Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 1 (FHEQ LEVEL 4)

CHEMICAL ENGINEERING

DEGREE PROGRAMMES

SUBJECT SPECIFIC
PART TWO OF TWO
MODULE AND COURSE STRUCTURE
2023-24

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.

The 23-24 academic year begins on 25 September 2023

Full term dates can be found here

DATES OF 23-24 TERMS

25 September 2023 – 15 December 2023

8 January 2024 – 22 March 2024

15 April 2024 – 07 June 2024

SEMESTER 1

25 September 2023 – 29 January 2024

SEMESTER 2

29 January 2024 – 07 June 2024

SUMMER

10 June 2024 – 20 September 2024

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.

Welcome to the Faculty of Science and Engineering!

Whether you are a new or a returning student, we could not be happier to be on this journey with you.

At Swansea University and in the Faculty of Science and Engineering, we believe in working in partnership with students. We work hard to break down barriers and value the contribution of everyone.

Our goal is an inclusive community where everyone is respected, and everyone's contributions are valued. Always feel free to talk to academic, technical and administrative staff, administrators - I'm sure you will find many friendly helping hands ready to assist you. And make the most of living and working alongside your fellow students.

During your time with us, please learn, create, collaborate, and most of all – enjoy yourself!

Professor David Smith
Pro-Vice-Chancellor and Executive Dean
Faculty of Science and Engineering

Faculty of Science and Engineering	
Interim Pro-Vice Chancellor/Interim Executive Dean	Professor Johann Sienz
Head of Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Professor Laura Roberts
School of Engineering and Applied Sciences **Head of School: Professor Serena Margadonna**	
School Education Lead	Professor Simon Bott
Head of Chemical Engineering	Professor Enrico Andreoli
Chemical Engineering Programme Director	Dr Matt Barrow M.S.Barrow@swansea.ac.uk
Year 1 Coordinator	Dr Dan Curtis D.J.Curtis@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 8.30am-4pm.

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, plus 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 (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 contain useful information and links to other resources:

https://myuni.swansea.ac.uk/fse/

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 23-24 handbooks to ensure that you have access to the most up-to-date versions.
We do not expect you to purchase textbooks, unless it is a specified key text for the course.

THE DIFFERENCE BETWEEN COMPULSORY AND CORE MODULES

Compulsory modules must be **pursued** by a student.

Core modules must not only be **pursued**, but also **passed** before a student can proceed to the next level of study or qualify for an award. Failures in core modules must be redeemed.

Further information can be found under "Modular Terminology" on the following link - https://myuni.swansea.ac.uk/academic-life/academic-regulations/taught-guidance/essential-info-taught-students/your-programme-explained/

Year 1 (FHEQ Level 4) 2023/24
Chemical Engineering

BEng Chemical Engineering[H831,H835]
BEng Chemical Engineering with a Year Abroad[H800]
BEng Chemical Engineering with a Year in Industry[H832]
MEng Chemical Engineering[H801]
MEng Chemical Engineering with a Year Abroad[H802]

Semester 1 Modules	Semester 2 Modules
EG-100 **Chemical Process Principles** **10 Credits** **Dr DJ Curtis** **CORE**	**EG-117** **Engineering Mathematics 2 (Chem & Med)** **10 Credits** **Prof PJ Holliman** **CORE**
EG-103 **Heat Transfer** **10 Credits** **Dr RC Butterfield/Dr SJI Shearan** **CORE**	**EG-160** **Fluid Mechanics 1** **10 Credits** **Dr F Del Giudice/Dr A Celik/Dr JS Thompson** **CORE**
EG-111 **Chemical Engineering Skills** **10 Credits** **Ms S Walsh/Dr JM Courtney/Dr SJI Shearan** **CORE**	**EGA102** **Chemical Process Analysis and Design** **10 Credits** **Ms S Walsh/Dr MS Barrow** **CORE**
EG-118 **Engineering Mathematics 1 (Chem & Med)** **10 Credits** **Dr DR Daniels** **CORE**	**EGA109** **Chemistry for Engineers** **10 Credits** **Dr S Sharma/Prof E Andreoli/Prof SG Bott** **CORE**
EG-169 **Environmental Awareness for Engineers** **10 Credits** **Dr B Sandnes** **CORE**	**EGA110** **Instrumental and Analytical Chemistry** **10 Credits** **Dr A Munnangi/Prof E Andreoli/Prof S Margadonna** **CORE**
	EGA114 **Chemical Engineering Science** **10 Credits** **Dr W Zhang** **CORE**
EG-101 **Chemical Engineering Laboratory** **10 Credits** **Dr MS Barrow/Dr S Alexander/Ms S Walsh/Dr W Zhang** **CORE**	
Total 120 Credits	

Year 1 (FHEQ Level 4) 2023/24
Chemical Engineering
BEng Chemical Engineering with a Year in Industry[H832]
MEng Chemical Engineering with a Year in Industry[H890]

