre's theorem and its applications

Differential Equations

- Form and solve first order differential equations including
  – the simplest,
  – with separable variables
  – linear
- Solve second order differential equations including
  – the simplest
  – linear with constant coefficients

Laplace Transform

- Definition and properties of the Laplace transform and its inverse
- Use Laplace transform to solve linear differential equations with constant coefficients

Learning Outcomes

On successful completion of this module, students should be able to:

- Recognise, recall and apply specific mathematical facts, principles and techniques.
- Select, organise and present relevant information clearly and logically.
- Select and apply appropriate mathematical techniques to solving problems.
- Carry out appropriate calculations using a formula booklet, a calculator and/or computer software where appropriate.

Skills

- Study independently and make personal notes for problem-solving and revision purposes
- Source and retrieve information from a variety of original and derived locations, such as textbooks, the internet, CDs, etc.
- Select and employ problem-solving skills (description, formulation, solution/analysis, interpretation)
- Use and apply information technology

NTO1038 – Engineering Design and Practice (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required; Laboratory: Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture 24 hours; Laboratory 24 hours

Assessment

Continuous assessment 100%

Prerequisites: None; **Co-requisites:** None

Compulsory elements

Attendance at all lectures and laboratories. Completed assignments.

Course Content

Circuit Diagrams

- Symbols and Conventions
- Measurements
- Fault Finding

Engineering Design Cycle

- Functional Specification
- Design
- Simulation
- Prototyping
- Testing
- Documentation
- Design Iteration

Design Project

- Design a simple functional circuit, predict its performance, build it, test it and analyse its physical performance.
- Use a CAD circuit simulator to predict circuit performance.
- Anaylse results and learn how modelling assumptions impact on circuit performance and determine why a design may not meet specifications and produce a modified design
- Report contributes to summative assessment

Printed Circuit Boards

- Types of Construction
- Manufacturing Technology
- Soldering (Hand, Wave-flow, Reflow)

PCB Design Project

- Design a PCB with a CAD package of the circuit from first design project
- PCB is made and components soldered
- PCB is tested to verify performance
- Report contributes to summative assessment

Project Management

- Critical Path Method
- Gantt Charts
- Product Engineering
- Reliability

Consultant Assignment

- Students are provided with a project design and manufacturing scenario with alternative routes to create the final product and are given several cost and time dilemmas to resolve and justify
- Report contributes to summative assessment.

Professional Practice

- Laws and Regulations
- Technical Standards
- Ethics
- Intellectual Property

Learning Outcomes

- to experience the stages involved in the design and creation of an electronic “product”
- to be able to connect electrical circuits and take appropriate measurements
- to use software tools to simulate and test electrical circuits
- to modify designs according to implementation constraints
- to use software tools to create a printed circuit board and to fabricate a printed circuit board
- to assess the specification, cost, time and legislative parameters of a product design

Skills

- Use of software tools such as CAD tools, spreadsheets and word processors for report writing.
- Understanding of test and development, including comparison of test results with predictions.
- Use of lab equipment in circuit construction and testing.

NTO1040 - Drawing and Design (10 CATS)

Level: Undergraduate

Credits 10

Course Components

Lecture & tutorial required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture – 20 hours (approx.)

Tutorial (including practical assignments) – 28 hours (approx.)

Assessment: Continuous assessment – 100%

Assignment 1 (10%): Hand drawing test

Assignment 2 (30%): CAD use test

Assignment 3 (60%): Consolidation of the module content

Exam Session NA

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and tutorial/practical sessions. Completed Assignment 1, 2 and 3 as detailed above.

Course Content

- Introduction to engineering drawing
- Introduction to isometric, oblique and orthographic projection

Sectional views

- Dimensioning, tolerancing and surface texture
- AutoCAD use: Drawing preparation using AutoCAD
- Introduction to 3D drawing software
- Engineering Drawings consolidation
- Introduction to Engineering Design and the design process

Learning Outcomes

Introduction to Engineering Drawing and Projection

- Define fundamental engineering vocabulary and terminology
- Define the principles of isometric and oblique projection
- Use borders and title blocks appropriately
- Read and prepare an engineering drawing
- Demonstrate a knowledge of engineering elements
- Define and apply the principles of orthographic projection

Sectional Views

- Demonstrate an understanding of sectional view and use them appropriately in engineering drawings
- Be able to clearly show internal detail via the use of sectional views

