Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE & ENGINEERING

STUDENT HANDBOOK

MSc (FHEQ LEVEL 7)
MSc CHEMICAL ENGINEERING
(JANUARY INTAKE)
DEGREE PROGRAMMES

SUBJECT SPECIFIC

(PART TWO OF TWO)

MODULE AND COURSE STRUCTURE

2021/22

DISCLAIMER

The Faculty of Science and Engineering has made all reasonable efforts to ensure that the information contained within this publication is accurate and up-to-date when published but can accept no responsibility for any errors or omissions.

The Faculty of Science and Engineering reserves the right to revise, alter or discontinue degree programmes or modules and to amend regulations and procedures at any time, but every effort will be made to notify interested parties.

It should be noted that not every module listed in this handbook may be available every year, and changes may be made to the details of the modules. You are advised to contact the Faculty of Science and Engineering directly if you require further information. It is likely that the module descriptors for the September-January modules will be updated by module coordinators later in the year.

COVID-19

As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible.

We are working hard to enable learning to take place in a Covid-aware environment, based on Welsh law and Welsh Government guidance. Delivery of both teaching and assessment will be ‘blended’ including live and self-directed activities online and on-campus.

Given the changeable situation with COVID-19 it is important that staff and students comply with the procedures that are in place to protect the health of our community. Please familiarise yourself with the Student Charter and follow all of the guidance in place across the University and Faculty of Science and Engineering. As a community we all need to ensure that we keep Swansea University a safe place to study and work.

TERM DATES

The 2021/22 academic year for January start programmes begins on 17th January 2022

Full term dates can be found here

IMPORTANT

Swansea University and the Faculty of Science of Engineering takes any form of **academic misconduct** very seriously. In order to maintain academic integrity and ensure that the quality of an Award from Swansea University is not diminished, it is important to ensure that all students are judged on their ability. No student should have an unfair advantage over another as a result of academic misconduct; whether this is in the form of **Plagiarism**, **Collusion** or **Commissioning**.

It is important that you are aware of the **guidelines** governing Academic Misconduct within the University/Faculty of Science and Engineering and the possible implications. The Faculty of Science and Engineering will not take intent into consideration and in relation to an allegation of academic misconduct - there can be no defence that the offence was committed unintentionally or accidentally.

Please ensure that you read the University webpages covering the topic – procedural guidance here and further information here. You should also read the Faculty Part One handbook fully, in particular the pages that concern Academic Misconduct/Academic Integrity. You should also refer to the Faculty of Science and Engineering proof-reading policy and this can be found on the Community HUB on Canvas, under Course Documents.

WELCOME

We would like to extend a very warm welcome to all students for the 2021/22 academic year.

We are looking forward to having you on campus for the new academic year. We have been busy making preparations to ensure a COVID aware environment in line with the latest Welsh Government guidelines and with your safety as our top priority.

The campus experience may still be different from an ordinary year. For example, some teaching activities will be online rather than in person, with a 'blended learning' approach.

Given the continued situation with COVID-19 it is important that staff and students comply with the procedures that are in place to protect the health of our community. Please familiarise yourself with the Student Charter and follow all of the guidance in place across the University and the Faculty of Science and Engineering. As a community we all need to ensure that we keep Swansea University a safe place to study and work.

We would like to wish you every success with the year ahead.

Faculty of Science and Engineering	
Executive Dean and PVC	Professor Ken Meissner
Deputy Executive Dean	Professor Johann Sienz
Head of Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Professor Paul Holland
School of Engineering and Applied Sciences **Head of School: Professor Serena Margadonna**	
School Education Lead	Professor Cris Arnold
Head of Chemical Engineering	Dr Enrico Andreoli
Chemical Engineering Programme Director	Dr Matt Barrow M.S.Barrow@Swansea.ac.uk
Chemical Engineering MSc Coordinator	Dr Shirin Alexander S.Alexander@Swansea.ac.uk

STUDENT SUPPORT:

The Faculty of Science and Engineering has two **Reception** areas - Engineering Central (Bay Campus) and Wallace 223c (Singleton Park Campus).

Standard Reception opening hours are Monday-Friday 9am-5pm.

The **Student Support Team** provides dedicated and professional support to all students in the Faculty of Science and Engineering. Should you require assistance, have any questions, be unsure what to do or are experiencing difficulties with your studies or in your personal life, our team can offer direct help and advice and also signpost you to further sources of support within the University. There are lots of ways to get information and contact the team:

Email: studentsupport-scienceengineering@swansea.ac.uk (Monday–Friday, 9am–5pm)

Call: +44 (0) 1792 295514 and also 01792 6062522 (Monday-Friday, 10am–12pm, 2–4pm).

Zoom: By appointment. Students can email, and if appropriate we will share a link to our Zoom calendar for students to select a date/time to meet.

The current student **webpages** also contains useful information and links to other resources:

https://myuni.swansea.ac.uk/college-of-engineering/coe-student-info/

READING LISTS:

Reading lists for each module are available on the course Canvas page, and are also accessible via http://ifindreading.swan.ac.uk/. We've removed reading lists from the 21-22 handbooks to ensure that you have access to the most up-to-date versions. Access to print material in the library may be limited due to CV-19; your reading lists will link to on-line material whenever possible. For Engineering courses, we do not expect you to purchase textbooks, unless it is a specified key text for the course.

MSc (FHEQ Level 7) 2021/22
Chemical Engineering
January Start – PTFCE02J

Jan-June 21-22	**Sept-Jan 22-23**
EGDM01 **Colloid and Interface Science** **10 Credits**	**EG-M01** **Complex Fluids and Rheology** **10 Credits**
EGCM01 **MSc Research Practice** **20 Credits**	**EG-M09** **Water and Wastewater Engineering** **10 Credits**
10 credit optional module	**EGCM38** **Membrane Technology** **10 Credits**
10 credit optional module	**EG-M11** **Biochemical Engineering II** **10 Credits**
	EGTM79 **Environmental Analysis and Legislation** **10 Credits**
EG-M91J - Begins in June and runs through to January **MSc Design Project** **20 Credits**	
Research Project – July-September 21-22	
EGCM30 **MSc Dissertation - Chemical Engineering** **60 Credits**	
Total 180 Credits	

Optional Modules
Choose 20 credits from here:

EG-M07	Optimisation	Jan-June 21-22	10
EG-M47	Leadership Development	Jan-June 21-22	10
EG-M160	Advanced Microfluidics	Jan-June 21-22	10
EGCM40	Pollutant transport by groundwater flows	Jan-June 21-22	10
EGTM89	Polymers: Properties and Design	Jan-June 21-22	10
EGCM36	Desalination	Jan-June 21-22	10

EG-M07 Optimisation

Credits: 10

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr C Giannetti, Dr L Evans

Format: Timetabled lectures and example classes 30 hours;
Directed private study 70 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Assessment:
Exam: 80% (LO1, 2 & 3)
Continuous Assessment: 20% - Assignment 1 (LO1 & 2) and Assignment 2 (LO 2 & 3)

Module Aims: This module provides an introduction to some important techniques of optimisation that may be used across a broad range of engineering disciplines. The focus is on understanding the methods through hand calculation rather than the use of particular software packages. Numerical examples are employed to illustrate concepts and potential applications.