Semester 1 Modules	Semester 2 Modules
EG-100 **Chemical Process Principles** **10 Credits** **Dr DJ Curtis** **CORE**	**EG-117** **Engineering Mathematics 2 (Chem & Med)** **10 Credits** **Prof PJ Holliman** **CORE**
EG-103 **Heat Transfer** **10 Credits** **Dr RC Butterfield/Dr SJI Shearan** **CORE**	**EG-135** **Placement Preparation: Science and Engineering Year in Industry** **0 Credits** **Prof GTM Bunting/Dr SA Rolland/Dr V Samaras**
EG-111 **Chemical Engineering Skills** **10 Credits** **Ms S Walsh/Dr JM Courtney/Dr SJI Shearan** **CORE**	**EG-160** **Fluid Mechanics 1** **10 Credits** **Dr F Del Giudice/Dr A Celik/Dr JS Thompson** **CORE**
EG-118 **Engineering Mathematics 1 (Chem & Med)** **10 Credits** **Dr DR Daniels** **CORE**	**EGA102** **Chemical Process Analysis and Design** **10 Credits** **Ms S Walsh/Dr MS Barrow** **CORE**
EG-169 **Environmental Awareness for Engineers** **10 Credits** **Dr B Sandnes** **CORE**	**EGA109** **Chemistry for Engineers** **10 Credits** **Dr S Sharma/Prof E Andreoli/Prof SG Bott** **CORE**
	EGA110 **Instrumental and Analytical Chemistry** **10 Credits** **Dr A Munnangi/Prof E Andreoli/Prof S Margadonna** **CORE**
	EGA114 **Chemical Engineering Science** **10 Credits** **Dr W Zhang** **CORE**
EG-101 **Chemical Engineering Laboratory** **10 Credits** **Dr MS Barrow/Dr S Alexander/Ms S Walsh/Dr W Zhang** **CORE**	
Total 120 Credits	

EG-100 Chemical Process Principles

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr DJ Curtis

Format: Lectures: 20 hours
Workshops: 20 hours
Private study: 60 hours

20 x 1 hr lectures + 10 x 2 hour workshops (delivered weekly with half cohort attending each week such that each student attends 5).

Delivery Method: This module will be delivered via a blend of in-person lectures and in-person workshops/examples classes. Supplementary material will be available via the Canvas Digital Learning Platform.

Module Aims: The module provides basic intellectual tools for analysis and design of chemical (and biochemical) processes. The module will cover flows of material and energy to and from a variety of processes and production of complete mass and energy budgets and estimates of process efficiency. Some hazards related to release and exposure to flammable materials in relation to their properties (especially vapour pressure) will be covered. Only a basic level of chemical knowledge is required and the module is suitable for Process Engineering students.

Module Content:
Principles and characteristics of non-reactive batch and continuous processes and their representation using block diagrams and flowsheets.
Material balances on chemically non-reactive and reactive systems (involving the use of conservation of atoms or chemical reaction stoichiometry.
Simple energy balances on chemically non-reactive systems, involving thermal properties that may be a function of temperature.
Application of energy balances to physical and chemical processes, forms of energy, states of matter.
Acquisition and use of enthalpy data associated with heating/cooling, phase changes and chemical reaction, application of Hess's law and Van't Hoff's method.
Vapour pressure of pure compounds, mixtures and solutions. Vapour liquid equilibria (VLE) of solutions.
Application of Dalton's & Raoult's laws for estimation of bubble and dew points temperatures and equilibrium compositions.
Distillation of solutions. Analysis using temperature composition and VLE diagrams, and the concept of the ideal stage of separation.
Hazards of flammable materials in relation to their volatility

Intended Learning Outcomes: Upon completion of this module students should be able to:
• Apply basic scientific and engineering principles to prepare and solve material and energy balances
• Select appropriate physical and thermodynamic data presented in a variety of forms.
• Draw and discuss block flow diagrams to illustrate material and energy flows in a process

Assessment: Examination 1 (100%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: The written examination is of the closed book type.

Resits are examined by supplementary exam.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: A review of student performance in the examination will be available via the University feedback system.

Failure Redemption: An opportunity for students to redeem failures will be available within the rules of the University, where permitted, a supplementary examination worth 100% will be provided.

Additional Notes: This module will be delivered on campus. Lecture recordings will be provided following each lecture but not recordings will be available for the workshops as these focus on student led activities.

Lecture notes, examples, tutorial assignments (coursework) and other resources are available to students on Canvas (including the basic chemical knowledge required to complete the module).

This module is available to visiting and exchange students.

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

The module is a CORE module for the Chemical & Environmental Engineering Degree Schemes.

Resits are examined by supplementary exam.

EG-101 Chemical Engineering Laboratory

Credits: 10 Session: 2023/24 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr MS Barrow, Dr S Alexander, Ms S Walsh, Dr W Zhang

Format: Lectures - 8 hours. Laboratory work – 14 hours. Directed private study - 70+ hours. Further Contact Hours will involve technical and safety briefings, practical sessions and Office Surgeries (Office Hours).

Delivery Method: All Programmes will typically 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 during the semester.

Module Aims: This module provides practical experience of conducting bench-scale experimental studies on a variety of systems (comprised of both apparatus and contents) in order to observe, record and characterise the behaviour of these systems under specified conditions. Students are typically required to determine factors which may influence a system's overall response, for example, experimental results can be linked with theory (from lecture-based modules or equivalently from directed reading) to determine physical or thermochemical properties of materials, or, to evaluate how such properties influence the performance of the system. Wider analysis aims to link and develop skills in data acquisition and processing, error analysis, and interpretation of experimental results. As a component part of these studies, students will build experience of conducting experiments in a laboratory environment, documenting results, organisation and communication of experimental results and analysis through both tabular and graphical formats accompanied by written discussion; this being evidenced first through maintenance of their own laboratory notebooks and secondly through technical report writing exercises.

Module Content: • Basic data analysis concepts, terms and measures of error; combination (propagation) of errors, influence of dominant source of error.
• Graphs - Error bars, fitting data using least squares principle. Logarithmic plots. Interpretation of graphs and common pitfalls.
• Handling units in Numerical Calculations - why numbers and units need to be processed together, presentation of example calculations.
• Conducting and Recording of Experiments - Experimental planning and conduct. Presentation of data, Laboratory note books, Readability of text.

• Practical work: Experiments - allocated from applied physical chemistry, combustion energy, heat transfer, fluid and particle mechanics, fluid mixing, liquid/solid separation, liquid/vapour separation.