Principles of Dimensioning, tolerancing and surface finish

- Define and apply the principles of dimensioning
- Define and apply the principles of tolerancing
- Demonstrate and appreciation of the cost implications of tight tolerances
- Define and apply the principles behind surface texture
- Apply dimensions, tolerances and surface finish symbols to detail drawings

2D CAD System

- Use a 2D CAD system to prepare simple engineering drawings

3D CAD Introduction

- Use a 3D CAD system to prepare simple assembly and detail drawings

The Engineering Design Process

- Define the creative engineering design process
- Demonstrate an understanding that the design process is iterative via the production of detail and assembly drawings
- Demonstrate a knowledge of the engineering design process and its connection with engineering drawings via the production of detail and assembly drawings

Skills

On successful completion of this module the students will have acquired basic skills in drawing and design communication, AutoCAD, a basic understanding of engineering vocabulary and engineering terminology

NTO1041 - Electrical & Electronic Engineering (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture – required

Tutorial – required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture – 34 hours

Tutorial - 10 hours

Laboratory – 4 hours

Assessment

Continuous assessment – 20 %

Exam – 80%

Prerequisites: None**; Co-requisites:** None

Compulsory elements

Attendance at all lectures and seminars. Completed assignments and exams.

Course Content

Introductory topics

- System of units
- Voltage and Current Concept
- The Ideal Basic Circuit element/symbols
- Conventional Current Flow Convention
- Power and Energy

Resistance and resistor

- Resistance
- Resistivity

DC circuit theory

- Ohm's Law
- Calculate total resistance of networks in series, parallel and combinations

Kirchhoff Laws

- Kirchhoff's Current and Voltage laws
- Application of Kirchhoff's voltage and current laws to a resistive circuit

Thevenin's theorem

- Express Thevenin's theorem as a means of simplifying linear circuits
- Calculate Thevenin equivalent voltage and resistance of simple circuits, including bridges

Superposition theorem

- Express the superposition theorem as a means of simplifying linear circuits
- Apply the superposition theorem to simple circuit analysis

Maximum Power Transfer theorem

- Express the maximum power theorem as a means of optimising power transfer
- Use the maximum power transfer theorem to calculate power transfer

Capacitors

- Capacitor values
- Charging and discharging of a capacitor

Inductors

- series, parallel and series/parallel combinations of inductors
- concept of inductive energy storage

Single-phase AC Theory

- Sinusoidal and non-sinusoidal waveforms
- Amplitude, Period, Frequency
- Instantaneous, peak/peak-to-peak
- Root mean square (rms)

AC Circuit Theory Application

- Phasors
- Analysis of simple circuits

Learning Outcomes

Be able to explain fundamental concepts associated with, and solve problems on:

- Fundamental DC circuit theory
- The solution of DC network problems
- The characteristics of resistors, capacitors and inductors in circuits
- Fundamental AC circuit theory and the means of representing alternating quantities

Skills

To provide a wide-ranging introduction to Mechanical Engineering students to applicable Electrical Engineering topics

NTO1042 – Mechanical Principles (10 CATS)

Level: Undergraduate

Credits 10

Course Components

Lecture – required; Tutorial - required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture – 34 hours

Tutorial - 10 hours

Laboratory – 4 hours

Assessment

Continuous assessment – 40 %; Exam – 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and seminars. Completed assignments and exams.

Course Content

The module will cover the following topics:

- Introduction to basic concepts
- Explanation of the SI units system
- Basic definitions e.g. force, weight, mass, etc.
- Space diagrams and free body diagrams
- Types of force (internal, external, reaction, point loads, distributed etc.)
- Force calculations
- Force as a vector
- Resultants and equilibrants
- Vector diagrams and use of trigonometry
- Resolving forces
- Moments
- Definition of moments, couples and torques
- Calculation of reactions
- Calculations involving multiple force-moment systems
- Pin Jointed frameworks
- Static determinacy
- Method of joints
- Method of sections
- Laboratory session
- Mechanics of Materials
- Introduction to stress and strain
- Tensile and compressive stress
- Poisson’s ratio and Young’s modulus
- Shear stress and strain
- Factors of safety
- Supplementary Notes

Learning Outcomes

On completion of this module, students should be able to:

