Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 2 (FHEQ LEVEL 5)

MEDICAL ENGINEERING

DEGREE PROGRAMMES

SUBJECT SPECIFIC
PART TWO OF TWO
MODULE AND COURSE STRUCTURE
2022-23

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 22-23 academic year begins on 19 September 2022

Full term dates can be found here

DATES OF 22-23 TERMS
19 September 2022 – 16 December 2022
9 January 2023 – 31 March 2023
24 April 2023 – 09 June 2023

SEMESTER 1
19 September 2022 – 27 January 2023
SEMESTER 2
30 January 2023 – 09 June 2023
SUMMER
12 June 2023 – 22 September 2023

IMPORTANT

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

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

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

Welcome 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.

This has been a challenging period for everyone. The COVID-19 pandemic has prompted a huge change in society as well as how we deliver our programmes at Swansea University and the way in which you study, research, learn and collaborate. We have been working hard to make sure you will have or continue to having an excellent experience with us.

We have further developed some exciting new approaches that I know you will enjoy, both on campus and online, and we cannot wait to share these with you.

At Swansea University and in the Faculty of Science & 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 staff, administrators, and your fellow students - I'm sure you will find many friendly helping hands ready to assist you.

We all know this period of change will continue and we will need to adapt and innovate to continue to be supportive and successful. At Swansea we are committed to making sure our students are fully involved in and informed about our response to challenges.

In the meantime, learn, create, collaborate, and most of all – enjoy yourself!

Professor Johann (Hans) Sienz
Interim Pro-Vice Chancellor/Interim 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 Paul Holland
School of Engineering and Applied Sciences **Head of School: Professor Serena Margadonna**	
School Education Lead	Professor Simon Bott
Head of Medical Engineering	Professor Huw Summers
Medical Engineering Programme Director	Dr Chris Wright C.Wright@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 9am-5pm.

The **Student Support Team** provides dedicated and professional support to all studentsin 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 and 01792 6062522 (Monday-Friday, 10am–12pm, 2–4pm).

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

The current student **webpages** also contain useful information and links to otherresources:

https://myuni.swansea.ac.uk/fse/coe-student-info/

READING LISTS

Reading lists for each module are available on the course Canvas page and are also accessible via http://ifindreading.swan.ac.uk/. We've removed reading lists from the 22-23 handbooks to ensure that you have access to the most up-to-date versions. Access to print material in the library may be limited due to CV-19; your reading lists will link to on-line material whenever possible. 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) 2022/23
Medical Engineering
BEng Medical Engineering[HB18,HBC9]
BEng Medical Engineering with a Year Abroad[HB01]
MEng Medical Engineering[HB1V]
MEng Medical Engineering with a Year Abroad[HB02]

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 Signals and Systems 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 JA Baker CORE
EG-277 Research Project Preparation 0 Credits Dr MR Brown/Mrs KM Thomas	
Total 120 Credits	

Year 2 (FHEQ Level 5) 2022/23
Medical Engineering
BEng Medical Engineering with a Year in Industry[HB19]
MEng Medical 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** **Signals and Systems** **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 JA Baker** **CORE**
EG-233 **Placement Preparation: Engineering Industrial Year** **0 Credits** **Prof GTM Bunting/Dr CME Charbonneau/Dr P Esteban/Dr SA Rolland/Dr V Samaras/Dr S Sharma**	
EG-277 **Research Project Preparation** **0 Credits** **Dr MR Brown/Mrs KM Thomas**	
Total 120 Credits	

EG-215 Process Modelling

Credits: 10 Session: 2022/23 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: Universal second marking 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.

The College of Engineering has 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: 2022/23 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 or 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 **-** Open Book (contributes 50% to module grade). Students will tackle a series statistical questions covering all topics. Students need to achieve at least 30% in both components in order to pass the module. If you do not meet the component level requirements for the module (i.e. achieving 30% 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: Second marking as sampling or moderation
Assessment Feedback: Students will receive their grades, together with models 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 College of 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 30% in both components.

EG-232 Multivariable Calculus for Medical Engineers

Credits: 10 Session: 2022/23 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: Universal second marking 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:** 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof GTM Bunting, Dr CME Charbonneau, Dr P Esteban, Dr SA Rolland, Dr V Samaras, Dr S Sharma

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: Class Test 1 - Coursework (0%)
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: 2022/23 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 mutli-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 (10%)
Assignment 2 (10%)

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

Assessment Description: 20% from two online tests (10% each) administered via CANVAS at the middle and towards the end of semester 2, and 80% from an in-person examination in May-June.

This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. Any resits are done by a supplementary exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework.

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

Assessment Feedback: Generic feedback on the online tests will be provided, following the tests. 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.

This module is assessed by a combination of examination and coursework. In order for the coursework marks to count, you have to pass the exam component (with at least 40%). If you have less than 40% in the exam, then the module mark will be just the exam mark. Any resits are done by a supplementary exam. If you pass the exam but have failed the coursework, you may still fail the module, depending on the marks achieved, so it is important to do the coursework.