Intended Learning Outcomes: After completing this module you should be able to:

• Demonstrate how to interpret engineering/experimental data.
• Understand principles and characteristics of operation of a variety of instruments and sensors.
• Identify and distinguish systematic and random sources of error, and estimate the combined random errors.
• Establish the units of the result of a calculation.
• Effectively and efficiently collect experimental data, maintain complete records of laboratory work in a lab notebook.
• Prepare technical reports to prescribed formats, present sample calculations, tables and graphs; manage, manipulate
and present data using IT facilities.

Assessment:	Practical (10%)
	Practical (10%)
	Practical (10%)
	Practical (10%)
	Laboratory report (30%)
	Laboratory report (30%)
Resit Assessment:	Practical (40%)
	Laboratory report (30%)
	Laboratory report (30%)

Assessment Description: The method of assessment focusses on conducting experiments and completion of laboratory notebooks which is then linked to report writing.
Students will undertake 4 practical sessions and maintain records of all findings in a laboratory notebook.
Students will produce 2 technical reports, as directed by the staff, on 2 of the experiments performed.
Lab book - 40% (i.e. 4 x 10% each)
Reports - 60% (i.e. 2 x 30% each)

Students typically conduct laboratory work in pairs.

IMPORTANT: please note that individuals who do not attend scheduled laboratory activities will not receive any associated lab book mark and will be awarded 0/10 for that item. Therefore, failure to attend lab classes is a serious situation which will affect lab book marks which in turn also has potential to impact marks available for the major Report components (as the reports represent a continuation of the study which builds upon the experimental data produced in the lab).

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students have access to verbal feedback during the lab sessions so as to assist with operation and organisation of their experiments, and are also provided with written feedback on their lab notebooks. Written feedback will also be provided on the technical reports.

Failure Redemption: IMPORTANT:- An opportunity to redeem failure in EG-101 is NOT guaranteed - please review the details below.

An opportunity to redeem failure in EG-101 is provided for students who have attended at least 3 of the 4 practical sessions. Students with a final module mark of less than 40% who failed to attend at least 3 of the compulsory lab classes will not be entered for supplementary assessment in EG-101; this will mean that the student must repeat the module or repeat the year during the next academic session (provided they are eligible to do so).

IMPORTANT:- Supplementary assessment in EG-101 is only worth up to 60 module marks due to the nature of the assessments.

For those students permitted to undertake Supplementary Assessment in EG-101;

The marks accrued from the 4 laboratory sessions (total/40) will not change and will be carried forward.

The student will then be required to submit 2 new technical reports, each worth 30% of the module mark. Students should not assume that the subject of the supplementary technical reports will be the same as those set previously.

Additional Notes: This module is not available to visiting and exchange students.
Policy for late submission of work is Zero Tolerance in accordance with Faculty guidelines.
IMPORTANT: For those students who fail the module, eligibility for supplementary assessment is conditional upon having achieved a threshold attendance at laboratory sessions, please refer to the notes on Redeeming Failure in EG-101 for more information.

EG-103 Heat Transfer

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr RC Butterfield, Dr SJI Shearan

Format: Lectures 20 hrs, problem classes 10 hrs, Office Hours 10 hrs, independent study 60 hrs.

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. Primary Assessment: 40% continuous assessment delivered in periodic stages throughout the semester and an end of semester examination contributing the remaining 60%.

Module Aims: The module aims to provide a comprehensive introduction to heat transfer principles and its applications in a chemical engineering context. The encountered problems will involve the mechanisms of conduction, convection and radiation.

Module Content: • Conduction: Fourier's law, one-dimensional conduction, composite materials, insulation, material properties
• Convection: Free and forced convection, introduction to dimensional analysis, convective heat transfer coefficient derivation, flow in and outside tubes and planes, overall heat transfer coefficient, internal and external flow over banks of tubes, phase change effects.
• Radiation: Mechanism, Stefan-Boltzmann law, emissivity, radiation into a large enclosure, heat transfer coefficient.
• Heat Exchangers: Counter and co-current flow, log mean temperature difference, types of heat exchanger and applications.
• Insulation: economic and critical thickness for heat loss.
• Liquids and vapours: Enthalpy, the steam table, boiling and condensation of liquids

Intended Learning Outcomes: Intended Learning Outcomes: Upon completion of this module, students should be able to:
• Explain the fundamental concepts and mechanisms of heat transfer and identify them for a broad variety of representative problems, from everyday practical situations to mechanical and process engineering.
• Analyze and solve conductive and convective heat transfer problems including composite planar surfaces, thin and thick-walled pipes, etc.
• Identify heat transfer coefficients by using experimentally-derived correlations.
• Design and analyze thermal performances of basic process equipment including heat exchangers and tanks.
• Analyze and solve problems involving radiative heat transfer from source to surroundings.
• Analyze, deconstruct and solve heat transfer problems involving combined heat transfer mechanisms.

Assessment: Coursework 1 (40%)
Examination 1 (60%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: 40% continuous assessment delivered in periodic stages throughout the semester according to course progression.
60% examination.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Students will complete coursework assessments that have immediate feedback via Canvas.

A feedback form for the examination will be available electronically.

Failure Redemption: Supplementary examination 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.
Penalty for late submission of work: ZERO TOLERANCE.

EG-111 Chemical Engineering Skills

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Ms S Walsh, Dr JM Courtney, Dr SJI Shearan

Format: 44 contact hours of synchronous activity will utilise work in the computer laboratory consisting of lectures and practical sessions. Directed private study is 80 hours

Delivery Method: Delivery will be employed utilising 4 weekly formal contact hours on campus. Students will have the opportunity to engage with online versions of weekly course concepts and examples via Canvas.

Module Aims: In this module you will be introduced to computer aided drawing packages in which you will produce drawings of engineering items to British Standards. You will also develop necessary ICT skills in Word and Excel to enable you to convey information in the form of technical reports, with an emphasis on the presentation and layout of these reports to convey the required information. You will also develop skills in engineering problem solving using Excel applied to a range of practical engineering problems. There is an emphasis on ethical design by engineers throughout. You will also develop skills to improve your employability by working towards the first part of the Swansea Employability Award, and have an understanding of academic integrity and its importance as a professional engineer.