Module Content:
Indicative syllabus content:
1. Statement of optimisation and reliability problems.
2. Lagrange multipliers
3. One-Dimensional Minimisation Methods. Direct and indirect methods: unrestricted search; dichotomous search; golden section method; quadratic interpolation; Newton's procedures.
4. Extrema of functions of several variables.
5. Multidimensional Minimisation Problems - direct methods such as: Taxi-cab; conjugate search procedure
6. Multidimensional Minimisation Problems - indirect methods such as: Steepest descent method; Newton's method.
7. Linear Programming - the Simplex Method

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student should:
- Understand and be able to set up and carry out the necessary calculations for univariate unimodal optimisation problems LO1)
- Be able to use search techniques to determine the optima of unconstrained and constrained multivariable systems (LO2)
- Understand and be able to set up and carry out the necessary calculations for Linear Programming problems (LO3)

Accreditation Outcomes (AHEP)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems (SM2m)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects (SM6m)
- Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods (EA7M)
- Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D10M)

Assessment: Examination 1 (80%)
Coursework 1 (10%)
Coursework 2 (10%)

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

• Identify the different types of biocatalysts and evaluate their application in diverse scenarios: justify when to use different genetically engineered microorganisms; explain how biological information can be utilised, manipulated and stored; be aware of and overcome deviations from ideality and diffusional limitations.
• Assess, calculate and predict product formation and optimal conditions when using mixed cultures in batch and continuous reactors, and compare the major interactions between different populations of microorganisms.
• Describe the principles of biofilm formation and biofouling, and evaluate different routes to monitor and control them.
• Compare and assess different optimisation, advanced separation processes and quality control tools, and their applications.
• Evaluate and categorise the potential hazards when working with bioprocesses and microorganisms, and describe the precautions required to reduce the risks associated with them.
• Summarise, explain, defend and discuss scientific findings and express ideas in a logical and coherent manner.

Assessment: Examination 1 (100%)

Assessment Description: Examination in January, 100%

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: Questions from students will be answered during class, and office hours allocated for this module. Worked-examples during classes are participative, and written solutions to every problem are provided after discussion.

Failure Redemption: A supplementary examination will form 100% of the module mark.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Lecture notes are available on Canvas

EG-M160 Advanced Microfluidics

Credits: 10

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr F Del Giudice

Format: Lectures: 20 hours
Lab Work: Variable during revision week
Office Hours: 11 hours
Private study: 100 hours

Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Lecture activities:
The lecture will first present the theoretical foundation for each topic. Students will be guided by the lecturer in the critical analysis of existing microfluidic platforms in order to identify potential limitations. Students will also be guided towards the design of alternative platforms with better performances.

Lab Work:
Brief lab activities will be carried out by the student in order to strengthen the content learned during the lecturers and to enhance the learning with practical skills. These are not compulsory and will be delivered during Revision week on a rota basis.

Lectures will be held face to face unless University guidelines specify otherwise. In this case, the lectures will be delivered online during the timetabled slots.

Module Aims: Microfluidics is the set of science and technology at the micrometer scale. In the last 30 years, microfluidic devices have been widely employed for a variety of engineering applications, including cell and particle separation, fabrication of fiber, production of droplets and microparticles and characterization of complex fluids. In all these applications, chemical engineers have employed their skills to work across scientific fields in order to promote significant improvement in many areas including diagnostic, molecule detection and advanced manufacturing. Microfluidics has enormous advantages compared to conventional techniques such as small volume of samples required (less than 1 ml), easy and accurate control of flow parameters, larger sensitivity, compact size.

In this course, we will introduce the advanced phenomena occurring at the micrometer scales. We will see how complex flows can be used to drive a variety of further phenomena including alignment and spacing of particles, droplet formation, particle fabrication, and cell separation. We will employ a critical approach to identify limitations of existing microfluidic technologies and we will develop a mindset oriented towards problem solving (i.e., positive attitude) and design of alternative devices for targeted applications. A workshop will be run to see how chemical engineering skills can be used across different fields. Impact of artificial intelligence on the microfluidic practice will also be discussed. Laboratory activities will be employed to strengthen the concepts learned during the lectures.

The concepts presented in this course underpin active and ongoing research. The lecturer running the course is the head of the Rheological Microfluidic lab at Swansea University.

Module Content: Introduction to the course. Complex flow at the micrometre scale. Relevant dimensionless numbers. Bounded and unbounded flow. Navier-Stokes Equations. Particle migration in Newtonian and non-Newtonian liquids. [4] Particle focusing and separation in Stokes flow [2]] Forces acting on particles migrating in Inertial flow and their relation to the Navier-Stokes equations. [2] Applications of inertial microfluidic for alignment and sorting of particles and cells. [2] Design of microfluidic devices based on inertial flow [2] Conformation of polymers in solutions and concentration regimes. Viscoelasticity of polymer solutions. [2] Tuning rheological properties for targeted microfluidic applications: the case of constant-viscosity liquids, shear-thinning liquids and impact of secondary flows. [2] Design of microfluidic devices based on viscoelastic flow [2] Formation of droplets in microfluidic devices. Encapsulation of particles and cells. [2] Laboratory Activities: Viscoelastic focusing of particles in microfluidic devices. [Variable during Revision Week] *Square brackets denote the approximate number of lectures.
Intended Learning Outcomes: By the end of the module the student will be able to: 1. Critically analyze a research paper featuring microfluidic applications: identify strength, limitations and future directions 2. Design microfluidic devices for targeted applications.
Assessment: Examination 1 (100%)
Assessment Description: Exam (100%): Extended examination through the production of a report (100%) to be completed during the end of the semester examination period. Critical analysis of an existing microfluidic device reported in a published journal + design of a microfluidic device for targeted applications. The marking rubric will be provided in advance. Open book. This component will be carried out at home and students will have a pre-defined amount of time to complete and submit the report. Resit: Exam (100%): Extended examination through the production of a report (100%) to be completed during the supplementary exam period. Critical analysis of an existing microfluidic device reported in a published journal + design of a microfluidic device for targeted applications. The marking rubric will be provided in advance. Open book. This component will be carried out at home and students will have a pre-defined amount of time to complete and submit the report.
Moderation approach to main assessment: Not applicable
Assessment Feedback: Students will receive feedback during lectures, laboratory activities, workshop and office hours.
Failure Redemption: Report (100%): Critical analysis of an existing microfluidic device + design of a microfluidic device for targeted applications. Marking rubric will be provided in advance. Open book. This component will be carried out at home and students will have a pre-defined amount of time to complete and submit the report.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Available to visiting and exchange students.

