



**Swansea University
Prifysgol Abertawe**

**FACULTY OF SCIENCE AND
ENGINEERING**

**UNDERGRADUATE STUDENT
HANDBOOK**

YEAR 2 (FHEQ LEVEL 5)

**BIOMEDICAL 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 Biomedical Engineering | Professor Huw Summers |
| Biomedical Engineering Programme Director | Dr Sanjiv Sharma Sanjiv.Sharma@Swansea.ac.uk |
| Year 2 Coordinator | Dr Rob Daniels D.R.Daniels@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 2 (FHEQ Level 5) 2023/24**Biomedical Engineering****MEng Biomedical Engineering[HB1V]**

| Semester 1 Modules | Semester 2 Modules |
|---|---|
| EG-219 Statistical Methods in Engineering 10 Credits Miss CM Barnes/Prof L Li/Prof P Rees/Dr Y Xuan CORE | EG-215 Process Modelling 10 Credits Dr R Van Loon CORE |
| EG-232 Multivariable Calculus for Medical Engineers 10 Credits Dr H Arora CORE | EG-235 Dynamics 1 (Med & Civil) 10 Credits Dr H Madinei CORE |
| EG-236 Design for Medical Engineering 10 Credits Dr PJ Dorrington/Dr F Zhao CORE | EG-238 Experimental Studies for Medical Engineers 10 Credits Miss CM Barnes/Dr DR Daniels/Dr R Van Loon/Dr EMP Williams CORE |
| EGA219 Cell Biology and cell mechanics for engineers 10 Credits Miss CM Barnes CORE | EG-247 Digital Signal Processing 10 Credits Dr CP Jobling CORE |
| EGA226 Physiological systems 10 Credits Prof HD Summers CORE | EG-256 Fluid Mechanics 1 10 Credits Dr F Del Giudice/Dr A Celik/Dr JS Thompson CORE |
| PM-230 Selected Medical Diagnostic Techniques 10 Credits Prof KM Hawkins/Prof OJ Guy/Mr MJ Lawrence CORE | EG-262 Stress Analysis 1 10 Credits Dr L Prakash CORE |
| EG-277 Research Project Preparation 0 Credits Dr AC Tappenden/Dr M Fazeli/Mrs KM Thomas | |
| Total 120 Credits | |

Year 2 (FHEQ Level 5) 2023/24
Biomedical Engineering
MEng Biomedical Engineering with a Year in Industry[HB1W]

| Semester 1 Modules | Semester 2 Modules |
|---|---|
| EG-219 Statistical Methods in Engineering 10 Credits Miss CM Barnes/Prof L Li/Prof P Rees/Dr Y Xuan CORE | EG-215 Process Modelling 10 Credits Dr R Van Loon CORE |
| EG-232 Multivariable Calculus for Medical Engineers 10 Credits Dr H Arora CORE | EG-235 Dynamics 1 (Med & Civil) 10 Credits Dr H Madinei CORE |
| EG-236 Design for Medical Engineering 10 Credits Dr PJ Dorrington/Dr F Zhao CORE | EG-238 Experimental Studies for Medical Engineers 10 Credits Miss CM Barnes/Dr DR Daniels/Dr R Van Loon/Dr EMP Williams CORE |
| EGA219 Cell Biology and cell mechanics for engineers 10 Credits Miss CM Barnes CORE | EG-247 Digital Signal Processing 10 Credits Dr CP Jobling CORE |
| EGA226 Physiological systems 10 Credits Prof HD Summers CORE | EG-256 Fluid Mechanics 1 10 Credits Dr F Del Giudice/Dr A Celik/Dr JS Thompson CORE |
| PM-230 Selected Medical Diagnostic Techniques 10 Credits Prof KM Hawkins/Prof OJ Guy/Mr MJ Lawrence CORE | EG-262 Stress Analysis 1 10 Credits Dr L Prakash CORE |
| EG-233 Placement Preparation: Engineering Industrial Year 0 Credits Prof GTM Bunting/Dr SA Rolland/Dr V Samaras | |
| EG-277 Research Project Preparation 0 Credits Dr AC Tappenden/Dr M Fazeli/Mrs KM Thomas | |
| Total 120 Credits | |

EG-215 Process Modelling

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr R Van Loon

Format: Lectures:20 hours
Revision: 2 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

Theory and Examples: 2 hour classes taught over a 10 week period.

Revision: A 2 hour session during week 11.

Module Aims: The module aims to develop the ability to construct mathematical models of processes so as to be able to predict their performance and optimise their design. Models of simple processes will lead to ordinary (or partial) differential equations, with special reference to biochemical and biomedical engineering processes, as well as environmental and general engineering systems..

Module Content:

Module content: [lecture hours]

- Introduction to process modelling: purpose of modelling, making assumptions, deriving ordinary differential equations (ODEs) from conservation laws, dependent, independent variables and parameters, steady versus unsteady problems. Mathematical similarity between various physically different processes [8]
- Analytical solution of ODEs models: revision and extension with emphasis on recognition of order, degree and linearity as determinant of method of solution, homogeneous versus non-homogeneous equations, linear and non-linear first order equations, second order equations with x or y missing, linear n-th order equations with constant coefficients. [4]
- Numerical Solution of ODE models: When numerical methods are needed, Euler (explicit and implicit) methods, numerical stability and accuracy, truncation error by Taylor expansion, accumulated truncation and round-off error as functions of step size, Runge-Kutta methods. [4]
- Solving non-linear models: Second order equations, fixed-point iterations, Newton Raphson, Systems of equations (derivation and application). [4]

Some examples through which these topics can be taught are: mixing in a continuous stirred tank (CST), heating/cooling in a continuous stirred tank (CST), fluidisation/sedimentation, draining/filling a tank, drug delivery, oxygen exchange in the lung, cell growth in a bioreactor, and coffee making.