Module Content:

• Computer aided drawing Skills: Have an appreciation of available CAD software packages. Be able to interpret engineering drawings. Be able to use appropriate software to communicate representations of engineering processes and process items.
• Effective use of Word for report writing: This includes report structure, layout and formatting of Figures & Tables, and effective referencing & citation of published work. Have an understanding of how to develop report templates using Word.
• Effective use of Excel: How to present data, perform iterative calculations with goal seek and solver.
• Roles and responsibilities of professional engineers. Have an appreciation of engineering ethics and the role this has for the professional engineer.
• Awareness of Academic Integrity and the relevant University rules and regulations.

Intended Learning Outcomes:

1) Utilise ICT skills to apply numerical techniques to solve engineering problems.
2) Communicate engineering data and detailing using visual means.
3) Communicate engineering concepts, facts and data by written report and/or oral presentation.
4) Utilize ICT skills to access online resources and apply appropriate academic judgement & integrity on the appropriate use of the material obtained.
5) Evaluate the ethical implications of engineering design and practice through case studies.
6) To be able to consider their own professional development and the requirements of a Curriculum Vitae (CV). To develop your self-awareness through reflecting on your values, mindset and what you have to offer.

Assessment:	Assignment 1 (15%) Assignment 2 (10%) Assignment 3 (5%) Assignment 4 (20%) Assignment 5 (20%) Report (30%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description:
Assignment 1: CAD Drawing Assignment (15%)
Assignment 2: Professional Development Course Units* (10%)
Assignment 3: Understanding Academic Misconduct (5%)
Assignment 4: Engineering Ethics Assignment (20%)
Assignment 5: Excel Assignment - (20%)
Technical Report: (30%) Produce a report on a directed topic which utilizes and showcases the skills developed within the module.

*Re: Assignment 2: Professional Development Course Units.
There are 5 units for students to complete and these will be open for the majority of the semester for students to study and attempt inside and outside of classes.
To complete a unit a student must gain 8/10 in the unit test, and they get 5 attempts to sit each unit test. A student can gain 2% for each unit they pass.
When they complete a test canvas will let the students know how many marks out of 10 they have gained. If they have not gained 8/10 they will need to take the test again.

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students will be given continuous feedback, guidance, instruction and support during practical sessions.

Failure Redemption: Failure redemption in the form of a report worth 100%

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

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

The PC classes are there to support the learning outcomes associated with the module. Attendance at these PC classes will be monitored.

EG-117 Engineering Mathematics 2 (Chem & Med)

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof PJ Holliman

Format: Lectures 20 hours
Tutoring classes 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: This module will consist of lectures and examples classes, which concentrate on understanding the concepts of mathematical theory and the application in solving engineering problems. Besides, self-directed e-learning and e-assessment system MyMathLab developed by Pearson, which concentrate on practising the calculation techniques, will be available through the Canvas Digital Learning Platform.

Module Aims: Module Aims: This module (in combination with Engineering Mathematics 1) provides further grounding in mathematical analysis techniques for Engineering students. The module extends the understanding into more complex analytical methods, focusing on complex numbers, multi-variable functions, series and sequences and differential equations.

Module Content:

• Vectors: physical meaning, Cartesian, cylindrical and spherical coordinates scalar and cross products. Equations of lines and planes. Scalar and vector fields.

• Complex numbers: manipulation with complex numbers, Cartesian, polar and exponential forms. Functions of complex variable, Euler's formula, relationship between trigonometric and hyperbolic functions. Solving ODEs with the help of complex numbers.

• Ordinary differential equations: classification of differential equations, solutions to first order ODE's including separable, linear and more specialised types. Solution to second order ODE's with constant coefficients, homogeneous and inhomogeneous. Laplace transform methods.

• Functions of more than one variable: visualisation, partial differentiation, vector calculus differential operators (in Cartesian coordinates). Contour, surface and volume integrals.

• Sequences and series, infinite series, tests of convergence. Taylor series of common functions.

Intended Learning Outcomes: Technical Outcomes
On successful completion of this unit students will be expected, at threshold level, to be able to:
- Demonstrate knowledge of the mathematics, which underpin their engineering degree.
- Demonstrate a comprehension of the mathematics, which underpin their engineering degree, through the use of the following specific techniques: work with complex numbers, manipulate vectors (in Cartesian, cylindrical and spherical coordinates), perform partial differentiation, integrate lines, surfaces and volumes, solve first and second order differential equations and expand real functions into series.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)

Assessment:	Coursework 1 (20%) Coursework 2 (20%) Coursework 3 (20%) Coursework 4 (20%) Examination 1 (20%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: 4 electronic online tests with randomised questions will be set during the semester, in total worth 80% of the final mark. There will be an opportunity to practice similar exercises before attempting each test. Each test is an individual piece of coursework.

Examination:
An online 2 hour examination will take place in May/June (worth 20% of the final mark).

Specific rules for passing this module
In order to pass the module students must achieve a minimum of 40% in the examination component, and a minimum of 40% overall for the module. If students do not meet the exam and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 40%.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: A feedback form for the examination will be available electronically.

Feedback will be provided electronically for each of the assessed tests.

Failure Redemption: A supplementary on-site invigilated MyLabMath test 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.

AVAILABLE TO visiting and exchange students.

This module operates with a zero tolerance penalty policy for late submission of all coursework and continuous assessment.

EG-118 Engineering Mathematics 1 (Chem & Med)

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr DR Daniels

Format: Lectures 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: This module will consist of lectures and examples classes, which concentrate on understanding the concepts of mathematical theory and the application in solving engineering problems. Besides, self-directed e-learning and e-assessment system MyMathLab developed by Pearson, which concentrate on practising the calculation techniques, will be available through the Canvas Digital Learning Platform.