- State the system of SI units and how it is applied
- Extract, draw and use free body diagrams
- Define the different types of force, and understand their effects
- Perform basic calculations relating to various force types
- Use vectors to represent a force, be able to draw and use a vector diagram
- Resolve forces
- Perform basic calculations relating to moments, couples and torques
- Manipulate moments within an engineering system and to analytically combine both forces and moments
- Calculate reactions in the supports of a pin jointed framework
- Calculate loads in the members of a pin jointed framework
- Define the difference between tensile and compressive stress and strain
- State the relationship between stress, strain and Young's modulus
- Manipulate basic stress and strain equations and solve simple stress/strain related problems
- Define Poisson’s ratio
- Be able to perform basic calculations with shear stress, shear strain and shear modulus
- Be able to apply factors of safety

Skills

Upon completion of this module students will possess the knowledge and ability to analyse basic static engineering systems and carry out basic stress analysis.

NTO1043 – Materials and Manufacture (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required

Tutorial Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture – 32 hours

Tutorial – 16 hours

Assessment

Continuous assessment – 40%

Exam – 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and tutorials. Completed assignments and exams.

Course Content

- Introduction to Materials Science: The importance of materials science and the discovery of key materials and their significance.
- Inter-atomic bonding: Ionic, covalent, metallic bonds. Secondary bonding (including Van der Waals).
- Metal Structures: FCC, BCC and HCP metal crystal structures. Dislocations.
- Materials classification: Metallic, ceramic, polymer and composite materials.
- Material testing: Tensile test, hardness tests, fatigue tests. Identify ductile and brittle failure.
- Material selection: The role of the design specification. The compromise between strength, cost, weight, recyclability, manufacturability etc. Material selection techniques.
- Manufacturing 1 - Forming: Vacuum, extrusion, rolling, drop forging
- Manufacturing 2 - Casting: Sand casting, lost wax, die casting, continuous casting. Casting defects.
- Manufacturing 3 - Material removal: machining and grinding Non-traditional processes (chemi-milling for example). Sawing and shaping. Cutting tools
- Manufacturing 4 – Moulding: Injection moulding and suitable polymers.
- Case Study: Analyse a common engineering product/component with a view to redesigning it to improve the materials and/or manufacturing processes.

Learning Outcomes

On completion of this module, students should be able to:

- Understand the importance of materials science and the key milestones in materials discovery and development.
- Describe the primary bonding systems and how they affect the materials properties.
- Describe the difference in atomic/molecular structure between crystalline and non-crystalline materials.
- Draw the unit cells for metal crystal structures.
- Understand how materials are classified.
- Carry out materials tests and interpret material test data.
- Select suitable materials for a common engineering product/component.
- Describe the main manufacturing processes and select suitable processes for engineering components.

Skills

The student should be able to:

- Use observation and analysis to increase understanding.
- Undertake detailed observation of existing products and components to draw useful conclusions.
- Demonstrate an ability to apply knowledge of materials and manufacturing processes to solve design problems.

NTO1045 - Civil Engineering Principles (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture, tutorial & practical required

Enrolment information

Typically offered Second Semester

September intake and January intake

Contact Teaching Methods

Lecture – 28 hours; Tutorial - 12 hours

Laboratory - 8 Hours

Assessment

Continuous assessment: 40%

Final exam – 60% (2 hours)

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures, laboratories and tutorials. Completed class test, laboratory report and end of module exam.

Course Content

Hydraulics: Introduction & Hydrological Cycle. Design of pipelines (Series) & Energy Line Diagrams, type of pipes, joints. Cover and bedding. Pumps and pump systems

Overview of different materials commonly used in Civil Engineering: •Overview. Engineering properties

Concrete*:* An introduction to its composition and properties. Production, composition and hydration reaction of Normal Portland Cement. Aggregates. Plastic concrete. Hardened concrete. Compressive strength test for concrete. Introduction to admixtures.

Masonry*:* Manufacture. Mortar. Movement joints. Durability of masonry

Timber*:* • Macrostructure & microstructure of wood. Structural properties of timber. Durability of timber

Learning Outcomes

Hydraulics: Draw and annotate the Hydrological Cycle. Design simple pipelines (Series). Draw simple Energy Line Diagrams. State different types of pipes and joints. Describe the use and application of cover and bedding. Describe the use and application of different pumps and pump systems

Overview of Civil Engineering Materials: Describe different materials commonly used in Civil Engineering. State key engineering properties of each material. Describe the applications to which each material can be put. State the major advantages and disadvantages of each material.