Intended Learning Outcomes: Technical Outcomes

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

- Demonstrate a knowledge and understanding of how ordinary and partial differential equations can be defined from conservation laws and how they can be used to describe simple biomedical and biochemical engineering processes with a view to understanding the process, predicting its performance and optimising its design. The processes will mostly involve fluid dynamics, mixing/reaction and heat transfer problems typically found in bioprocesses and everyday life processes, and one learning outcome will be a reinforced and deeper understanding of these fundamental areas, already introduced in other modules - evaluated in Assessment and Exam (SM3b, SM5m, EA1b)
- Solve (non)-homogeneous and/or (non)-linear ODEs using various analytical and numerical approaches - evaluated in Exam (SM2b)
- Interpret the results by sketching a graph of the solution, by manipulation of the final equation(s) and by relating these equations to the physics in the process. Finally, use the equations to predict/control the physical process. Analyse physical processes - evaluated in Exam (SM5m, EA1b, EA2)

Accreditation Outcomes (AHEP)

- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
- 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)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline (SM3b)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)

Assessment: Examination 1 (80%)

Assignment 1 (20%)

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

Assessment Description: A group assignment will be set in week 4 or 5. The emphasis of this assignment will lie on conservation laws and the formulation of ODEs from them for given processes.

The examination will consist of a number of questions, all of which need to be solved. The examination will be closed book.

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

Assessment Feedback: The students will receive their marked work back and the answers to the assignment will be discussed in class. Typical mistakes will be highlighted to prevent repetition in the final exam.

Feedback on the final examination is via the University feedback form.

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.

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

Notes, worked examples and past papers for this module can be found on Canvas.

Students must have completed Year 1 maths modules in order to take this module.

EG-219 Statistical Methods in Engineering

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Miss CM Barnes, Prof L Li, Prof P Rees, Dr Y Xuan

Format: Lectures: 18 hours
Computer-based example classes: 16 hours
Directed private study 40 hours
Preparation for assessment 35 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

Series of lectures and computer practicals (face-to-face and online options available).

Module Aims: This module offers a balanced, streamlined one-semester introduction to Engineering Statistics that emphasizes the statistical tools most needed by practicing engineers. Using real engineering problems students see how statistics fits within the methods of engineering problem solving and learn how to apply statistical methodologies to their field of study. The module teaches students how to think like an engineer when analysing real data.

Mini projects, tailored to each engineering discipline, are intended to simulate problems that students will encounter professionally during their future careers. Emphasis is placed on the use of statistical software for tackling engineering problems that require the use of statistics.

Module Content:

Unit 1: Data Displays

- Lecture 1: Robust Data Displays. Engineering Method and Statistical Thinking (Variability); The Median; The Inter Quartile Range; Stem-and-Leaf displays; Boxplots.
- Lecture 2: Traditional Data Displays. The Mean; The Standard Deviation; Histograms; Chebyshev's Rule.

Unit 2: Modelling Random Behaviour

- Lecture 3: Probability. Rules of Probability; Independence; Total Probability; Bayes Rule; Reliability.
- Lecture 4: Discrete Random Variables. The Binomial Distribution; The Poisson Distribution; The Hyper geometric Distribution; Modelling Failure.
- Lecture 5: Continuous Random Variables. The Normal Distribution, The Exponential and Weibull Distributions; MLE; Sampling Distributions & The Central Limit Theorem.

Unit 3: Estimation and Testing

- Lecture 6: Non - Parametric Hypothesis Testing. The Null and Alternative Hypothesis; Significance Levels, The Sign Test; The Tukey Test.
- Lecture 7: Parametric Hypothesis Testing. Inference for a Single Mean; Inference for Two Independent Samples; Inference of Variances.

Unit 4: Model Building and Regression Analysis

- Lecture 8-9: Correlation & Simple Regression Analysis. The Correlation Coefficient, Simple Linear Regression, Non Linear Regression through Data transformations.
- Lecture 10-12: Multiple Regression and Diagnostics. Multiple Linear Regression, R², Statistical Significance of Model Parameters; Residual Analysis.

Practical classes will complement each of the above lectures, where directed study will be provided to highlight how the techniques learnt in each lecture can be applied to typical engineering problems for each discipline.

Intended Learning Outcomes:

Technical Outcomes

Upon completion of this module the student should be able to:

- Appreciate the use and applicability of statistical analysis in engineering.
- Use statistical software to compute and visualise statistical functions.
- Build probabilistic models.
- Apply common statistic methodologies to their field of study.
- Apply statistical thinking and structured problem solving capabilities.
- Think about, understand and deal with variability.

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 mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b/SM2p)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline (SM3b/SM3p)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3p)
- Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems (EA6m)

| | |
|---|------------------------------------|
| Assessment: | Project (50%) Examination (50%) |
| Assessment Description: Discipline Specific Mini Project (contributes 50% to module grade). Students will work on a mini project, related to their field of discipline, to perform statistical analysis and interpretation of a real-world data set using Matlab. The students will present their findings by submitting a written report. | |
| Exam - (closed book and face-to-face, contributes 50% to module grade). Students will tackle a series of statistical questions covering all topics. | |
| Students need to achieve at least 40% in both components in order to pass the module. | |
| If you do not meet the component level requirements for the module (i.e. achieving 40% in both components) 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 40%. | |
| Moderation approach to main assessment: Moderation by sampling of the cohort | |
| Assessment Feedback: Students will receive their grades, together with model answers, within 3 weeks of submission. | |
| Failure Redemption: Students will be required to redeem the component that they fail during the August supplementary period. Failure of both the project and examination will result in resitting both components. | |
| Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. | |
| PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION | |
| Attendance at computer classes is compulsory. | |
| The module is only for students within the Faculty of Science and Engineering. | |
| The module is unavailable to visiting/exchange students. | |
| Notes, worked examples, assignments and mini projects can be found on Canvas. | |
| Students need to achieve at least 40% in both components. | |

EG-232 Multivariable Calculus for Medical Engineers

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-117; EG-118

Co-requisite Modules:

Lecturer(s): Dr H Arora

Format: Lecture 1 hour/week
Tutorial 1 hour/week
Weekly Office Hour

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

1 hour of lectures or worked examples plus 1 hour of tutorial sessions each week. A set of tutorial questions will be provided each week to reinforce the weekly content. Students are expected to complete these tutorials each week to ensure steady progress, as content will be cumulative and interlinked in places.