Module Aims: This module (in combination with Engineering Mathematics 2) provides the essential grounding in mathematical analysis techniques for engineering students. This module ensures that all students have a suitable level of analytical skills for subsequent engineering modules.

Module Content:

* Linear Algebra: simultaneous equations, Gauss elimination, matrices, rules of matrix algebra, rank and linear dependence, calculation of determinates and eigenvalue problems.
* Number systems: numbers, algebra and geometry.
* Functions: inverse and composite functions, polynomial functions, rational functions, circular functions, exponential, logarithmic and hyperbolic functions, continuous and discontinuous functions, plotting functions.
* Differentiation: basic ideas and definition, elementary functions, rules of differentiation, parametric and implicit differentiation, higher derivatives, optimum values.
* Integration: basic ideas and definition, definite and indefinite integrals, techniques of integration, integrals of partial fractions, integration by parts, integration by substitution.

Intended Learning Outcomes: On successful completion of this module students will be expected, at threshold level, to be able to:

Technical Outcomes
- Demonstrate knowledge of the fundamentals of mathematics, which underpin their engineering degree.
- Demonstrate a comprehension of the fundamentals of mathematics, which underpin their engineering degree, through the use of the following specific techniques: manipulate algebraic expressions, differentiation (including optmisation of functionals), integration, matrices and Gauss elimination.

Accreditation Outcomes (AHEP3)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)

Assessment: Coursework 1 (10%)
Coursework 2 (10%)
Coursework 3 (10%)
Coursework 4 (10%)
Examination 1 (60%)

Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Coursework:
4 electronic online tests with randomised questions will be set during the semester, in total worth 40% of the final mark. There will be an opportunity to practice similar exercises before attempting each test. Each test is an individual piece of coursework.

Examination:
A closed book 2 hour examination will take place in January (worth 60% of the final mark).

Specific rules for passing this module:
This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 40% in the examination component, and a minimum of 40% overall for the module. If students do not meet the exam and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 40%.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: A feedback form for the examination will be available electronically.

Feedback will be provided electronically for each of the assessed tests.

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.

AVAILABLE TO visiting and exchange students.

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

EG-135 Placement Preparation: Science and Engineering Year in Industry

Credits: 0 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof GTM Bunting, Dr SA Rolland, Dr V Samaras

Format: 11 hours consisting of a mix of seminars and workshops and drop-in advice sessions. 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

This module is delivered through directed and self-directed learning, careers resources, interactive workshops, reflective learning practice and drop-in advice sessions. The module is delivered on the Bay Campus.

Module Aims: This generic cross-disciplinary module is for all students who have enrolled (or transferred) onto the Faculty of Science and Engineering Year in Industry scheme. The module focuses on the underpinning and fundamental requisites required to gain, enter and progress effectively through an industrial placement. Learners will be introduced to a) sourcing placements, CV writing and application techniques; (b) interview techniques - how to pitch yourself and be successful; (c) workplace fundamentals and IP awareness, behaviours and expectations; and (d) key employability skills; getting the most from your Industrial Placement.

Module Content: The module will focus on the key requirements to gain and be successful whilst on a placement. Directed and self-directed activity will address the following topics;

1) Industrial Placements - what they are, how to search and how to apply.
2) CV writing, cover letters and application processes.
3) Assessment centres, interview techniques and mock interviews.
4) Recognising and developing employability skills.
5) Reflecting and maximising the placement experience

Intended Learning Outcomes: By the end of this module, students should be able to:

1) Demonstrate the essential skills needed to apply for and secure placement opportunities.
2) Perform effectively in an interview process and apply the tools and attributes that make a good interview.
3) Discuss and share what is expected within the workplace including behavioural and professional conduct.
4) Identify personal employability skills and how these will be used in a workplace setting.
5) Express a reflective view of the placement demonstrating the ability to maximise the placement experience in future career decisions

Assessment: Participation Exercise (100%)

Assessment Description: Not assessed

Moderation approach to main assessment: Not applicable

Assessment Feedback: Not assessed

Failure Redemption: Not assessed

Additional Notes: Module to support students on the Year in Industry programmes.

EG-160 Fluid Mechanics 1

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-113; EG-114; EG-118

Lecturer(s): Dr F Del Giudice, Dr A Celik, Dr JS Thompson

Format: Lectures: 30 Hours (3 hours per week) Office Hour: 33 hours (3 hours per week) Directed Private Study: 100 hours

Delivery Method: Students will be expected to study some materials at home in preparation for the lecture. The preparation material will be part of a coursework component and will need to be completed using a technology adaptive learning platform fully integrated with Canvas. During the weekly contact hours of lectures, first some concepts to strengthen the theoretical understanding of the topic will be introduced, followed by several exam-like examples. Common difficulties experienced by the cohort when studying the preparation material will also be addressed.

Module Aims: Fluid mechanics is ubiquitous in our daily life, as well as within a wide breath of engineering disciplines. For instance, fluid mechanics plays a crucial role in understanding and optimising the flow of air around aircraft, in the design and optimization of vehicles, in the design and analysis of chemical reactors, mixing vessels, heat exchangers, and other process equipment, and it also underpins several key processes taking place in our body (e.g. blood flow).

This modules provides an introduction to Fluid Mechanics, with special focusing on hydrostatics, hydrodynamics and pipe flow. Hydrostatics is essential to identify points of high pressure in a system and to also identify forces acting on submerged surfaces either planar or curved. Hydrodynamics, instead, focuses on the motion of fluids and the requirement to identify pressure drops, losses, flow rate values, and forces generated by moving fluids. Pipe flow is a special case of hydrodynamics, where the fluid is forced to flow in a closed geometry that can have different types of cross-section.