Concrete*:* Describe the composition and structural properties of concrete and the production process of Ordinary Portland Cement. Describe the hydration reaction between cement and water. State and explain the main factors controlling workability and cohesion of plastic concrete. State and explain different test methods used to measure workability. Describe and explain the role played by the aggregate with regard to the strength and deformation of fresh and hardened concrete. State different failure mechanisms of hardened concrete and weather they are satisfactory or not. Describe the various mechanisms of deterioration in reinforced concrete, their consequences and means of minimising their occurrence. Describe the effect of the addition of various chemical admixtures

Masonry: Define the different components of masonry. Briefly describe the different types of units. State and explain the role played by the mortar in a masonry structure. Describe the different forms of movement that can occur in masonry structures and the importance of movement joints in controlling this movement. State and explain the different mechanisms of deterioration that can occur in masonry and ways of minimising their occurrence

Timber: Draw a simple cross section through a tree trunk. Briefly describe the structure of wood. State and explain the most important structural properties of wood. Describe the degradation processes involved when timber becomes exposed to fire, insect infestation and moisture

Skills

By the end of the module, the student should be able to:

Design simple pipelines. Draw energy line diagrams. State and explain the use and application of different types of cover and bedding. State and explain the use and application of pumps and pump system. Describe the basic properties of materials used in Civil Engineering. Describe the different applications to which each can be put. Describe the main cause of degradation of each material

NTO1046 - Geotechnics (10 CATS)

Level: Undergraduate

Credits: 10

Course Components

Lecture & tutorial required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture – 30 hours

Tutorial - 14 hours

Laboratory - 4 Hours

Assessment

Continuous assessment: 40%

Exam: 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures, laboratories and tutorials. Completed class test, laboratory report and end of module exam.

Course Content

- Introduction to geological processes, formation of soils and rocks.
- Soil classification including index tests, particle size distribution and field tests.
- Principle of effective stress, strength and stress-strain behaviour.
- Mohr-Coulomb criteria, laboratory and field tests.
- Introduction to consolidation and permeability
- Introduction to lateral earth pressure

Learning Outcomes

By the end of the module, the students should be able to:

- Describe the formation of soils and rocks.
- Carry out soil classifications.
- Carry out a particle size analysis.
- Describe the principle of effective stress.
- Carry out calculations involving the strength of soils and stress-strain behaviour.
- Describe the Mohr-Coulomb criteria.
- Describe how to carry out laboratory and field tests.
- Describe the consolidation and permeability properties of soils.
- Sate and explain the effect of lateral earth pressures.
- Analyse simple sheet pile retaining walls.

Skills

By the end of the module, the students will be able to:

- Describe the main types of soil
- Analyse the behaviour of different types of soil in an engineering context

NTO1047 - Surveying (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture, tutorial & practical required

Enrolment information

Typically offered Second Semester

September intake and January intake

Contact Teaching Methods

Lecture – 30 hours; Tutorial/practical - 18 hours

Assessment

Four coursework assignments, each worth 10%, based on practical classes

Final Exam- 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and practical/ tutorial classes. Four completed practical coursework assignments, each worth 10%, based on the practical classes and completed end of module exam.

Course Content

- Linear distance measurement: using steel tapes, slope and standardisation corrections, and basic principles of electromagnetic distance measurement.
- Levelling: Setting up a level, the levelling staff, reading the staff, booking, back sights, intermediate sights, fore sights, reduction of levels using both the 'rise and fall' and 'height of collimation' methods, arithmetical checks, bench marks and temporary bench marks, closing errors and acceptable closing errors, collimation errors, two-peg test, applications of levelling.
- The theodolite: Setting up a theodolite, levelling and centring over a station, reading horizontal angles, booking readings, rounds of angles, reading and booking vertical angles.
- The total station: Measurement of horizontal and vertical angles and distances
- Theodolite traverse surveys: Closed traverses, loop and link traverses, measurement of the angles and distances required, traverse computations for closed loops and for link traverses.
- Stadia tacheometry: Use of the stadia hairs on the diaphragm of the level and theodolite, multiplying constant, inclined lines of sight.
- Contouring: linear interpretation of contours from spot heights.
- Surveying and booking details: Using offsets and ties