A scheme of direct private study supports the comprehensive lecture notes and relevant reading material provided.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

COVID-19 restrictions: Work in laboratory may need to be replaced with different activities. Those will be planned more closely to the beginning of TB2 to work following the guidelines of the Welsh Government provided at that time.

EG-M47 Business Leadership for Engineers

Credits: 10

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr V Samaras

Format: Lectures/Workshops - 22 hours
Open door tutorials/workshops - 8 hours
Directed private study 70 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Combination of interactive lectures/workshops/case studies and self-study.

Module Aims: At the end of this course students will be able to recognise and understand key characteristics of leadership as well as a wide range of strategic business skills, ideas and theories with emphasis on innovation and "entrepreneurial thinking" which is essential for the current multidisciplinary engineering environment. The course delivery integrates practical project work and academic rigour.

Module Content: Workshop 1 – Introduction & Leadership Part 1
Workshop 2 – Leadership Part 2
Workshop 3 – Team Formation, Development and Communication
Workshop 4 - Entrepreneurial Thinking
Workshop 5 – Change Management
Workshop 6 – Strategic Management
Workshop 7 – Innovation and Business Thinking, Group Assignment Part 1
Workshop 8 – Innovation and Business Thinking, Group Assignment Part 2
Workshop 9 – Group Assignment Workshop
Workshop 10 – Group Assignment Workshop

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

- Assess and compare different synthetic routes for the manufacture of an unconventional or novel product, and choose the most suitable one based on critical and justified analyses.
- Adapt designs to meet new purposes or applications;
- Develop a detailed Process and Instrumentation Diagram (P&ID);
- Evaluate and select the adequate unit operations and items of equipment in line with national standards and codes for equipment design;
- Estimate, describe and justify process capital and operating costs;
- Select the most appropriate method to estimate of the probability and severity of hazard events, and prepare a detailed process safety and environmental assessment for a complex process;
- Operate specialised computer packages for simulating complex process systems (e.g. ASPEN, UniSim, etc.) and generate a build a Steady-state static model with UNISIM or ASPEN process simulation software to replicate the identified process route.
- Prepare an advanced technical design report and exposition of a process design to an audience; summarising, explaining, defending and discussing their findings in a logical and coherent manner.

Assessment: Other (100%)

Assessment Description: Coursework/Assignments from lectures in semester 1 (10%); Project Report (70%); Presentation (10%); Conduct of Project (10%)

Moderation approach to main assessment: Universal non-blind double marking

Assessment Feedback: Final result and general feedback forms via the internet. Constant advice and feedback throughout the course. Each student receives feedback at the end of his/her presentation.

Failure Redemption: There is no mechanism to redeem a failure in this module.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

EGCM01 MSc Research Practice

Credits: 20

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr ML Davies

Format:

Delivery Method: Delivery over 1 semester in the form of lectures, seminars and individual tutorial sessions with continuous assessment.

Module Aims: A Masters level course to deliver knowledge and skills on how to write and submit scientific papers and reports. The course requires that the students prepare multiple reports focused on specific aspects involved in preparing a draft publication of journal quality. Research data is gathered and, subject to suitable data analysis, is used to write a draft publication. In addition to this, a graphical abstract for a highly cited paper in a relevant chosen field needs to be prepared, as does a letter to an editor. For the paper writing, data is gathered from laboratory-based work and the students must analyse the data and write up the results as a suitable manuscript. They must make a reasoned choice of journal; then follow the format required by that specified journal and its instructions. They must present results appropriately and of the correct quality and then describe and discuss these. The students must also prepare a substantial literature survey (up to 5000 words) on a topic in chemical or biochemical engineering. The course is designed as such so there are multiple smaller assignments prior to the substantial literature review so students can learn and improve through the duration of the course.

Module Content: 1. The preparation of a presentation (2 lectures)
2. The preparation of a draft publication of journal quality (3 assessments):
2.1 Preparation of a graphical abstract of highly cited paper that significantly advanced the scientific field (prior to the common use of graphical abstracts).
2.2 Preparation of a letter to an editor of a journal concisely summarizing why the paper should be published, why they have chosen that journal and how it will enhance the field. (2 lectures)
2.3 The students undertake a lab based experimental (up to 10 hours). The information generated is recorded in a laboratory notebook along with the experimental procedures and methods used. This data is then used to write a manuscript formatted for a specific chosen journal. This is then assessed. (Lab time plus 5 lectures)
3. The preparation of a substantial literature survey (up to 5000 words) on a topic in chemical or biochemical engineering and a presentation of 15 minutes duration of the survey (5 lectures)
4. Tutorials (20 hours)

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

- Examine technical literature and synthesise information;
- Describe and analyse experimental data;
- Use insight and creativity to present findings, resolve ambiguity and develop conclusions;
- Write clear and concise reviews and technical papers, and communicate effectively through oral presentations and discussion.

Assessment: Other (100%)

Assessment Description: Assignment 1. Introduction and CV presentation. This is an individual piece of coursework (5% marks)
Assignment 2. Graphical abstract (10%) and letter to the editor (10%).
Assignment 3. Preparation of a manuscript from lab work. This is an individual piece of coursework. (25% total mark)
Assignment 4. Literature survey. Detailed and critical assessment of research problem or topic. This is an individual piece of coursework and the candidate will get a choice of topics. (50% marks)

Moderation approach to main assessment: Second marking as sampling or moderation

Assessment Feedback: Individual feedback on marked assignments.
Module report.

Failure Redemption: Resubmission of individually assessed coursework in the summer.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

EGCM30 MSc Dissertation - Chemical Engineering

Credits: 60

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Alexander

Format: Typically 1 hour per week i.e. 10-15 hrs total contact time. Each student is to be supervised in accordance with the University's Policy on Supervision, with a minimum of three meetings held. A careful record should be kept, agreed between supervisor and student, of all such formal meetings, including dates, action agreed and deadlines set.

Delivery Method: The module is delivered primarily as an individual research project. The student is expected to liaise with the supervisor on a regular basis, with a minimum University requirement of three formal meetings for full-time students. In the case of part-time students it is recommended that a minimum of four meetings are held. Ideally, contact should be more regular, with at least one meeting a week to discuss the development and progress of the project. Depending on the project, the student would be expected to carry out their research individually. Any necessary risk assessments and training required to work on an industrial site or within laboratory facilities of the University must be completed before undertaking such work.

Module Aims: The EGCM30 research project is the major item of directed independent learning undertaken during the master's programme and will normally be carried out on a research topic proposed by a member of staff from the College of Engineering. Study for the dissertation, which may be based on practical, industrial, simulation or literature work, or any combination of these, is carried out over a period of about 12 weeks, with the dissertation submitted at the end of September.

Module Content: The dissertation study will generally be carried out on a research topic associated with, and supervised by, a member of staff in the College of Engineering. Study for the dissertation, which may be based on practical, industrial, or literature work, or any combination of these, is carried out over a period of about 12 weeks, with the dissertation being submitted at the end of September. Preparatory work on the dissertation may take place during Part One of the programme but students will only be permitted to submit their dissertation following successful completion of Part One. The student will meet regularly with the supervisor to ensure that the project is well developed and organised. Progress will be monitored.