Module Content: Introduction to the module. Classification of fluid flows. System and control volume. Importance of dimensions and units. Density and specific gravity. Viscosity. [3]
Pressure at a point. Variation of pressure with Depth. Stevin’s and Pascal Law. Hydraulic Jack. Multi-flow manometers. [3]
Forces on Planar Surfaces. Forces on submerged planar objects. Forces acting on gates and moment equation. [3]
Forces on Curved Surfaces. Cylindrical gates. Circular gates attached to springs. [3]
Class Test on hydrostatics.[2]
Conservation of Mass and Energy. Mass and volume flow rate. Mass balance for steady-flow processes. Incompressible flows. The Bernoulli equation. General Energy equation. [3]
Laminar and Turbulent flow in pipes. The Moody Chart. Iterative procedure for the resolution of fluid mechanics problems. Flow in channel having a different cross-section. [3]
Minor Losses in Pipe Flows. [3]
Piping Network and and Pump selection [3]
Momentum analysis of flow systems. Newton's law. Choosing a contro volume. Forces acting on a control volume. The linear Momentum equation. [5]

Intended Learning Outcomes: Technical Outcomes
By the end of the module, the student should be able to:
- Critically apply fluid mechanics laws and equations to solve engineering problems.

Accreditation Outcomes (AHEP)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline (SM3b)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4b)

Assessment:	Coursework 1 (1.8%) Examination (60%) Class Test 1 - Coursework (25%) Coursework 2 (1.8%) Coursework 3 (1.8%) Coursework 4 (1.8%) Coursework 5 (1.8%) Coursework 6 (1.8%) Coursework 7 (1.8%) Coursework 8 (1.8%)

Assessment Description: Coursework (15%): this coursework component is a sum of 8 weekly individual components. It will be completed using a technology-adaptive platform fully integrated into Canvas. Students will be expected to complete a theory section in preparation for each week's lecture.

Class Test (25%): this is a 1-hour closed book class-test to be completed in a university computer room in invigilated conditions. The test will focus on Fluid Statics. The class test will take place in Week 5 of the teaching block. For those with granted Extenuating Circumstances, the class test will be sat in week 11 of the teaching block. If a second extenuating circumstances in approved, the class test will be disregarded from the mark, and the module mark will instead be calculated as 0.15 x CW1 + 0.85 x Examination.

Examination 1 (60%): This is a 2-hour closed book exam. Students will be expected to solve two new fluid mechanics problems about fluid dynamics. For those of you with granted deferrals, the exam paper will be the same as the one for the cohort re-sitting the module, meaning that students will have to solve two problems featuring all the topics in the module, including hydrostatics.

Coursework will be awarded regardless of the examination mark. You will pass the module if the sum of all the contributions is greater than 40%. This means that the coursework is important to pass the exam. You can pass the exam and still fail the module if you do not complete the coursework, meaning that the coursework is very important.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Students will receive instant feedback on their coursework components and on their class test.

Failure Redemption: Resit: Examination 100%
This is a 2-hours closed book exam. Students will be expected to solve two new fluid mechanics problems featuring all the topics presented in the module, meaning hydrostatics and hydrodynamics.

Please bear in mind that the coursework mark will not be applicable for the resit.

Additional Notes: Available to visiting and exchange students.

The Faculty of Science and Engineering has a zero-tolerance policy for late submissions.

The module will be taught in parallel to different departments by different lecturers. The module syllabus, the assignment, the delivery and the exam components will be the same across the cohorts.

Students are invited to attend the lectures, as these will feature interactive solutions of new problems. During this period, students will have the opportunity to interact with the lecturer directly and to solve problems together with their peers. Students that cannot attend the lecture, are invited to visit the office hour and to interact more with the lecturers during the scheduled times..

EG-169 Environmental Awareness for Engineers

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr B Sandnes

Format: Onsite lectures and office hours provided.

Delivery Method: - Onsite lectures
- Recorded content on Canvas
- Written material on Canvas

Module Aims: The module focuses on the environmental impacts of human activity, industry, and energy consumption. With the global population soaring past 8 billion in an increasingly industrialised world, human activity is now affecting energy and material balances on a global scale. The next generation of engineers must appreciate the environmental impacts of current technology in order to engineer better solutions for the future.

Module Content: The biophysical environment.
A brief history of Earth. Earth as a system.
Energy: Consumption and resources.
Fossil fuels, conventional and unconventional hydrocarbon resources.
Renewable energy technologies.
Sustainable development, Life Cycle Analysis, Environmental Impact Assessment.
Pollution: Land, water, air.
Climate Change.

Intended Learning Outcomes:
After completing the module students should be able to:

- Identify the major environmental issues facing society, and the role of engineers in protecting the environment.
- Describe the role of fossil and renewable energy resources in society and, determine both power output capacity and potential environmental impact of different energy technologies.
- Determine pollution concentration and transport using mass balance principles.
- Assess the drivers for climate change, feedback mechanisms in the climate system, and potential future impacts of global warming.
- Demonstrate knowledge of key sustainability concepts such as Sustainable Development, Life Cycle Assessment and Environmental Impact Analysis.

Assessment: Examination 1 (100%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Examination (2-hours): 100% of total mark

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: In accordance with university regulations.

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

Additional Notes: Available to visiting and exchange students.
The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

EGA102 Chemical Process Analysis and Design

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-100

Lecturer(s): Ms S Walsh, Dr MS Barrow

Format: Typically, support classes/team tutorials, lectures and office surgeries (30 hours)
Directed private study (70 hours), 100 hours total.
Contact Hours will be delivered through on-campus activities and may include, for example, lectures, practical (PC) sessions.

Delivery Method: All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed activity, with on-campus classes each week.

Students are required to work outside of formally timetabled sessions and record progress via a series of meeting minutes.