Learning Outcomes

- Measure linear distances using steel tapes.
- Apply the necessary corrections
- Describe the basic principles on which electromagnetic measuring instruments work.
- State how horizontal distances are measured using a total station.
- Set up a tilting and automatic level.
- Read a levelling staff.
- Book the readings using the 'rise and fall 'method and also the 'height of collimation' method.
- Complete the level book by reducing the levels.
- Apply arithmetical checks in both 'rise and fall' and 'height of collimation' level books.
- Use bench marks.
- Evaluate the closing error in a piece of fieldwork.
- Identify the principal parts of the theodolite.
- Set up a theodolite.
- Read and book horizontal angles.
- Define the term "round of angles".
- Read and book vertical angles.
- Identify the principal features of a total station.
- Read and book horizontal angles, vertical angles and distances using a total station.
- State the advantages of using a total station.

Skills

By the end of the module, the student should be able to:

- Set up and read simple surveying instruments.
- Carry out the necessary computations (with adjustments where necessary).
- Interpret and use a large scale plan.

NTO1050 – Aerospace Principles (10 CATS)

Level Undergraduate

Credit 10

Course Components

Lecture Required; Tutorial Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture – 32 hours

Tutorial – 16 hours

Assessment

Continuous assessment – 20%; Exam – 80%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and tutorials. Completed assignments and exams.

Course Content

- Introduction to Aerofoil terms: Lift, drag, chord, leading edge, trailing edge, camber, dihedral, anhedral, aspect ratio, angle of attack, angle of incidence, lift and drag coefficients.
- Main aircraft structural components: Vertical and horizontal stabilisers, fuselage construction (formers, skin, bulkhead, stringers etc.) wing construction (ribs, spars, etc.), nacelles, landing gear, power plant.
- International Standard Atmosphere: Derivation of relevant equations, variations of pressure, temperature and density.
- Subsonic Flow around a streamlined body 1: Laminar and turbulent flow, volume flow rate, mass flow rate, continuity of flow, Bernoulli's equation,
- Flow around a streamlined body 2: Pressure distribution around an aerofoil, lift and drag forces.
- Wing and Aerofoil characteristics: Lift, drag and pitching moment (including coefficients), centre of pressure, aerodynamic centre, pressure coefficient.
- Aerodynamic drag: types of drag; induced drag, skin friction drag and the boundary layer, form drag, total drag.
- High lift devices: Slots and slats, flaps (plain, split, fowler etc.), stalling, boundary layer control.
- Aircraft instruments: Air speed (indicated, true and equivalent), pitot-static system, altimeter, vertical speed indicator.
- Straight and level flight: Maximum endurance and range, simple performance calculations.
- Aircraft stability: Axes system, static and dynamic, pitching moment, static margin.

Learning Outcomes

On completion of this module, students should be able to demonstrate knowledge and understanding of:

- The function of the main aircraft components.
- The basic flow around an aerofoil.
- How lift and drag forces arise.
- The International Standard Atmosphere and variations of the temperature, pressure and density with height.
- The definitions of airspeed, true, equivalent, indicated airspeed.
- The basic aircraft instruments.
- The main structural components.
- Straight and level flight.
- Basic longitudinal stability and control of a fixed wing aircraft.

Skills

The student should be able to:

- Determine flow similarity parameters and perform related calculations.
- Calculate lift and drag from a pressure distribution.
- Perform airspeed, stability and performance calculations.

NTO1051 – Electronic Materials and Devices (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required

Laboratory Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture 32 hours

Tutorial 8 hours

Laboratory 8 hours

Assessment

Continuous assessment 40%

Exam 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and laboratories. Completed assignments and exams.