EG-236 Design for Medical Engineering

Credits: 10 Session: 2022/23 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: Second marking as sampling or moderation

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: 2022/23 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 it 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 are 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: Second marking as sampling or moderation
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 College of 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 Signals and Systems

Credits: 10 Session: 2022/23 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 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 signal representations and transform concepts.
* The Laplace Transform and its Applications to Circuit Analysis.
• Fundamentals of 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)

Assessment: Examination (60%)
Portfolio (30%)
Project (10%)
Resit Assessment: Examination (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 15 MATLAB Exercises graded by MATLAB Grader will be presented. Students need to complete 10 of the 15 exercises to pass the module. (30%)

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

NOTE: For continuous assessment marks to be included in the overall module mark, students must achieve 30% in the examination.

Moderation approach to main assessment: Universal second marking 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% For other issues, following university policy (see below): http://www.swan.ac.uk/registry/academicguide/assessmentissues/redeemingfailures/

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

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

This module is assessed by a combination an on campus examination and continual assessment. In order for the continual assessment marks to count, you must achieve at least 30% in the examination. If you achieve less than 30% in the examination, then the module mark will be just the examination mark.

EG-256 Fluid Mechanics 1

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

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

Format: Lectures: 22 Hours (2 hours per week)
Office Hour: 55 hours (5 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 2 hours of lecture, some common difficulties experienced by the cohort when studying the preparation material will be addressed. Afterwards, students will be invited to solve a new set of problems together with the lecturers and may receive feedback at any time.

Module Aims: The module provides an introduction to the methods that can be employed by engineers for the analysis of basic problems involving stationary and flowing fluids.

Module Content:
Introduction to the module. Fluid Properties [2]
Stevin’s and Pascal Law [2]
Forces on Planar Surfaces [2]
Forces on Curved Surfaces [2]
Buoyancy [2]
Class Test [2]
Macroscopic mass balance and energy Balance: The Bernoulli equation [2]
Pipe Flow and distributed viscous losses [2]
Minor Losses [2]
Pipelines, Pumps and turbines [2]
Macroscopic Momentum Balance [2]

Intended Learning Outcomes:
Technical Outcomes
By the end of the module, the student should be able to:
- Comprehend the conservation laws of mass, energy and momentum.
- Apply conservation laws to solve engineering problems.
- Determine how to calculate hydrostatic forces on both planar and curved surfaces.

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: Examination (50%)
Coursework 1 (25%)
Class Test 1 - Coursework (25%)

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

Assessment Description: Coursework (25%): this coursework component will be completed using a technology adaptive platform fully integrated to Canvas. Students will be expected to complete a theory section and some additional problems in preparation to each week lecture.

Class Test (25%): this is a 2-hours closed book class-test to be completed in a university computer room in invigilated conditions. The test will focus on Fluid Statics.

Examination 1 (50%): This is a 2.5-hours closed book exam. Students will be expected to solve two new fluid mechanics problems about fluid dynamics.

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: Universal second marking as check or audit
Assessment Feedback: Students will receive instant feedback on their coursework components. Students will receive feedback on the Class test within 3 weeks of submitting the work.
Failure Redemption: Resit: Examination 100% This is a 2.5-hours closed book exam. Students will be expected to solve two new fluid mechanics problems featuring the topics presented in the module. 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 cohort. 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-262 Stress Analysis 1

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules: EG-120

Co-requisite Modules:

Lecturer(s): Dr JA Baker

Format: Lectures: 20 hours
Example classes: 10 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: 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 based on lectures and example classes and additional supporting on-line content.

A complementary experiment will be carried out within EG-268. The experiment will build on theory studied in this module.

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 Lame 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)

Assessment: Examination 1 (70%)
Assignment 1 (15%)
Assignment 2 (15%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description:
Examination: The examination forms 70% of the module mark.
Assignment 1 will be a Canvas test (15%)
Assignment 2 will be a case study (15%)

Moderation approach to main assessment: Universal second marking 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.
Assignment 2 will be marked and feedback will be provided within 3 weeks of 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.

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

Available to visiting and exchange students.

Office hours will be posted on Canvas.

EG-277 Research Project Preparation

Credits: 0 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr MR Brown, Mrs KM Thomas

Format: Formal Lectures - 2-3 hours

Delivery Method: 2-3 formal lectures throughout the academic year concerning project design and selection.

Module Aims:
This module has been designed to provide you with information needed ahead of undertaking a research project in Year 3 of studies.

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.

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.

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.

Module Content: In conjunction the formal lectures and supplementary resources will cover:

• 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: 2022/23 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 prospective. 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: Second marking as sampling or moderation
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: 2022/23 September-January

Pre-requisite Modules: EG-142

Co-requisite Modules:

Lecturer(s): Prof HD Summers

Format: 11 lectures of taught material
11 hours of computer labs
78 hours of self study
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

11 lectures: 1 hour per week covering formal taught content.
11 computer laboratory sessions: 1 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)

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. There will be 10 assignments each worth 5% 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: Second marking as sampling or moderation

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: The module coursework will account for 50% of the module mark.
The remaining 50% will be assessed by a resit examination.

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: 2022/23 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 measurments eg blood pH, non invasive analysis (eg blood oxygen & carbon dioxide conc)

Oximetry: Standard benchtop and pulse oximiters

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: Second marking as sampling or moderation

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.