Module Aims: Students are required to tackle a variety of engineering problems and to work within a team to deliver results. This module tests a variety of fundamental engineering skills, highlights the importance of basic project management skills and serves to provide experience of working in partnership with others. Projects are student-led with support and feedback available from the staff during project classes. The module considers the formulation of both material and energy balances for operations which involve either recycle or by-pass systems, and is aligned with key concepts introduced in EG100 (Chemical Process Principles). The module also considers vapour-liquid equilibria with application to the basic design of unit operations. These concepts are then used to assist the design a manufacturing process and students are encouraged to further assess the safety impact of their chosen design. The team design project leads to the production of a design report which is the major assessed component within the module.

> Students will be required to complete a review which provides assessment of the team and individual team member performances.

Module Content:
Key content includes,
1) Material balances on reactive steady processes with recycles, bypasses and purges.
2) Simple analysis of fractionating columns.
3) The philosophy of process design and an introduction to the components and standards of process flow sheets
4) Use of software packages for solving engineering problems and simple technical drawing.

Intended Learning Outcomes: • Analyse multi-component, multi-layered design problems.
• Evaluate and construct viable solution pathways.
• Formulate and solve material balances incorporating recycles using spreadsheets.
• Formulate and solve energy balances over unit operations using spreadsheet methods.

Assessment: Presentation (30%)
Group Work - Project (50%)
Assignment 1 (20%)

Resit Assessment: Coursework reassessment instrument (75%)
Presentation (25%)

Assessment Description: Assignment 1 - Material and Energy Balances with flowsheet exercise
Group Project - Design project, multiple components
Presentation - Team exercise

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Feedback, guidance, instruction and support is provided by staff throughout the semester during classes. Written comments on presentations and reports will also be provided.

Failure Redemption: Where a student has failed the module, a redemption mechanism is provided in EGA102, this will involve supplementary coursework i.e. an individual design exercise (70 marks) and a presentation exercise (30 marks).
Additional Notes: Not available to visiting students. There is a ZERO TOLERANCE penalty policy for late submission of coursework. Guidance, instruction and supporting materials will be co-ordinated through Canvas.

EGA109 Chemistry for Engineers

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Sharma, Prof E Andreoli, Prof SG Bott

Format: Lectures 30 hours
Practical classes / Example classes/ Lab based: 12 hours
Directed private study 72 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 & practical classes. Assessed by a combination of end-of-module examination (75%) and continuously assessed practicals (25%)

Module Aims: The module introduces the basic principles of chemistry to Engineers. It covers a wide range of topics ranging from reactions in organic and inorganic compounds to the physicochemical properties of compounds. We will also explore the principles of thermodynamics and chemical kinetics in chemical reactions.

Module Content:

Introduction, Units, States of matter, physicochemical properties of compounds (melting points, boiling points, density, solubility)
Stoichiometry (balancing of chemical reactions, Redox equations, balancing of redox equations), Calculus of concentrations (e.g. molarity, molar fraction, %wt/wt, %vol/wt…)
Intermolecular forces, Inter-atomic and intermolecular interactions and relationship to melting and boiling points of phases, colligative properties and mixtures.
Basic Chemical Thermodynamics: Energy, Enthalpy, Entropy, Gibbs energy.
Chemical Equilibria Gas Phase (ideal) Liquid phase Equilibria Constants
Introduction to Kinetics, difference between rate constant and equilibria constant and relationship between the two
Empirical rate expressions, Orders of reaction.
Using rate expressions for solving order and k
Rate constant and temperature: Arrhenius & Critical temp for decomposition with explosion
Studying Rate: Isolation techniques, fractional lifetime. Introduction to Catalysts and Rate.
Basic Chemical Reactors (just descriptive no mathematics)
Industrial case studies. Reactive chemistry (exothermic reactions)
Briefing for Labs, Safety etc.
Practical Session – Rate experiment for Lab. Liquid-liquid extraction
Basic Organic Chemistry (Aliphatic and Aromatic compounds)

Intended Learning Outcomes: After completing this module you should be able to:

• Knowledge-based Learning Outcomes:
1. Predict, describe and draw the three-dimensional structure of inorganic and organic compounds
2. Predict the reactivity and stability of organic molecules based on the structure
3. Use the kinetic theory of matter to describe phases and relate to physical properties of different substances
4. Explain the origin of intermolecular forces and relate to the physical properties of different substances
5. Distinguish between thermodynamic and kinetic factors in chemical reactions
6. Predict the direction of a reaction
7. Explain factors that contribute to the spontaneity of reactions and relate them quantitatively
8. Describe qualitatively and quantitatively aspects of aqueous equilibria
9. Explain concepts of chemical kinetics and interpret chemical reactions from kinetic data.
10. Demonstrate an understanding of the mechanisms and predict products of addition reactions
11. Demonstrate an understanding of fundamental thermodynamic concepts of systems, work and heat flow
12. Apply mathematical knowledge to derive solutions and solve problems in thermodynamics
13. Demonstrate an understanding of the mechanisms of substitution and elimination reactions, and predict their products
14. Provide simple quantitative descriptions of redox reactions, and predict their products

Skill-based Learning Outcomes:
1. Knowledge of how to carry out laboratory manipulations in an accurate and safe manner.
2. Work effectively and safely in a laboratory environment. Effectively perform group organised practical tasks, record and report experimental results.

Assessment:	Examination 1 (75%) Practical (15%) Practical (10%)

Assessment Description: Lectures & practical classes. Assessed by a combination of end-of-module examination (75%) and continuously assessed practical (25%).

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Individual and group feedback on laboratory work provided during laboratory sessions. Individual marked laboratory reports returned to students. Feedback on module coursework given in lectures and by Canvas.
Generic feedback on exams provided via exam feedback procedures.

Failure Redemption: Supplementary exam in August worth 75% of the marks; 25% for practical and coursework marks will be added (unchanged) to the supplementary exam mark.