Lectures to introduce theory and implementation of new content. The module requires significant independent learning outside of class. During tutorials both individual and collaborative study is encouraged to cement understanding of a topic. The occasional "abstract" appearance of a mathematical approach lends itself well to discussion. To form real understanding, therefore, discussion/debate of problems/proofs is encouraged with your peers and tutors.

Module Aims: Module aims to build upon Engineering Analysis 1 and Engineering Analysis 2 to provide tools required for practical execution of mathematical operations. Application areas from image analysis to the characterisation flow fields, amongst others, will be studied in the context of this mathematical module. From transform functions to gradient operators, these mathematical tools will be studied in their fundamentals before being applied to biomedical application areas. This mathematics module aims to: provide further fundamental analysis tools for engineering applications; and provide a bridge towards advanced analytical modules in Year 2 and 3.

Module Content: This module will cover the following content (in varying levels of depth):

Topics:

- Fourier series
- Fourier transforms
- Partial differential equations
- Vectors (div grad curl)

Topics will be studied in the context of real application areas including some of the following:

- Thermodynamics (heat diffusion)
- Solid mechanics (stress tensors)
- Fluid mechanics (Navier Stokes)
- Imaging and image analysis (vector fields)

A detailed syllabus will be uploaded to Canvas before the class starts.

Intended Learning Outcomes: Technical Outcomes

Upon completion of this module students should be able to:

- Demonstrate a knowledge and understanding of advanced mathematical methods such as vector fields, Fourier transforms and partial differential equations, necessary to underpin the medical engineering discipline and to enable them to apply a range of mathematical tools and notations proficiently and critically in the analysis and solution of engineering problems - evaluated in Exam (SM1b/m).
- Demonstrate a comprehensive knowledge and understanding of mathematical models relevant to the engineering discipline, and an appreciation of their limitations - evaluated in Exam (SM5m).
- Identify, classify and describe the performance of physical processes found in biomedical engineering through the use of analytical methods and modelling techniques - evaluated in Exam (EA2).

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/m)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4b)

Assessment: Examination (100%)

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

Assessment Description: Format and schedule of module:

Week 1 Introduction and course overview

Week 2 Lecture content and problem sheets to complete

Week 3 etc.

January Open Book Examination (worth 100%)

Mini tests will be provided periodically throughout TB1 to help prepare students for the final exam style/difficulty and to help students gauge their progress within the course. Feedback will be provided in lectures, highlighting common problem areas and challenges.

Final exam to be formed of multiple questions reflecting the style and content of the tutorials ranging from prescribed to more open-ended problems. All questions are compulsory.

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

Assessment Feedback: Lectures will provide feedback on observed progress and reinforce teaching of topics where needed.

Tutorial sessions may also be used for general feedback and guidance.

After informal assessments there will be a review of performance of the cohort. Feedback will be provided in class.

Failure Redemption: In the event of failure of the final examination, a 100% supplementary exam will be provided in line with standard University resit protocols/processes.

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

Announcements relating to the module will appear on or via Canvas (<https://canvas.swansea.ac.uk/>). Canvas contains course information, background content and core module material, which will be updated on a regular basis.

EG-233 Placement Preparation: Engineering Industrial Year

Credits: 0 Session: 2023/24 September-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. 11 one hour drop-in advice sessions. Review of CV and cover letter. 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 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; (d) key employability skills; getting the most from your Industrial Placement; and (e) health and safety in the workplace.

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) Engineering 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.
- 6) One to one meeting with careers and employability staff.
- 7) Health and safety in the workplace.

Intended Learning Outcomes:

Technical Outcomes

By the end of this module, students will:

- Know how to find and apply for placements, create a CV and complete a placement application.
- Understand the interview process and gain interview experience.
- Discuss and share what is expected within the workplace including behavioural and professional conduct.
- Identify personal employability skills and how these will be used in a workplace setting.

Accreditation Outcomes (AHEP)

EL5b Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues

EL6b Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk,

Assessment: Placements (100%)

Assessment Description:

Students are required to attend the health and safety lecture. Students who do not attend and have no valid reason will not be permitted to continue on an Engineering Industrial Placement Year programme of study.

Moderation approach to main assessment: Not applicable

Assessment Feedback:

N/A: students will however be able to discuss and seek feedback/advice on their search for an industrial placement, during the drop-in sessions.

Failure Redemption:

Successful completion of this module depends upon attendance at, and engagement with, the health and safety lecture. Therefore there will normally be no opportunity to redeem failure. However, special provision will be made for students with extenuating or special circumstances.

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

This module is only available for students enrolled on the Engineering Year in Industry scheme.

EG-235 Dynamics 1 (Med & Civil)

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr H Madinei

Format: Lectures & Example Classes 2 hours per week. Directed private study 3 hours per week
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

Classroom based teaching, CANVAS notes.

Module Aims: Elements of vibrating systems; simple harmonic motion; use of complex exponential representation. One-degree-of-freedom systems; natural frequency; effect of damping; harmonic excitation; transient dynamics; frequency domain analysis; impulse response function. Undamped multi-degree-of-freedom systems; eigenvalues and eigenvectors.