Intended Learning Outcomes: On completion of this module, students should have developed their ability to:-

• Investigate a research topic in detail.
• Formulate research aims.
• Devise and plan a research strategy to fulfil the aims.
• Carry out research work - undertake a literature search, a laboratory-based or computer-based investigation or a combination of these.
• Gather, organize and use evidence, data and information from a variety of primary and secondary sources.
• Critically analyse information.
• Make conclusions supported by the work and identify their relevance to the broader research area.
• Resolve or refine a research problem, with reasoned suggestions about how to improve future research efforts in the field.
• Report their work in the form of a dissertation, with the findings presented in a well organised and reasoned manner.

Assessment: Other (100%)

Assessment Description: The research project and dissertation forms Part Two of the master's degree.

Information about dissertation preparation and submission can be found at:
http://www.swansea.ac.uk/academic-services/academic-guide/postgraduate-taught-awards-regulations/standard-taught-masters/14-submission-of-directed-independent-learning/

Additionally, students should refer to:
http://www.swansea.ac.uk/academic-services/academic-guide/postgraduate-taught-awards-regulations/standard-taught-masters/

The word limit is 20,000. This is for the main text and does not include appendices (if any), essential footnotes, introductory parts and statements or the bibliography and index.

Each student is to submit an electronic copy of their dissertation through the link provided on Canvas by the deadline of 30th September. The online system will automatically check the similarity of the report.

The dissertation must contain:

- A statement that it is being submitted in partial fulfilment of the requirements for the degree.
- A summary of the dissertation not exceeding 300 words in length.
- A statement, signed by you, showing to what extent the work submitted is the result of your own investigation.
- Acknowledgement of other sources shall be made by footnotes giving explicit references. A full bibliography should be appended to the work.
- A declaration, signed by you, to certify that the work has not already been accepted in substance for any degree, and is not being concurrently submitted in candidature for any degree.
- A signed statement regarding availability of the thesis.

The dissertation is marked by the supervisor and another member of staff and sent to an External Examiner for moderation. An Internal Exam Board is then held to confirm the mark. Finally, all marks are ratified at the University Postgraduate Taught Examination Board.

Moderation approach to main assessment: Universal double-blind marking

Assessment Feedback: Ongoing feedback and project-specific discussion is available from the Supervisor throughout the duration of the project and will consider aspects including, but not limited to, assessment of project planning, project execution and approaches to drafting and reporting results. A feedback session will be given to any student who fails their dissertation and is permitted by the Award Board to resubmit their work.

Failure Redemption: Candidates who fail the dissertation are given an opportunity to resubmit the dissertation within 3 months of the result of the examination if a full-time student or 6 months for part-time students. Such students will be given one formal feedback session, including written feedback on the reasons for failure, immediately following confirmation of the result by the University Postgraduate Taught Examination Board. The opportunity to resubmit will only be offered to students who submit a dissertation and are awarded a fail. Those candidates who do not submit a dissertation will not be offered a resubmission opportunity.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The research project is a good opportunity for the student to specialise and explore a specific topic related to the master’s degree or develop an advanced insight and appreciation of closely associated research subjects. The scope of projects and achievable outcomes can be discussed with the academic staff in view of the resources available.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

If an extension is deemed appropriate a Postgraduate Taught Master’s 'Application for Extension to the Submission Deadline/ Period of Candidature' Form will need to be submitted as follows:
- 31 August – deadline for Part Two students (non-resit students)
- 8 November – deadline for Part Two Students (students who had resits)

EGCM36 Desalination

Credits: 10

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Sarp

Format: Lectures 20 hours
Design classes/tutorials 10 hours
Directed private study 70 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

On campus lectures and example classes.

Module Aims: Desalination is an important process in the management of water resources and it has a large societal, economic and environmental impact. This module will give engineering students a solid grounding in desalination and related separation processes. This will prove invaluable for a future career in many areas of engineering.

Module Content: 1. Introduction including Resources and Need for Water Desalination; Composition of Seawater; Definition and Classification of Industrial Desalination Processes.
2. Basics of desalination systems including Pre-treatment and Post-treatment Systems; Energy Recovery Devices;
3. Thermal Desalination Systems including Evaporators; Single Effect Evaporation; Multiple Effect Evaporators; Multiple Effect Distillation (MED): Forward Feed Multiple Effect Evaporation; Parallel Feed Multiple Effect Evaporation; Multi Stage Flash Distillation (MSF); Freeze Desalination Systems.
4. Reverse Osmosis: Elements of Membrane Separation; Performance Parameters; RO Membranes; Membrane Modules; Design of RO Systems; RO Feed Treatment, Biofouling and Membrane Cleaning.
5. Novel Desalination Systems including Forward Osmosis (FO), Pressure Retarded Osmosis (PRO), Solar Greenhouses; Membrane distillation etc.

Intended Learning Outcomes: After completing this module students should be able to:
• Demonstrate a systematic understanding of different desalination systems (Exam, Coursework 3)
• Apply theory critically to analyse the mechanisms of desalination technologies (Exam, Coursework 2).
• Make critical evaluation and appreciation of the different thermal and RO membrane modules used in desalination industry (Exam).
• Formulate mathematical models for mass and heat transfer in thermal desalination (Exam, Coursework 1).
• Develop flowsheeting and detailed design of either thermal/RO membrane systems (Exam).

Assessment: Examination 1 (85%)
Coursework 1 (15%)

Assessment Description: Online examination (85%)
Coursework 1 (15%)

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: Exam feedback will be given via exam results and the exam feedback forms available on the Swansea University intranet.

Failure Redemption: A supplementary examination will form 100% of the module mark.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Available to visiting and exchange students with chemical engineering background.
The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

EGCM40 Pollutant transport by groundwater flows

Credits: **10**

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr B Sandnes

Format: Lectures

Delivery Method: Lectures, lecture recordings, examples embedded in lectures.

Module Aims: This module focuses on groundwater flow in aquifers, the transport of pollutants by groundwater flows, and the chemical and biological transformation of pollutants in the subsurface.

Module Content:

- Introduction: Ground water resources.
- Characteristics of the porous medium and fluid.
- Darcy flow in saturated porous media.
- Role of advection, diffusion and dispersion in environmental flows.
- Geochemical interactions, reactive transport.
- Carbonates and carbon dioxide.
- Pollutant transport.
- Transport models.
- Multiphase flows.

Intended Learning Outcomes:

After completing this module students should be able to:

1. Demonstrate an understanding of how flows in porous media play a fundamental role in a range of environmental and engineered processes.
2. Demonstrate detailed knowledge of how the properties of the fluid and the porous media govern the flow behaviour.
3. Evaluate the transport and fate of environmental pollutants subjected to groundwater flows.
4. Assess common geochemical reactions involving solutes carried by environmental flows.
5. Independently implement models to quantify hydrological transport of pollutants.
6. Critically assess model results and how they relate to real world problems.