Course Content

Introductory Materials Science

- Atomic Structure
- Covalent Bonding
- Crystal Structures
- Energy Band Diagrams

Conductors

- Classical Drude Model of Conduction
- Derivation of Ohms Law
- Band Theory of Conduction

Semiconductors

- Intrinsic Semiconductors and electron-hole pairs
- Extrinsic n-type and p-type semiconductors,
- Drift and Diffusion Equations

Semiconductor Devices

- pn junction diode
- Bipolar Junction Transistor
- Junction Field Effect Transistor
- Metal Oxide Semiconductor Field Effect Transistor

Dielectrics Materials and Insulation

- Relative Permittivity
- Polarisation Mechanisms
- Capacitor Dielectric Materials
- Dielectric Breakdown

Magnetisation

- Electromagnetism and Magnetisation of Matter
- Magnetic Material Classification
- Soft and Hard Magnetic Materials
- Applications and uses

Learning Outcomes

Be able to:

- Explain and solve basic problems related to the conductivity of conductors, and intrinsic and extrinsic semiconductors
- Describe and explain the operating characteristics of and solve problems related to semiconductor devices: pn junction diode, bipolar junction transistor, junction field effect transistor or metal-oxide-semiconductor field effect transistor
- Analyse simple circuits using semiconductor devices
- Describe and solve problems related to relative permittivity and polarization of dielectric materials used in capacitors
- Describe and solve basic problems related to electromagnetic fields and magnetisation of materials

Skills

- employ appropriate laboratory equipment skills to determine and measure characteristics of different semiconductor devices

use alternative diagrams to represent different features of the same engineering concept or model

NTO1052 – Communications (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required

Laboratory Required

Enrolment information

Typically offered Second Semester

September intake and January intake

Contact Teaching Methods

Lecture 30 hours

Tutorial 12 hours

Laboratory 6 hours

Assessment

Continuous assessment 40%

Exam 60%

Prerequisites

None

Co-requisites

None

Compulsory elements

Attendance at all lectures and laboratories. Completed assignments and exams.

Overview of Communication Systems

- **Communication System Elements**
- **The Communications Channel**
- **Introduction to Time domain and Frequency domain**

Gain, Attenuation, Decibels

- **Voltage gain in absolute value and in decibels**
- **Power gain in absolute value and in decibels**
- **Relationship between dBW and dBm**
- **Gain Blocks and Cascaded gain stages**

Amplitude Modulation (AM)

- **Time and amplitude Representation**
- **Double Sideband (DSB AM) and its Power distribution**

Frequency Modulation (FM)

- **Time and Frequency Representation**
- **Modulation Index & Sidebands**
- **Spectrum and Sidebands**
- **Narrowband FM (NBFM) and Wideband FM (WBFM)**

Radio Receivers

- **Superheterodyne Receivers**
- **AM Detector**
- **FM Detector**

Noise

- **Sources of Noise, Signal-to-noise ratio, NR, NF**
- **The FRIIS noise equation**

Transmission Lines

- **Types of transmission line**
- **Connectors**

Wireless Communications

- **Common antenna types, gain and directivity**
- **The Link Design Equation**

Optical Communication

- **Optical principles, Light waves, Refraction**
- **Fibre-optic communication systems**
- **Single Mode, Multimode and Graded Index Fibre**

Describe and solve problems on

- **the basic elements of communications systems**
- **transmission lines, optical fibres and radio channels**
- **analogue modulation techniques**
- **sources of noise and the impact of noise**

Skills

Relate and interpret engineering models of communication channels and signals to practical performance and explore simple design choices.

NTO1053 – Introduction to Chemical Engineering (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture: Required

Laboratory: Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture 32 hours

Tutorial 18 hours

Assessment

Continuous assessment 20%

Exam 80%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and tutorials. Completed assignments and exams.

Course Content

Introduction to the Chemical industry: Background and development of the Chemical industry. Chemical processes.

Units, Quantities, Dimensional Analysis and Dimensionless Groups: System of units. Conversion of units. Dimensional analysis. Dimensionless groups.

Mass and Energy Balances: Conservation of mass and energy. Enthalpy and heat capacity. Basic enthalpy changes for phase transitions. More complex mass and energy balances.

Combustion and Thermal Efficiency: Composition of fuels. Calculation of air requirement. Calculation of volume and composition of flue gases. Excess air. Gaseous fuels.

Steam as a Heat Transfer Medium: Introduction. Basics of boilers. Water-treatment. Review of Water properties. Steam, Condensing and Superheated steam. Wiredrawing and Desuperheating.

Basic Economics for the Chemical Industry: Sources of capital and hire charges. Interest. Depreciation. Capital investment. Profitability. Break-even charts. Marginal costs and dumping. Cash flow diagrams and activity charts. Standard costing. Discounted cash flow. Net present value.

Chemical Product Development: Applications of new Chemistry in modern industry. Examples in the polymer industry. Examples in the energy industry

Learning outcomes

Develop a foundation in the principles of process design and chemical development, including mass and energy balances.