Module Content:

- Introduction to vibration and free response: Elements of vibrating systems, basic concepts, natural frequency, and simple harmonic motion.
- Free vibration of One-Degree-of-Freedom Systems: Application of Newton's second law to translating and rotating systems for the determination of differential equations of motion. Finding the natural frequency and considering the effect of damping in vibrating systems.
- Forced vibration of One-Degree-of-Freedom Systems: Considering different types of harmonic excitation.
- Transient response of One-Degree-of-Freedom Systems: Impulse response function and impact response.
- Free vibration of Multi-Degree-of-Freedom Systems: Natural frequency and mode shapes of a Two-Degree-of-Freedom Systems will be investigated.

Intended Learning Outcomes:

- A knowledge and understanding of the importance of natural frequencies and resonance. The analysis of single and two degree of freedom systems.

- An ability to estimate resonances of simple systems.
- An ability to apply the methods presented in the course to develop simple models of real structures. Analyse these models to calculate natural frequencies and evaluate the response to harmonic forces.
- Study independently and use library resources.

SM1b 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

SM2b 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

SM3b Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline

EA1b Understanding of engineering principles and the ability to apply them to analyse key engineering processes

EA2 Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques

EA3b Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action

EA4 Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems

P1 Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.)

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

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

Assessment Description: 20% from an online class test administered via CANVAS, and 80% from an in-person examination in May-June.

This module is assessed by a combination of examination and class test. 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%.

If you pass the exam but have failed the class test, you may still fail the module, depending on the marks achieved, so it is important to complete the class test.

Resits are in the format of a supplementary exam.

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

Assessment Feedback: Generic feedback on the online class test will be provided, following the test. The feedback for the final examination will be through the College module feedback procedure.

Failure Redemption: An opportunity to redeem failures will be available within the rules of the University. A supplementary exam 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.

PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

Available to visiting and exchange students.

Additional notes:

- Office hours will be posted on CANVAS.
- Submission of the assignments will be via CANVAS ONLY. Email submissions will NOT be accepted.
- All notes and other teaching materials will be delivered via CANVAS ONLY.

EG-236 Design for Medical Engineering

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr PJ Dorrington, Dr F Zhao

Format: Lectures: x12 (up to 1 hour); Virtual Reality design workshops: 4 hours; PCLabs: 16 hours; directed private study (including additional learning of Virtual Reality (VR) and CAD in your own time, group work, and report writing): 68 hours.

Delivery Method: Any student awarded a supplementary exam in this subject will be provided with an assessment based on Component 2, which will be capped at 40%.

Component 1 (Dr Feihu Zhao)

Lectures and PC Labs will be used to deliver reverse-engineering, CAD and engineering drawing training.

Component 2 (Dr Peter Dorrington)

PC Labs and workshops will be used to deliver Component 2.

Lectures (face-to-face, asynchronous or synchronous) will introduce the design process, the design brief, the importance of the design specification, and how a user-focused design process puts the design requirements into context. Where additional asynchronous lectures are provided (i.e. recorded online) students will be expected to view this content as requested to supplement other learning approaches.

There will be several facilitated workshops to guide students in understanding concept development tools which will then be used for exploring creative engineering solutions individually and as a group. These may take the form of Virtual Reality tools and/or collaborative idea generation sessions as per the discretion of the lecturer, and project progress being made by the class. This will teach the students practical problem-solving techniques to further understand the end-users, and develop and refine their early concepts. These are planned onsite activities.

Additional PC Labs will then follow to support the design project in Component 2, once students have learnt the fundamentals of Solidworks (CAD) and how to utilise resources such as Granta Edupack for material selection.

There will be online office hours to support individual/group student queries, one hour with each lecturer for each week. These will be online and students will be able to share their screens with the lecturer for focused support on their designs and project work.

Onsite PCL abs will have Teaching Assistants (TAs) and lecturers in the room.

NOTE:- students must use part of their self-directed learning time to improve their CAD skills, Virtual Reality (VR) skills and make use of the CAD and VR cafes which are additional to the module and provide drop-in support to improve skills. Students should not leave it to the last minute to learn these fundamental skills which are required to produce a project of sufficient quality.

Module Aims: This module has two main components:

Component 1 (Engineering drawing and CAD):

The first is the development of their engineering drawing skills using a CAD software package to the required British Standard.

Component 2 (Design project):

The second component involves the students working together in groups to address a 'real-world' medical device design brief. Students will be introduced to the medical design development process, which they will follow in order to develop their product concepts. There will be an emphasis on the importance of identifying end user needs (i.e. functional requirements), and how these inform the design process. The importance of having a robust product design specification is emphasised, along with an introduction to innovative design tools and approaches. The selected concept design will be developed virtually in CAD. Each group participant will be responsible for a component or element of the device, which will then be part of the overall product assembly which will be outlined in the group element of the report.

Module Content: Compulsory a) Engineering drawing skills using a CAD software package to the required British Standard. Drawings: a reverse-engineering and dimensioning exercise, medical component/product assembly.

b) group and individual medical engineering design project and report.

Intended Learning Outcomes:

Technical Outcomes

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

- Possess practical engineering skills acquired through, for example, work carried out in laboratories and workshops; in industry through supervised work experience; in individual and group project work; in design work; and in the development and use of computer software in design, analysis and control. Evidence of group working and of participation in a major project is expected. However, individual professional bodies may require particular approaches to this requirement (Evaluated in Coursework 1, Individual Coursework and Group Work Coursework and Class Test 1, PS1)
- Demonstrate a knowledge and understanding of: effective written and oral communications and standard IT tools.
- Produce engineering drawings to the required standard using a CAD system.
- Be aware of business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics (Evaluated in Individual Coursework and Group Work Coursework, D1).
- Apply problem-solving skills, technical knowledge and understanding to create or adapt design solutions that are fit for purpose including operation, maintenance, reliability etc. Work with information that may be incomplete or uncertain and be aware that this may affect the design (Evaluated in Individual Coursework and Group Work Coursework, and Oral Examination, D3, D4).
- Define the problem identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards (Evaluated in Individual Coursework and Group Work Coursework, D2).