(1 - 6 assessed in exam and coursework)

Assessment: Coursework 1 (10%)
Examination 1 (90%)

Assessment Description: Exam, 90% of mark.
Coursework 1: Tutorial sheet, 10% of total mark. Individual piece of coursework.

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: Informal feedback will be provided during lectures and examples classes. Feedback on coursework will be given as written notes and informal feedback. Formal feedback following completion of exam will be provided in line with standard College of Engineering protocols.

Failure Redemption: Eligibility for the redemption process is subject to the degree scheme and the associated progression/completion criteria; where permitted, a supplementary examination will form 100% of the mark.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Available to visiting and exchange students.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment

As this is a masters level module, it is expected that students demonstrate independent study, and seek out and extract relevant information from a range of available sources.

EGDM01 Colloid and Interface Science

Credits: 10

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Alexander

Format:
Lectures: 20 hours
Example classes: 25 hours
Directed Private Study: 78 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity as well as some on-site options.

Module materials available at CANVAS.

Module Aims: Students will gain an in-depth understanding of the properties of colloids and their importance in industry.

Module Content: Introduction to the nature of the colloidal state
Particle size and its determination; theory and practice
Determination of zeta potential
Charge and potential distribution: the structure of the electrical double layer;
Interactions between particles: repulsive and attractive forces, DLVO theory; Van der Waals theory and Steric stabilisation
Determination of important properties for colloidal systems, e.g. Osmotic pressure, viscosity, diffusion coefficients;
Coagulation and Flocculation
Small-angle neutron and X-ray scattering
Solid-gas, liquid-gas and liquid-liquid interfaces
Surface tension and wetting
Emulsions, foams and aerosols

Intended Learning Outcomes: You should be able to demonstrate a knowledge and understanding of:

• What colloids are; their characteristics and properties;
• Techniques used to characterize colloid size and colloidal systems;
• Colloidal stability and charged particles;
• The importance and examples of colloidal science in industry;
• The relationship between properties at the nano, micro and bulk scales;

You should be able to demonstrate an ability to:

• Use scientific literature to evaluate information on colloidal systems;
• Analyse and present scientific findings and express ideas in a logical and coherent manner;
• Apply knowledge and understanding to calculate relevant parameters, e.g. different measures of size, zeta potential, molecular weight etc.

Assessment:
Examination 1 (70%)
Coursework 1 (20%)
Coursework 2 (10%)

Assessment Description: This module is assessed by examination and coursework.

Examination - Answer 3 Questions from 4 (70%).
Coursework 1- Case study: this is a teamwork assignment/presentation (20%)
Coursework 2- Individual assignment (10%)

Note: In order for continuous assessment marks to be included in your final module mark, you must achieve a mark of 40% in the final exam.

Moderation approach to main assessment: Universal second marking as check or audit

Intended Learning Outcomes:
Technical Outcomes
- An understanding of the principles of life cycle analysis and the different approaches that have been used.
- An appreciation of the application of LCA to industry.
- Familiarity of the significant legislation relevant to circular economy/ sustainability and an understanding of legislation as a key driver for sustainable business activities.
- An understanding of the circular economy and how it relates to new opportunities for industry.
- An appreciation of the complexity of legislative, social and political pressures on technological development.

Accreditation Outcomes (AHEP)
MEng:
- Understanding of the need for a high level of professional and ethical conduct in engineering, a knowledge of professional codes of conduct and how ethical dilemmas can arise (EL1m)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2m)
- Knowledge and understanding of management techniques, including project and change management that may be used to achieve engineering objectives, their limitations and how they may be applied appropriately (EL3m)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues, and an awareness that these may differ internationally (EL5m)
- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk (EL6m)
- Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction (EL7m)

MSc:
- Awareness of the need for a high level of professional and ethical conduct in engineering (EL8M)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M)
- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation (EL10M)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL11M)
- Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation (EL12M)
- Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk (EL13M)

Assessment: Assignment 1 (50%)
Assignment 2 (50%)

Assessment Description:
Assignment 1 - a 2500 word report based around information gathering, review and collation.
Assignment 2 - a numerical analysis of an LCA Case Study, coupled with a written report on interpretation of the findings.

Important information: The pass mark for a module at Level 4/M is 50%. In addition, in order to pass the module, students must achieve a minimum of 40% in both components.

If you do not meet the component level requirements for the module you will receive a QF outcome. This means that you will be required to repeat the failed component(s), even if your module mark is above 50%.

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: Each student will receive the mark and individual feedback comments on each piece of submitted coursework, via Canvas.

Failure Redemption: Submission of additional assignment worth 100%.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Available to visiting and exchange students.

The pass mark for a module at Level 4/M is 50%. In addition to this students must also achieve at least 40% in both components to pass this module.

EGTM89 Polymers: Properties and Design

Credits: 10

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof JC Arnold

Format: Lectures 22 hours
Blended Learning activity 12 hours
Directed private study 34 hours
Preparation for assessment 30 hours

Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Lectures and examples classes delivered on campus and on-line

Assessment will be by a combination of an on-line test (50%) and a design assignment (50%). A minimum mark of at least 40% is needed in both assessments in order to pass the module.

Module Aims: To instil an understanding of design methods with polymeric materials, dealing especially with viscoelastic behaviour.
• Mechanical properties and design with rubber.
• General mechanical properties of polymers; viscoelasticity, time and temperature dependence, creep, recovery and stress relaxation.
• Design using deformation data; creep curves, pseudo-elastic design methodology, time and temperature dependant modulus, limiting strain.
• Mathematical modelling of viscoelasticity; equations for creep, recovery, relaxation, Maxwell and Voigt models, 4-element model, standard linear solid model.
• Boltzmann superposition principle and its use with complex stress histories.
• Strength and fracture of polymers; energy approach, toughness, ductile / brittle transitions, yield strength, ductility factor.
• Creep failure of plastics; fracture mechanics approach, fatigue failure, effects of cycle frequency, waveform, fracture mechanics approach to fatigue.