By the end of the module the students should be able to:

- demonstrate understanding of the chemical industry;
- demonstrate awareness of chemical product design and the skills required for new product development;
- use basic dimensional analysis
- undertakeprocess design and produce process flow diagrams;
- Carry out mass and energy balances and apply these to the design of relevant processes;
- use methodologies for solving more complex design problems, including process economics;
- Show an awareness of industrial/practical thermal efficiency;
- describe the scale, economics and complexity in design;
- demonstrate technical report writing skills.

Skills

Develop competencies in chemical engineering by developing a basic understanding of the design of chemical engineering plants. The student will develop an understanding of the processes, unit selections and basic economics involved in the Chemical Industry. They will also have an insight into new developments.

The student will gain an understanding of product design, process flow diagrams, basic mass & energy calculations and the use of thermodynamic information (e.g. steam tables).

NTO1054 – Basic Chemistry 1 (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required

Laboratory Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture 30 hours

Tutorial 12 hours

Laboratory 6 hours

Assessment

Continuous assessment 20%; Exam 80%

Prerequisites: None; **Co-requisites:** None

Compulsory elements

Attendance at all lectures and laboratories. Completed assignments, pre-lab and post-lab reports and exams.

Course Content

This module aims to give students an introduction to the fundamental principles of atoms from the viewpoint of a chemist. It starts with a simple atomic model and then uses the results of quantum mechanics to achieve a more appropriate model. Students should aim to achieve a solid grounding in the fundamental principles of atomic structure including principal quantum numbers, s and p atomic orbitals, the periodic table and the Aufbau principle. They should also aim to achieve a good understanding of trends in atomic and ionic properties in the Periodic table and use these concepts to explain and predict the properties of the different elements. They should gain the ability to answer problems related to all of these concepts.

This module also introduces a discussion of bonding in discrete molecular species centring on the valence bond and molecular orbital theories. Important parameters that help to describe bonding will be discussed and the students must be able to define and apply these terms in a qualitative way. Students should be able to draw Lewis structures for simple molecules that obey the octet rule and be able to use hybridisation to describe more complex structures especially those involving single, double and triple bonds to carbon. They must also be able to understand how resonance is used in simple molecular structures. They should understand the significance of molecular orbital diagrams, be able to draw them for simple molecules and use them to work out the bond order and relate this to stability. Students should be able to contrast the valence bond and molecular orbital theory. Students will receive an introduction to solids in order to understand the main classes of solids and how they differ.

The final section of the module looks at organic chemistry where students will develop an understanding of the chemistry of different functional groups including their inter-conversion and then be able to provide mechanistic details for reactions.

Learning Outcomes

At the end of this course students will be able to:

- draw structural formula to represent organic compounds, identify isomers and convert structural formula to molecular formula;
- identify common organic functional groups, name organic compounds containing these groups, and predict their chemistry and reactivity;
- recognise nucleophiles, electrophiles and bases and identify which chemistry these species participate in;
- explain the importance of acidity and basicity in organic chemistry;
- sketch substitution, elimination and addition mechanisms and appreciate the importance of ‘mechanism’ in rationalising organic chemical reactions;
- suggest reagents for interconverting one functional group into another;
- apply general organic chemistry laboratory skills;
- Describe the development of theories concerning atomic structure;
- Describe and explain trends in the Periodic Table;
- Use valence bond theory to describe the bonding in simple molecules;
- Construct molecular orbital diagrams for simple molecules;
- Compare and contrast different bonding theories

Skills

Students will become familiar with chemical descriptions of the composition and organisation of matter in the Periodic Table. They will also learn about organic compounds and how they can be prepared, named and reacted. Students will acquire basic organic chemistry laboratory skills. (Bullet points)

NTO1055 – Basic Chemistry 2 (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required

Laboratory Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture 30 hours

Tutorial 12 hours

Laboratory 6 hours

Assessment

Continuous assessment 20%

Exam 80%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and laboratories. Completed assignments, pre-lab and post-lab reports and exams.