Accreditation Outcomes (AHEP)

- Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics (D1)
- Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards (D2)
- Work with information that may be incomplete or uncertain and quantify the effect of this on the design (D3)
- Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal (D4)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (P1)
- Understanding of, and the ability to work in, different roles within an engineering team (P11)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)

Assessment: Assignment 1 (20%)
Assignment 2 (5%)
Assignment 3 (35%)
Assignment 4 (40%)

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Assignment 1, CAD assignment - 20%

Assignment 2, Concept development assignment - 5%

Assignment 3, Coursework (group section) - 35%

Assignment 4, Coursework (individual section) - 40%

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

Assessment Feedback: Students will receive continuous feedback during PC labs, during Q&A lectures, during office hours, and during workshops, along with written feedback on their assessments, within 3 weeks of submission.

Failure Redemption: Supplementary coursework will form 100% of the resit mark; the mark will be capped at a maximum of 40%.

Additional Notes: PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

This module will be delivered face-to-face and on-site. Office hours will in the main be online.

This project involves groupwork, which will be carried out using suitable online collaboration tools; these will be recommended to you.

Deadlines will be set during standard teaching, learning and assessment times, and as such it is **STRONGLY RECOMMENDED** that each individual has reviewed the final group PDF submission before it is made to Canvas. This way all group members see the final version of their work before submission.

There will be zero tolerance for any individual who blames others in their group for not submitting their work correctly if it is part of a group submission.

Available to visiting-exchange students.

EG-238 Experimental Studies for Medical Engineers

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Miss CM Barnes, Dr DR Daniels, Dr R Van Loon, Dr EMP Williams

Format: Lectures 5 hours in total, throughout the module.
Practical classes 4 hours per week
Directed private study 4 hours per week
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, practical and directed independent study.

Module Aims: The course introduces the students to experimental studies in a wide range of subjects.

Each experiment is self contained and the student will present the findings in written form through a lab report which will have a set of experiment specific questions to answer.

This written report also forms the basis for the assessment.

All students work in groups and carry out five experiments which vary according to discipline, however the assignments are all individually submitted.

The students keep a log-book of the experimental observations and results, which is used for reference for the technical report from each experiment written-up in the week after the experiment.

Module Content: Revision of lab report writing, and statistical data/error analysis [3].

Measurement techniques for physical parameters: position, velocity, acceleration, temperature, pressure, strain, flow.

Laboratory classes are:

- Mechanical & Materials (compression forces, pressure tests on biomedical materials).
- Aerospace (stress, jet engine, vibration, flight simulator and aeroplane based flight lab, wind tunnel).
- Medical (pulsatile flow loop, vibration, respiratory physiology, motion analysis, ultrasound).

Intended Learning Outcomes: Technical Outcomes

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

- Demonstrate a knowledge and understanding of: a range of experimental techniques (Evaluated in: All assessments, SM3).
- Understand and follow experimental procedures across a range of biomedical engineering applications (Evaluated in: All assessments, P3, SM3).
- Post-process and analyse quantitative experimental data to identify, classify and describe the performance of various systems (Evaluated in: All assessments, EA2).
- Maintain accurate informal notes and report the technical findings in professional written form (Evaluated in: All assessments, D6).

Assessment: Coursework 1 (20%)
Coursework 2 (20%)
Coursework 3 (20%)
Coursework 4 (20%)
Coursework 5 (20%)

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: 1. Experimental reports for each experiment (C1 to C5) are handed a week after the experiment each worth 20%

2. All assignments are submitted electronically on Canvas using templates

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

Assessment Feedback: Lab reports are returned with feedback via Canvas within three weeks from submission.

Failure Redemption: A supplementary piece of coursework will be set which will form 100% of the mark. Written work may be resubmitted in the supplementary period but it is not possible to repeat experiments.

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

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

A grade of ZERO will be awarded for failure to attend the experimental lab.

All assignments are submitted electronically and the University rules on Plagiarism apply.

Additional notes:

Final mark is based on:

5 Technical Reports for each of 5 experiments

EG-247 Digital Signal Processing

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-116; EG-150

Co-requisite Modules:

Lecturer(s): Dr CP Jobling

Format: On-demand lecture materials to be reviewed before and after class: 10 hours
On-campus examples classes: 20 hours
On-campus laboratory and project work: 20 hours
Directed private study 50 hours

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.

Timings are based on completely on-campus delivery. EG-247 can easily be delivered on-line should circumstances prevent on-campus delivery.

Lab and project work can be done using on-campus PCs, virtual machines, or MATLAB online. A flipped blended learning approach to class contact will be used.

The key concepts and readings will be introduced, and understanding tested before each class, leaving time to practice the mathematical techniques causing the most difficulties during the on-campus examples classes.

This will be reinforced by making worked solutions available after class. The OneNote Class Notebook will be used as a classroom delivery, shared whiteboard, and portfolio.

Canvas will be used for class discussion, assignment distribution, and submission.

Assessment: on-campus invigilated examination 60%; Lab Portfolio: 30%; Project 10%.

MATLAB and Simulink will be used for the Lab Work and graded using MATLAB Grader.

The project submission will be made via the submission tool provided by Canvas.

Module Aims: To develop further methods of representing and analyzing signals and dynamic systems, to extend these concepts to sampled-data systems, to introduce concepts in digital signal processing and to use computer-aided methods for modelling and analysis.

Module Content: • Review of the Laplace transform and its applications to Circuit Analysis.