Module Content:
• Mechanical properties and design with rubber
• General properties of polymers; viscoelasticity, time and temperature dependence, creep, recovery and stress relaxation.
• Design using deformation data; creep curves, pseudo-elastic design methodology, time and temperature dependant modulus, limiting strain.
• Mathematical modelling of viscoelasticity; equations for creep, recovery, relaxation, Maxwell and Voigt models, 4-element model, standard linear model.
• Boltzmann superposition principle and its use with complex stress histories.
• Strength and fracture of polymers; energy approach, toughness, ductile / brittle transitions, yield strength, ductility factor.
• Creep failure of plastics; fracture mechanics approach, fatigue failure, effects of cycle frequency, waveform, fracture mechanics approach to fatigue

Intended Learning Outcomes: Technical Outcomes:
After completing this module students should be able to demonstrate:
• A thorough knowledge of mechanical design considerations with polymer-based materials. (EA1)
• A knowledge of mathematical models for viscoelasticity and complex stress histories. (SM2)
• A knowledge of failure modes in polymers. (SM1 / P2b)
• The application of mathematical models to mechanical behaviour of materials. (G1 / SM2)
• How to interpret and use design data for polymer-based materials (EA1)
• The application of mathematical skills in real engineering applications. (SM2)
• The application of fundamental materials knowledge across different materials classes. (P2b)

All LO's are assessed in the end of module exam

Accreditation Outcomes (AHEP):
MEng:
- A comprehensive knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1m)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems (SM2m)
- Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes (EA1m)
- Knowledge of characteristics of particular equipment, processes, or products, with extensive knowledge and understanding of a wide range of engineering materials and components (P2m)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

MSc:
- Advanced level knowledge and understanding of a wide range of engineering materials and components (P12m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- A comprehensive understanding of the relevant scientific principles of the specialisation (SM7m)

Assessment: Online Class Test (50%)
Assignment 1 (50%)

Assessment Description: Assessment will be by a combination of an on-line test (50%) and a design assignment (50%). A minimum mark of at least 40% is needed in both assessments in order to pass the module.
On-line Canvas test to be completed by April, but with more than one opportunity to complete before then.
Individual Design Study Assignment

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback:
Standard will receive written feedback on the assignment and immediate marks on the on-line test.

Failure Redemption: If a student is eligible for a resit, they will have an opportunity to redeem either assessment component failed. Capping of marks will apply at the component level.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Available to visiting and exchange students.
Detailed course material provided on Canvas which students should engage with in their own time.

PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

EG-M91J MSc Design Project (January intake)

Credits: 20 Session: 2021/22 Academic Year

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr JO Titiloye

Format: 20 hours: lectures and computer lab sessions

36 hours: tutorials (tutorial sessions with supervisor to give guidance on further progress).

Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

20 hours: On-line lectures and computer lab sessions using ZOOM platform with limited on-site face to face delivery options if needed.

36 hours: tutorial sessions with supervisor to give guidance on further progress using ZOOM video and meetings

Module Aims: This module aims to take MSc students, who arrive with a variety of backgrounds, and carry out an advanced, in-depth design of a novel manufacturing process. The course will be composed of lectures and independent project work, and will start in Semester 1 by developing the necessary background skills for process design and process synthesis, to then focus on more specific topics that deal with the use programming tools to support decision-making. Taught topics include: mass and energy balances, ASPEN simulations, costing, life cycle analysis, market analysis etc. In parallel with the taught aspects, students will be expected to start researching into an appropriate compound for manufacture. The project itself requires the students to develop an innovative design for a plant to make a molecule for which no large scale production facility exists. The molecules to be produced need to be selected on the following characteristics: they should not be manufactured on a large capacity production facility (there may however be small scale production) and an outline of a manufacturing process including basic chemistry exists somewhere. The project will require the students to make choices and judgments on: the production capacity, time of operation, raw materials to use, production process, and benefit of the molecule to the company (i.e. economic, extending the knowledge base etc). As design is essentially a team exercise working well as a team is critical to successfully completing this project.

Module Content: Lectures:
Mass and Energy Balances (2 lectures);
Block flow Diagrams, PFD's etc. (1 lecture);
Line and Pump Sizing (2 lectures);
Cost Estimation (1 lecture);
Process Control (2 lectures);
ASPEN simulations (8 lab sessions);
Environmental Considerations – Life Cycle Analysis (2 lectures);
Process Safety: What if, HAZID, HAZOP etc. (2 lectures);

The project also involves:
A literature search of alternative and innovative technologies;
Critical selection of a synthesis route and explanation of rationale;
Preparation of process scope;
PFD and development of a detailed equipment P&ID;
Advanced design and ASPEN Simulation of the novel process;
Detailed analysis of capital and operating costs;
Detailed discussion on health, safety and environmental issues of the selected process;
A review of process operability and viability assessment.

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

- Assess and compare different synthetic routes for the manufacture of an unconventional or novel product, and choose the most suitable one based on critical and justified analyses.
- Adapt designs to meet new purposes or applications;
- Develop a detailed Process and Instrumentation Diagram (P&ID);
- Evaluate and select the adequate unit operations and items of equipment in line with national standards and codes for equipment design;
- Estimate, describe and justify process capital and operating costs;
- Select the most appropriate method to estimate of the probability and severity of hazard events, and prepare a detailed process safety and environmental assessment for a complex process;
- Operate specialised computer packages for simulating complex process systems (e.g. ASPEN, UniSim, etc.) and generate a build a Steady-state static model with UNISIM or ASPEN process simulation software to replicate the identified process route.
- Prepare an advanced technical design report and exposition of a process design to an audience; summarising, explaining, defending and discussing their findings in a logical and coherent manner.

Assessment: Project (100%)

Assessment Description: Coursework/Assignments from lectures (10%); Project Report (70%); Presentation (10%); Conduct of Project (10%)

Moderation approach to main assessment: Universal non-blind double marking

Assessment Feedback: Final result and general feedback forms via the internet. Constant advice and feedback throughout the course. Each student receives feedback at the end of his/her presentation.

Failure Redemption: There is no mechanism to redeem a failure in this module.

Additional Notes: As the University continues to respond to the developing Covid-19 pandemic module information may be subject to change to ensure students receive the best learning experience possible. We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

Module is not available to Visiting Exchange students and is only available for MSc Chemical Engineering (January entry).

Module runs from January - January.

EG-M01 Complex Fluids and Flows

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof PR Williams

Format: Typically, lectures and office surgeries (20 hours) plus independent and directed study (80 hours). 100 hours total.
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Lectures, office surgeries and on-line media co-ordinated through Canvas.

Module Aims: This module considers the rheology of complex fluids. Course content provides an introduction to rheology from basic classifications of non-Newtonian materials to how the material properties affect processing operations. Consideration is given to the influence of product rheology and the manufacturing process, quality control and how this influences performance and end-user perception.

Rheological methods for the characterisation of non-Newtonian materials are reviewed and means by which the results of such tests can be used to describe and predict advanced aspects of transport processes involving non-Newtonian fluids are considered. Materials of interest range from simple inelastic time-independent fluids to more complex viscoelastic systems. Measurement techniques considered range from simple shear viscometers to advanced rheometrical techniques for the characterisation of evolving systems (those which are changing with time due to chemical or physical transformation).

Module Content:
• Non-Newtonian fluid mechanics, including aspects of:
• Applications of industrial rheology
• Definition of shear viscosity, shear stress and shear rate.
• Rotational viscometry (non-oscillatory testing)
• Yield Stress, Bingham plastic materials and associated measurement techniques.
• Power law fluids, Bingham plastics, yield pseudoplastics, Herschel Bulkley fluids etc.
• Time-dependent behavior of fluids, thixotropy, rheopexy.
• Rheological models including Power-law, Carreau, Ellis and Casson fluid models.
• Viscoelasticity – Maxwell, Kelvin-Voigt and Burgers models. Relaxation time, Retardation time.
• Time effects in viscoelastic flows- Deborah number
• Small amplitude oscillatory flow, complex shear modulus. Oscillatory flow – Maxwell model. Gel point analysis.
• Measurement of rheological parameters using different viscometer/rheometer systems.