Course Content

Basic Thermodynamics

This course will start with a review of states of matter and introduce the concepts of Ideal gases and Ideal solutions. Key definitions for chemical equilibria will be considered in order to allow students to perform calculations involving equilibrium constants for homogeneous and heterogeneous systems. Definitions and calculations involving enthalpy of solution and lattice energy will also be introduced. Continuing with chemical equilibria, applications of Le Chatelier's principle will be used to determine the effects of changes in concentration, pressure, temperature and catalyst on the composition of both the reaction mixture and the equilibrium constant. This will also include the Common Ion effect.

Key definitions of acids bases will be introduced followed by calculations including *pH*, pK_a, pK_b and the special case of water (K_w and pK_w). Acid/base titration terminology will be covered for monoprotic and polyprotic acids, including examples, and the use of indicators and buffer solutions. This will also involve calculations of pH for titrations and buffers. Log distribution diagrams and speciation will also be included.

For Phase equilibria, phase changes, melting temperature, boiling temperature, density, molar volume and lattice energy will be considered as well as an introduction to entropy. Simple P-T diagrams will be used to describe single component systems followed by the application of Raoult's Law and Henry's Law in ideal two component systems.

Basic Kinetics

The basic kinetics section of the course will look at reaction mechanisms, methods of measuring reaction rates, the derivation of rate-defining kinetic equations; the order of reaction, tests to determine order, distinction between order and molecularity. The dependence of reaction rate on temperature will be considered using the Arrhenius equation, collision theory and will look at the measurement of activation energies. Finally different classes of reaction, including simple gas phase reactions, chain reactions, branched chain reactions, reactions in solution, reactions of solids and catalysed reactions will be considered.

Learning Outcomes

The student will become familiar with basic chemical thermodynamics and kinetics. By the end of the course, the students will have an improved knowledge and understanding of states of matter and phase changes, equilibrium constants, acid/base chemistry, basic phase equilibria and chemical kinetics. The students will develop their problem solving abilities in these areas. More specifically the students will be able to:

- solve numerical problems involving equilibrium constants (K_c, K_p, K_{sp}), and enthalpy of solution;
- apply Le Chatelier's Principle to determine the effect of a change on a system at equilibrium;
- calculate the pH, pK_a and pK_b of solutions; perform calculations including buffers;
- use Raoult's Law and Henry's Law in two component systems;
- calculate reaction order, apply 1st and 2nd rate laws and use the Arrhenius equation;
- describe the relationship between reaction rates and reaction mechanism;
- demonstrate general chemical and engineering laboratory skills including statistical analysis and health and safety.

Skills

Students will develop thermodynamic and kinetic problem solving skills including the use of Excel-based calculations and graphing. They will also develop general chemical and engineering laboratory skills including the application of statistical analysis and health and safety.

NTO1056 – Heat and Mass Transfer (10 CATS)

Level Undergraduate

Credits 10

Course Components

Lecture Required

Laboratory Required

Enrolment information

Typically offered First Semester

September intake and January intake

Contact Teaching Methods

Lecture 30 hours

Tutorial 12 hours

Laboratory 6 hours

Assessment

Continuous assessment 40%

Exam 60%

Prerequisites: None

Co-requisites: None

Compulsory elements

Attendance at all lectures and laboratories. Completed assignments, pre-lab and post-lab reports and exams.

Course Content

Mass Transfer

- Introduction to mass transfer
- Molecular and convective diffusion
- Mass transfer operations (including Distillation)
- Equilibria in binary liquid mixtures
- Equilibria in ternary liquid mixtures
- Mass transfer operations(including solvent extraction)

Heat transfer

- Heat transfers by conduction, convection and radiation
- 0D and 1D transient problems
- Forced and natural convection
- The various designs of heat exchangers (including condensers, vaporisers and multipass exchangers)
- Calculations using the NTU method

Learning Outcomes

By the end of the semester, the students should be able to:

- carry out mass and energy balance equations of fluids in motion;
- describe heat transfer by conduction and convection;
- explain basic heat exchanger design diffusion and its importance in mass transfer, and carry out calculations;
- explain the methodology used to design distillation columns;
- describe binary and ternary liquid phase extraction processes;
- explain the methodology used to design an extraction unit;
- Calculate heat transfer rates using correlations of non-dimensional groups, analytical techniques or numerical techniques.

Skills

Students will gain an appreciation of the fundamentals of mass transfer in chemical engineering design and in chemical engineering unit operations. They will also be able to apply the concepts of heat transfer to the design of heat transfer systems. Finally, students will acquire heat and mass transfer laboratory skills.