- Fourier series and the Fourier Transform.
- Ideal and Butterworth filters.
- Fundamentals of Sampled data signals, digital systems, z-transforms.
- Discrete Fourier Transform (DFT) and the Fast Fourier Transform (FFT).
- Implementations of digital Infinite Impulse Response (IIR) and Finite Impulse Response (FIR) filters.

Intended Learning Outcomes: Technical Outcomes

Upon completion of the module, students should be able to:

- Demonstrate knowledge and understanding of the mathematical methods and their application to signals and systems; including complex numbers; elementary signals; Fourier series and spectral analysis; the Laplace, Fourier, Z- and Discrete Fourier Transforms and their applications to electronic and electrical systems. Assessed by the Examination and the Lab Portfolio (SM2p).
- Identify, classify, and describe the performance of analogue and digital signals and signal processing systems by the application of analytic methods and modelling techniques. Assessed by the Examination and the Lab Portfolio. (EA3p)
- Apply computational methods in order to solve engineering problems involving for time-domain and frequency-domain analysis of continuous and discrete-time systems, modelling and mathematical analysis in MATLAB and systems simulation in Simulink. Assessed by the Lab Portfolio (EA2p).
- Understanding and applying a systems approach to digital signal processing including signal sampling systems for analogue signals such as speech and filter design. Assessed by the Design Project (EA4p).

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 mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2p)

Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2p)

Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3p)

Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4p)

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| Assessment: | Examination (60%) |
| | Project (10%) |
| | Laboratory 1 (5%) |
| | Laboratory work (5%) |
| | Laboratory work (5%) |
| | Laboratory work (5%) |
| | Laboratory work (5%) |
| | Laboratory work (5%) |

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

Assessment Description: Student mastery of the material will be assessed using an online on-campus invigilated examination of 2 hours duration. 60%

Portfolio - A portfolio of evidence of completing a number of MATLAB Exercises graded by MATLAB Grader will be presented. These exercises will be graded weekly starting from teaching week 3.

A filter design project will be completed by each student and is worth 10%.

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% 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: Test feedback will be delivered through Canvas.

Coursework and project feedback will be returned via the assignment and peer assessment facilities provided by MATLAB Grader and Canvas.

Failure Redemption: If a student is awarded a re-sit - Failure Redemption of this module will be by Examination only (100%). Level 2 re-sits (Supplementary exams) are capped at 40%

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

- The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
- Class notes, homework problems, worked examples and past papers for this module are distributed through a OneNote Class Notebook linked to Canvas. You are advised to install OneNote prior to the start of class.

EG-256 Fluid Mechanics 1

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

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 module 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]
Buoyancy. Measuring specific gravity using a hydrometer. [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 control volume. Forces acting on a control volume. The linear Momentum equation. [3]

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)

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| Assessment: | <p>Examination (60%)</p> <p>Coursework 1 (1.8%)</p> <p>Class Test 1 - Coursework (25%)</p> <p>Coursework 2 (1.8%)</p> <p>Coursework 3 (1.8%)</p> <p>Coursework 4 (1.8%)</p> <p>Coursework 5 (1.8%)</p> <p>Coursework 6 (1.8%)</p> <p>Coursework 7 (1.8%)</p> <p>Coursework 8 (1.8%)</p> |
| <p>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.</p> <p>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 $0.15 \times CW1 + 0.85 \times Examination$.</p> <p>Examination 1 (60%): This is a 3-hour open 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.</p> <p>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.</p> | |
| <p>Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit</p> | |
| <p>Assessment Feedback: Students will receive instant feedback on their coursework components and on their class test.</p> | |
| <p>Failure Redemption: Resit: Examination 100%</p> <p>This is a 3-hour open 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.</p> <p>Please bear in mind that the coursework mark will not be applicable for the resit.</p> | |
| <p>Additional Notes: Available to visiting and exchange students.</p> <p>The Faculty of Science and Engineering has a zero-tolerance policy for late submissions.</p> <p>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 cohort.</p> <p>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.</p> | |

EG-262 Stress Analysis 1

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules: EG-120

Co-requisite Modules:

Lecturer(s): Dr L Prakash

Format: Lectures: 20 hours Example classes: 10 hours Directed private study and revision: 70 hours

Directed private study and revision: 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 is based on lectures and example classes and additional supporting on-line content.

Module Aims: This module continues on from EG-120 and includes: section properties; unsymmetrical bending; stresses in thick cylinders; rotating discs; theories of failure; stress concentration effects; fatigue and linear elastic fracture mechanics.

Module Content:

- Stress and strain: Stress equilibrium, strain compatibility, stress-strain relationships.
- Section Properties: Second moment of area; product moment of area; principal axes; unsymmetrical bending.
- Thin cylinder formulae.
- Thick Cylinders: Derivation of Lamé equations; built-up cylinders and shrink/interference fits.
- Rotating Discs: Derivation of basic equations; effect of 'fit' and external loads.
- Failure Theories: Failure mechanisms; ductile and brittle failure; Tresca theory, von Mises theory; other relevant theories.
- Stress Concentration Effects: Causes and effects; examples of stress concentration factors and design data; effect of surface finish, residual stresses etc.; design to minimise stress concentration effects.
- Fatigue: Nature of fatigue; low and high cycle fatigue; presentation of fatigue data; fatigue strength; notch sensitivity; variable loading and cumulative damage; design for infinite life and acceptable finite life.
- Linear Elastic Fracture Mechanics: Modes of failure; stress function approach; fracture toughness; LEFM applied to fatigue; environmental effects.