Intended Learning Outcomes:
The student should be able to:

Identify/describe various types of flow behaviour spanning inelastic to viscoelastic responses.

Identify and describe techniques for the measurement of material properties for a range of materials.

Manipulate flow models to evaluate the relationship between stress and rate in flow geometries for assessment of pressure drop from viscometric data or vice versa.

Interpret response to applied stress or imposed strain using mechanical analogues extended to sol-gel transition phenomena in terms of linear viscoelastic theory.

Assessment: Examination 1 (100%)

Assessment Description: An end of semester examination will form 100% of the module mark
Moderation approach to main assessment: Universal second marking as check or audit
Assessment Feedback: The examination feedback summary will be available on-line, for all other matters the lecturer will be available throughout the semester and personalised meetings may be arranged on request.
Failure Redemption: Eligibility for the redemption process is subject to the degree scheme and the associated progression/completion criteria; where permitted, a supplementary examination will be provided.
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. Supporting material will be available via Canvas. All students are required to use the iFind library service to download and retain their own e-copies of all chapters of the essential reading text, "An introduction to rheology" by H.A. Barnes, J.F. Hutton and K. Walters. These book chapters are available for your personal use through the University's Elsevier subscription.

EG-M09 Water and Wastewater Engineering

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof C Tizaoui

Format: Lectures and example classes 30 hours
Directed private study 70 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Online (and possibly on campus) lectures and example classes.
Notes and worked examples for this module are on Canvas
Assessment: Coursework1 (20%), coursework2 (20%), and coursework3 (60%).

Module Aims: This module aims to deliver a working knowledge of water and wastewater treatment processes. The module will cover various physical, chemical and biological unit operations commonly used in the treatment of water and wastewater. This module will particularly emphasise the design and operational issues related to these unit operations. Moreover, the module will cover regulatory aspects related to water quality and requirements for treatments of drinking water to be fit for human consumption and of wastewater to be disposed of safely in the aquatic environment.

Module Content: • Introduction. Water resources, quality, pollution, and requirements for treatment [3]
• Drinking water treatment. Selection of typical treatment processes. Preliminary treatment, design of typical treatment units from flotation, coagulation and flocculation, filtration. Chemical oxidation and disinfection. Water treatment works sludge [12]
• Wastewater composition, characterisation, flow rates. Aims of wastewater treatment and standards. Overview of wastewater treatment processes [3]
• Physical wastewater treatment processes, types and design: equalisation basins, screening, grit removal and settling [6]
• Secondary wastewater treatment. Design of the activated sludge process. [3]
• Natural Treatment Systems: Constructed wetlands for wastewater treatment [3]

Intended Learning Outcomes: After completing this module, students should be able to:
• Demonstrate knowledge and apply understanding of: the composition and characterisation of water and wastewater; the terminology used; the role and general principles of the main physical, chemical, and biological treatment processes;
• Analyse and propose design options for water and wastewater treatment unit operations;
• Synthesise and evaluate with reasoned arguments the stages and processes necessary to treat a given water supply or wastewater;
• Assimilate further knowledge relating to drinking water and wastewater treatment and critically appraise sources of information relating to treatment practices;

Assessment: Coursework 1 (20%)
Coursework 2 (20%)
Online Class Test (60%)

Assessment Description: Online Canvas: Coursework1 (20%), coursework2 (20%), and online assessment (60%) in January.
Resit is 100% Assessment - details of the format of assessment will be provided in advance.

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: Assessment results and general feedback forms common across College.
Assignment feedback will be given by individual written comments, one-to-one comments and assignment mark.

Failure Redemption: 100% Assessment - details of the format of assessment will be provided in advance.

Additional Notes: We will make every effort to engage with students where changes are necessary and any changes will be communicated to students, as soon as possible. Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Available to visiting and exchange students.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

EG-M11 Biochemical Engineering II

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr JJ Ojeda Ledo

Format: Lectures 20 hours
Example classes 5 hours
Private study 75 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

Assessment: 100% examination in January.

Module Aims: This module builds up from EG-203 (Biochemical Engineering I) and describes more advanced topics in the production and optimisation of biological materials and processes. Optimisation methods of bioprocesses are described, and how these are exploited in the commercial situation. Topics such as mixed cultures, allosteric enzymes, genetically modified micro-organisms, biofouling and biocorrosion, specialised biological separation processes (e.g. chromatography), biosafety, quality control, and Hazard Analysis and Critical Control Points (HACCP) are discussed in detail. The principal products of such processes are investigated to illustrate the current and future technology of these systems with an emphasis on modern biotechnology methods. The impact of the use of such techniques on quality management, safety assessment and regulatory environment are reviewed.

Module Content:

- Biocatalysts inhibition and immobilisation:
Models of more complex enzyme kinetics, Allosteric enzymes, Hill equation, Effects of pH, temperature and insoluble substrates, Diffusional limitations in immobilised systems, Electrostatic and steric effects.

- Production systems:
Deviations from ideality in cell growth and bioreactors, The logistic equation, Strategies to recover, purify and characterise products in the food and pharmaceutical industry: ultrafiltration, microfiltration, chromatography, spectroscopic tools.

- Biocatalyst Optimisation:
Molecular biology and biological information, Structure and function of nucleic acids and proteins, Protein synthesis, Mutation and genetic recombination, Genetic manipulation and genetic engineering, Screening and organism selection, Guidelines for using host-vector systems, Considerations in plasmid design.

- Mixed cultures:
Major classes of interactions in mixed cultures, Mixed cultures in nature, Mathematical models describing mixed-culture interactions, Industrial utilisation of mixed cultures.

- Biofilms, biofouling and biocorrosion:
Steps in biofilm formation, biofilms in industrial environments, Anti-fouling approaches, Monitoring, Control strategies, Surface modification.

- Safety in biotechnology:
Bio-hazards; Risk assessment; Containment; Quality management and process validation. Hazard Analysis and Critical Control Points (HACCP) in the food industry.

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

• Identify the different types of biocatalysts and evaluate their application in diverse scenarios: justify when to use different genetically engineered microorganisms; explain how biological information can be utilised, manipulated and stored; be aware of and overcome deviations from ideality and diffusional limitations.
• Assess, calculate and predict product formation and optimal conditions when using mixed cultures in batch and continuous reactors, and compare the major interactions between different populations of microorganisms.
• Describe the principles of biofilm formation and biofouling, and evaluate different routes to monitor and control them.
• Compare and assess different optimisation, advanced separation processes and quality control tools, and their applications.
• Evaluate and categorise the potential hazards when working with bioprocesses and microorganisms, and describe the precautions required to reduce the risks associated with them.
• Summarise, explain, defend and discuss scientific findings and express ideas in a logical and coherent manner.