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.
Penalty for late submission of work: ZERO TOLERANCE.

EGA110 Instrumental and Analytical Chemistry

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr A Munnangi, Prof E Andreoli, Prof S Margadonna

Format: 1 hour of synchronous session per week
(either on line, face-to-face, or streaming).
2 hours worth of asynchronous teaching
2 sessions of laboratory experience
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

The course will be delivered as a mixture of synchronous (on line or face to face) and asynchronous sessions. It will include
lectures, example classes, 2 laboratory sessions, on-line laboratory preparation.

Assessment:
Examination 70%, 2 practical reports for a total weighting of 30%

Module Aims: This module deals with the principles and practice of analytical chemistry and gives an introduction to a number of important instrumental techniques in analytical chemistry for both qualitative and quantitative analysis including: gravimetric, titrimetric separation and spectroscopic techniques.

Module Content:

• Introduction to chemical analysis and analytical methods. General approach; sources and types of errors in analytical chemistry; reporting results, error estimates and significant figures.
• Gravimetric analysis: principles, methods and applications.
• Titrimetric analysis: principles, methods, and applications.
• Principles of spectroscopy. Regions of the electromagnetic spectrum and their interactions with atomic and molecular species. Absorption, emission and scattering, Beer-Lambert law. Deviations from Beer Lamber law.
• UV-Vis spectroscopy: principles and applications.
• Separation techniques: basic principles and applications.
• Atomic absorption and emission spectroscopy: principles and applications.

Intended Learning Outcomes: Technical Outcomes
On successful completion of this module students should:
- have knowledge of a range of analytical techniques from classical gravimetric and volumetric analysis through to modern spectroscopic and separation methods
- understand the principles of analytical chemistry including estimation of errors in measurements.
- have acquired practical experience of analytical chemistry.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Communicate their work to technical and non-technical audiences (D6)
- Ability to apply relevant practical and laboratory skills (P3)

Assessment: Examination 1 (70%)
Laboratory work (15%)
Laboratory work (15%)

Assessment Description:
Examination: unseen exam, typically requiring answers to three out of four equal weight questions.

Laboratory work: Two laboratory sessions involving
1) the analysis of a solution of zinc, requiring analytical results and a written report
2) the analysis of Fe and organic compounds contained in spinach using UV-Vis and chromatography techniques
Practical results and understanding to be assessed in the form of written reports.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Individual and group feedback on laboratory work provided during laboratory sessions.
Individual marked laboratory reports returned to students.
Generic feedback on exams provided via College exam feedback procedures.

Failure Redemption: The practical component of this module is NOT REDEEMABLE.
However the exam component IS REDEEMABLE via a supplementary examination.
The resit mark will be therefore be made up as follows:
30% Laboratory mark (previously obtained)
70% Resit exam.

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.

This module operates with a zero tolerance penalty policy for late submission of all coursework and continuous assessment.

EGA114 Chemical Engineering Science

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr W Zhang

Format: Lectures 20 Hours including example classes
Private study 70 hours
Contact Hours will be delivered through a blend of on-campus activities, 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 activity, with live and self-directed on-campus activities each week.

Two hours of taught lectures including examples classes per week

Module Aims: This module will introduce fundamental principles of thermodynamics, physical chemistry and mass transfer relevant to the course including: gas behaviour; properties of pure substances and mixtures; laws of thermodynamics and their applications to energy and state calculations; phase equilibria; diffusive and convective mass transfer; and mass transfer coefficients.

Module Content:

• Units and dimensions:
Convert between different unit systems i.e. SI, imperial, US units;
Dimensional Analysis (check validity of equations for dimensional consistency, derivation of expressions from first principles);
• Thermodynamics:
Ideal Gas behaviour; Revision of Boyle's law, Charles' law, Avogadro's law, Dalton's law, Amagat's Law, Ideal Gas Law; Properties of pure substances and solutions; Equations of state; Energy and the first law of thermodynamics; Heat engines and the Carnot cycle;
• Thermochemistry:
Standard states, Hess' law of summation, heat's of formation, combustion and solution, relate H and U for chemical change, H and U as a function of temperature;
• Mass transfer:
Molecular diffusion in fluids (diffusion coefficients, Fick's law); Eddy or turbulent diffusion; Mass-transfer coefficients.

Intended Learning Outcomes: Technical Outcomes
After completing this module students should be able to:

Demonstrate knowledge and understanding of:
• The Ideal Gas Law and Equations of State
• The First Law of thermodynamics;
• The concepts of state and non-state functions; enthalpy (H), internal energy (U), work (W) and heat (Q);
• Heat effects;
• The physical mechanisms of mass transfer;

Demonstrate an ability to:
• Use conversion factors and convert between different units and unit systems, imperial, SI and USA units;
• Conduct dimensional analysis of equations;
• State and apply equations for ideal gases undergoing isochoric, isobaric, isothermal and adiabatic processes;
• Understand, describe and perform calculations around simple heat cycles, e.g. Carnot cycle;
• Calculate heats of formation, reaction and combustion.
• Define key terms and describe the process of combustion;
• Perform heat and mass balances for combustion processes.
• Apply Fick's law to calculate mass fluxes;
• Estimate diffusion coefficients in fluids and calculate mass transfer coefficients;

Assessment:	Examination 1 (80%) Class Test 1 - Coursework (10%) Class Test 2 - Coursework (10%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Two online Canvas Quiz assessments (worth 10% each) will be conducted in the students' own time.
The examination will be 80% of total mark.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback:
Canvas Quiz assessments give feedback on completion of the tests.
Model answers will be available for students to examine and compare with their own attempts.
General feedback on student performance in the exam is given via the University feedback system.

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 on-campus.

Available to visiting and exchange students.
This module operates with a zero tolerance penalty policy for late submission of all coursework and continuous assessment.