Intended Learning Outcomes:

Technical Outcomes

Upon successful completion of this module, students will be expected, at threshold level, to be able to: Understand and apply relevant engineering principles to analyse key engineering processes including (EA1b) (evaluated in examination):

- The significance and theory of unsymmetrical bending
- Thin and thick cylinders and rotating disc theory
- Theories of ductile and brittle material failure
- Stress concentration features and their effects on design
- Fatigue and fracture theories

Identify, classify and describe the performance of components through the use of analytical methods (EA2) (evaluated in examination) including an ability to:

- Identify the sources and types of stress and stress concentration in components and structures under various loading regimes and choose suitable methods of analysis based on the loading and boundary conditions.
- Apply the equations of unsymmetrical bending, thin and thick cylinders and rotating discs to practical problems.
- Design simple components and structures to avoid failure by yielding, fatigue and/or fracture, including the effects of stress concentration features.

Accreditation Outcomes (AHEP)

- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)

- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)

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| Assessment: | Examination 1 (70%) Assignment 1 (30%) |
| Resit Assessment: | Examination (Resit instrument) (100%) |
| Assessment Description: | Examination: The examination (written or online or OMR sheet based exam) forms 70% of the module mark. Assignment 1 (30%) will be either Canvas test or case study. |
| Moderation approach to main assessment: | Moderation of the entire cohort as Check or Audit |
| Assessment Feedback: | A general pro-forma is completed, covering errors/issues that were identified during the marking process, and produced as formal examination feedback. The marks for assignment 1 will be provided at the deadline time. Further feedback, including worked solutions will be provided within the week after the deadline. |
| Failure Redemption: | A supplementary written examination will be set which will form 100% of the mark. |
| Additional Notes: | Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment. Available to visiting and exchange students. |

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| EG-277 Research Project Preparation |
| Credits: 0 Session: 2023/24 September-June |
| Pre-requisite Modules: |
| Co-requisite Modules: |
| Lecturer(s): Dr AC Tappenden, Dr M Fazeli, Mrs KM Thomas |
| Format: Formal Lectures - 2-3 hours |
| Delivery Method: 2-3 formal lectures throughout the academic year concerning project design and selection. |
| <p>Module Aims: This module has been designed to provide you with information needed ahead of undertaking a research project in Year 3 of studies.</p> <p>The research project in Year 3 is worth 30 credits, and will involve the application of scientific and engineering principles to the solution of a practical problem associated with engineering systems and processes.</p> <p>In the research project you will gain experience in working independently on a substantial, individually assigned task, using accepted planning procedures. It will require and develop self-organisation and the critical evaluation of options and results, as well as developing technical knowledge in the chosen topic.</p> <p>The preparation for the research project commences in Year 2 where you are required to engage in project selection. In this preparation module we will confirm the options available to you to either define your own project or to select from a list of project titles and descriptors put forward by academic staff. Communications concerned project selection will be done via the Canvas course page. Additional supplementary resources will also be provided.</p> |
| <p>Module Content: In conjunction the formal lectures and supplementary resources will cover:</p> <ul style="list-style-type: none"> • Key staff members - contact details • Key dates for Year 2 regarding project selection - defining your own project or selecting from staff titles • How to design a project concept and what to consider before approaching a possible supervisor • Where to start in finding a possible supervisor • What to do if you're hoping to undertake a placement year • Selecting from staff titles • Further information around the allocation process • First steps in EG-353 when you commence Year 3 |
| Intended Learning Outcomes: NA |
| Assessment: Participation Exercise (100%) |
| Assessment Description: This module is not assessed but we would strongly suggest participation to ensure that you understand how the project selection system will work. |
| Moderation approach to main assessment: Not applicable |
| Assessment Feedback: NA |
| Failure Redemption: NA |
| Additional Notes: Only available to students following an Engineering Degree Programme. |

EGA219 Cell Biology and cell mechanics for engineers

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Miss CM Barnes

Format: 20 hours lectures, 80 hours self-study

Delivery Method: 7 weeks of lectures to deliver the core content, followed by a 4 week practical-work period in which workshops will cover computational modelling and technical report writing.

Module Aims: This course provides an introduction to the biology and mechanical properties of cells from an engineering perspective. The basic structures within the cell and the core processes of cell function will be covered and related to the interaction of cells within large populations and the growth of tissue. i.e. membrane bilayer, cytoskeleton, energy production, signalling, growth, division and genetic duplication. The fundamental principles will be related to specific areas of interest to medical engineers - technology developments, the risk of infection from medical implants and the use of stem cells for tissue engineering.

Module Content: 1. Brief introduction

A quick look at the biological cell – what is it? What does it do?

2. Basic concepts

Cells as systems, energy, entropy, diffusion and osmosis.

3. Structure and mechanics

Cytoskeleton, cell membrane, structural organisation.

4. Power and motion

Energy generation, molecular transport, cellular motility.

5. Information storage and transfer

DNA synthesis and protein expression, molecular networks and cell signaling.

6. Operation and control

Cell cycle, proliferation, feedback control

7. Experimental techniques

Flow cytometry, microscopy.

8. The immune system

Basic concepts, mechanisms of infection.

9. Tissue engineering

Stem cells and differentiation, cell scaffolds, engineered tissue growth.

Intended Learning Outcomes: Technical Outcomes

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

- Recall the main structural features of cells, define the basic physical and chemical processes which drive cell biology and relate this information to the overall life cycle of mammalian cells.
- Explain and summarise the concepts of energy use, motion and gene coding in relation to the life cycle of cells and demonstrate these concepts in specific examples.
- Construct and apply mechanical models to quantitatively assess cell structure and motion.
- Explain the operating principles of experimental techniques for cell study.
- Summarise the basic concepts of immune response and infection in relation to medical implants.
- Compare and contrast the different concepts in cell biology, analyse their relationships and examine their utility in describing cell function.

Accreditation Outcomes (AHEP)

- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)

- Communicate their work to technical and non-technical audiences (D6)

- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques (EL6)

- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (P1)

Assessment: Coursework 1 (30%)

Examination 1 (70%)

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

Assessment Description: The examination will be Open Book and is weighted at 70%. It will consist of a series of short questions designed to test the students' general understanding of the course content plus longer questions assessing knowledge of a specific topic in more detail.