Assessment: Examination 1 (100%)

Assessment Description: Examination in January, 100%

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: Questions from students will be answered during class, and office hours allocated for this module. Worked-examples during classes are participative, and written solutions to every problem are provided after discussion.

Failure Redemption: A supplementary examination will form 100% of the module mark.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Lecture notes are available on Canvas

EGCM38 Membrane Technology

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules: EG-100; EG-200

Co-requisite Modules: EGCM36; EGDM01

Lecturer(s): Dr P Esteban

Format: Formal Contact hours 28:
- Lectures – 20 hours
- Example Classes – 8 hours
- Directed private study 72 hours

Notional Hours 100

Contact Hours will be delivered line in lecture theatre

Delivery Method: Lectures supported by worked examples.

Assessment:
Course Work 20%
Written take home examination 80%

Module Aims: A Masters Level course to deliver a working knowledge of liquid phase membrane separation processes. This will include a detailed understanding of current membrane fabrication techniques to produce polymeric hollow fibres and flat sheet membranes and the subsequent production of tubular and spiral wound modules along with a review of current Ceramic membrane production. The design, construction and optimisation of membrane plants will be considered with specific emphasis placed on configuration. An appreciation of membrane characterisation techniques will be developed, including SEM, AFM, particle sizing, zeta potential measurement, rejection and flux experimentation. The specific operations of membrane microfiltration, ultrafiltration, nanofiltration and reverse osmosis will be investigated and mathematical descriptions will be developed. The course will conclude with a series of practical case studies detailing current applications of membrane processes and scope for future development.

Module Content:
- Introduction: introduction to membrane processes, classification of membrane processes, the filtration spectrum, the nature of synthetic membranes, fabrication processes, molecular weight cut off, module design and plant configuration.
- Microfiltration: introduction to frontal and cross flow filtration, development of knowledge and understanding of solid liquid separations and cake filtration, general membrane equations and adaptation to cake filtration, calculation of cake properties, time of filtration, bed depth and process optimisation, case studies
- Ultrafiltration: introduction to ultrafiltration processes, mass transfer and concentration polarisation effects, simple gel theory, osmotic pressure effects, effects of membrane charge, diafiltration, optimisation of separations, case studies.
- Nanofiltration: introduction to nanofiltration processes, equilibrium partitioning, pore models for neutral solute rejection, effects of membrane charge and effects on physical properties, pore size distributions, case studies
- Reverse Osmosis: what is osmosis, introduction to reverse osmosis, the solution diffusion mechanism of transport, case studies.
- Optimisation: membrane characterisation - methods and equipment.
- Process stream characterisation - methods and equipment, trial methods and data collection for design parameters, experimental requirements, process improvements, pre-treatments, case studies.

Intended Learning Outcomes: On successful completion of the module program students will be able to:

1. Choose and apply the appropriate membrane transport model for calculation of fluxes and determine the extent of separation of various membrane systems.
2. Interpret the various mechanisms of fouling and formulate proposals for prevention or removal from a membrane system.
3. Justify the selection of appropriate membrane material, module design and manufacturing process for a specific separation/purification by examination of the material to be processed.
4. Propose procedures to determine how to collect appropriate experimental data needed for the calculation of membrane design parameters.
5. Select and design a suitable membrane system or systems for a proposed separation process.

Assessment: Examination 1 (80%)
Coursework 1 (20%)

Assessment Description:
Standard format College of Engineering examination.
Coursework 1 - Case study review of a specific membrane separation system (individual work).

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: Course Work: Formal feedback will be provided on completion of the course work via Canvas. Additionally, informal feedback will be provided during lectures and examples classes. Students will receive peer review on completion of class tutorials.

Formal feedback will be provided following completion of the final exam in line with standard College of Engineering protocols.

Failure Redemption: A supplementary examination will form 100% of the module mark.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment. No prior knowledge of membranes or membrane systems is required.

EGTM79 Environmental Analysis and Legislation

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof GTM Bunting

Format: Lectures 25
Directed private study 35
Preparation of assignments 40

Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week. Students may also have the opportunity to engage with online versions of sessions delivered on-campus

On Campus

Module Aims: This module presents the principles of life cycle analysis and Circular Economy. It covers the assessment of resource conservation by optimal use of resources, including consideration of primary extraction processes, design/manufacturing/fabrication, improving product life and end of life usage. It also reviews the current and planned European legislation that is of relevance to materials and energy and considers its implementation in the UK.

Module Content:

• The concepts of lifecycle analysis and Circular Economy.
• Principle of energy and resource conservation from 'cradle to grave' and ‘cradle to cradle.’
• A review of the methodology of LCA, including inventory analysis, data sources and environmental impact assessment.
• Case studies from various sectors of engineering and waste management will be covered.
• The current environmental legislative framework, especially as it relates to energy and waste, including UN, EU and UK legislation.
• The effects of economic, social and political pressures on sustainable business activities.

Intended Learning Outcomes:
Technical Outcomes
- An understanding of the principles of life cycle analysis and the different approaches that have been used.
- An appreciation of the application of LCA to industry.
- Familiarity of the significant legislation relevant to circular economy/ sustainability and an understanding of legislation as a key driver for sustainable business activities.
- An understanding of the circular economy and how it relates to new opportunities for industry.
- An appreciation of the complexity of legislative, social and political pressures on technological development.

Accreditation Outcomes (AHEP)
MEng:
- Understanding of the need for a high level of professional and ethical conduct in engineering, a knowledge of professional codes of conduct and how ethical dilemmas can arise (EL1m)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2m)
- Knowledge and understanding of management techniques, including project and change management that may be used to achieve engineering objectives, their limitations and how they may be applied appropriately (EL3m)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues, and an awareness that these may differ internationally (EL5m)
- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk (EL6m)
- Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction (EL7m)

MSc:
- Awareness of the need for a high level of professional and ethical conduct in engineering (EL8M)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M)
- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation (EL10M)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL11M)
- Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation (EL12M)
- Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk (EL13M)

Assessment: Assignment 1 (50%)
Assignment 2 (50%)

Assessment Description:
Assignment 1 - a 2500 word report based around information gathering, review and collation.
Assignment 2 - a numerical analysis of an LCA Case Study, coupled with a written report on interpretation of the findings.

Important information: The pass mark for a module at Level 4/M is 50%. In addition, in order to pass the module, students must achieve a minimum of 40% in both components.

If you do not meet the component level requirements for the module you will receive a QF outcome. This means that you will be required to repeat the failed component(s), even if your module mark is above 50%.

Moderation approach to main assessment: Universal second marking as check or audit

Assessment Feedback: Each student will receive the mark and individual feedback comments on each piece of submitted coursework, via Canvas.

Failure Redemption: Submission of additional assignment worth 100%.

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.

Available to visiting and exchange students.

The pass mark for a module at Level 4/M is 50%. In addition to this students must also achieve at least 40% in both components to pass this module.