The coursework will be based around problem solving (within computer modelling) and report writing. The total weighting for the coursework is 30%. The coursework is compulsory.

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

Assessment Feedback: Examination - A generic overview of issues arising from the exam will be provided.

Coursework - individual feedback will be given for students' computer work and their written reports.

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 course does not require pre-requisites and therefore may be taken by visiting and exchange students

EGA226 Physiological systems

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-142; EGA100

Co-requisite Modules:

Lecturer(s): Prof HD Summers

Format: 11 lectures of taught material 22 hours of computer labs 67 hours of self study Contact Hours will be delivered.

Delivery Method: The course will employ a blended approach to delivery using the Canvas Digital Learning Platform for self-directed online activity, with in-person taught and self-directed on-campus activities each week. Students may also have the opportunity to engage with recorded materials covering material delivered on-campus. 11 lectures: 1 hour per week covering formal taught content. 22 computer laboratory sessions: 2 hour per week developing programming (Simulink) and analytical skills.

Module Aims: This course will consider human physiology from an Engineering standpoint, concentrating on the system architecture of major physiological components within the body, e.g. cardiovascular, nervous, muscular and respiratory systems. Emphasis will be place on the system level output and the control mechanisms required to maintain body homeostasis. A major practical element will run alongside the presentation of taught material. The Simulink programming environment will be used to:

- i. Model the behaviour and control of generalised systems and;
- ii. Simulate the function of specific biological systems relating to human physiology.

Course elements:

- Introduction to basic systems - definition, components and architecture, emergent phenomenon
- Introduction to control theory - feedback, error monitoring, proportional control, dynamic systems
- Translation of systems control theory and models to human physiology
- Detailed modelling and simulation of specific physiological systems

Module Content: Course elements:

- Introduction to basic systems - definition, components and architecture, emergent phenomenon, (Evaluated in: Coursework, Exam).
- Introduction to control theory - feedback, error monitoring, proportional control, dynamic systems, (Evaluated in: Coursework, Exam).
- Translation of systems control theory and models to human physiology, (Evaluated in: Exam).
- Detailed modelling and simulation of specific physiological systems, (Evaluated in: Exam).

Intended Learning Outcomes: Technical Outcomes

1. Basic understanding of the generalised behaviour of dynamic systems. (Evaluated in: Coursework and Exam, SM2)
2. Detailed understanding of control mechanisms for systems. (Evaluated in: Coursework and Exam, SM2)
3. Knowledge of examples of human physiological systems and their control. (Evaluated in: Exam, SM4)
4. Ability to model, analyse and hence understand the operation and control of human physiological systems using the Simulink programming environment. (Evaluated in: Exam, EA1, EA2, EA3)

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 mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- 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)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)

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| Assessment: | Coursework 1 (50%) Examination (50%) |
| Resit Assessment: | Examination (Resit instrument) (100%) |
| Assessment Description: | Coursework 1: a weekly assessment based on the SIMULINK programming assignments. These assignments may be completed during the timetabled session and will constitute 50% of the module mark. Examination: A 2-hour in-person examination. The exam will form 50% of the module mark. |
| | Resit: Supplementary assessment will be by examination and will form 100% of the module mark. |
| Moderation approach to main assessment: | Moderation by sampling of the cohort |
| Assessment Feedback: | Coursework - weekly exercises: feedback to class each week on successful elements plus highlighting and discussion of areas of difficulty report: individual scripts returned with comments. Programming - exemplar programs provided post-assessment for students to see where they were in error. |
| Failure Redemption: | Supplementary assessment will be done with a resit examination accounting for 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. |
| | N/A |

PM-230 Selected Medical Diagnostic Techniques

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof KM Hawkins, Prof OJ Guy, Mr MJ Lawrence

Format: Lead lectures

Contact Hours will be delivered through 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 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

Primarily on campus

Module Aims: This module looks at the design and operation of a wide range of instrumentation used to make measurements for diagnostic and monitoring of health and disease. The emphasis is on the underlying electrical, mechanical, chemical, optical and other engineering principles together with the advantages and limitations of techniques.

Module Content: Theoretical and practical aspects of the design and application of diagnostic techniques such as:

Temperature Measurements: Thermometers, Thermistors

Cell counting: Haemocytometer, Coulter counter

Complex processing for diagnostic purposes: Flow cytometry

Chemical analysis: Basic chemical analysis (ex-situ measurement of various analyte concentrations), immunoassays, electrochemical measurements eg blood pH, non invasive analysis (eg blood oxygen & carbon dioxide conc)

Oximetry: Standard benchtop and pulse oximeters

Biosensors: Enzyme-based biosensors (e.g. glucose sensors, enzyme-based field effect transistors) and other receptor-based sensors (eg antibodies), detection of adsorption of macromolecules at surfaces (eg surface Plasmon resonance, ellipsometry, infrared spectroscopy ATR etc).

Mechanical measurements: Rheological measurements of blood and their use as a diagnostic tool.

Nanotechnology: An introduction to the benefits of using nanotechnology for advanced, point of care diagnostic techniques.

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

* Identify and discuss the physical and chemical basis of a broad range of diagnostic measurements

* Identify and discuss the engineering principles required to make effective diagnostic instrumentation. This ranges from routine techniques currently used in hospitals to advanced research tools.

* Draw together various pieces of basic engineering from different disciplines to design effective instrumentation (eg chemical & electrical knowledge required to design biosensors).

Assessment: Examination 1 (75%)

Assignment 1 (25%)

Assessment Description: 120 minute Examination (75%)

Critical review (25%)

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

Assessment Feedback: Written feedback on assignments.

Failure Redemption: Re-sit examination and/or essay as appropriate.

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

Available to home and international level two Medical Engineering students and exchange students.