Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 3 (FHEQ LEVEL 6)

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 3 Coordinator	Dr Feihu Zhao feihu.zhao@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 3 (FHEQ Level 6) 2022/23
Medical Engineering

BEng Medical Engineering[HB18,HBC9]
BEng Medical Engineering with a Year Abroad[HB01]
BEng Medical Engineering with a Year in Industry[HB19]
MEng Medical Engineering[HB1V]
MEng Medical Engineering with a Year Abroad[HB02]

Semester 1 Modules	Semester 2 Modules
EG-3055 **Tissue Engineering** **10 Credits** **Dr CJ Wright** **CORE**	**EG-3070** **Biomedical Instrumentation** **10 Credits** **Prof PM Holland** **CORE**
EG-318 **Computer Aided Product Design** **10 Credits** **Dr MJ Clee** **CORE**	**EGA308** **Implant and prosthetic Technology** **10 Credits** **Dr CJ Wright/Dr F Zhao** **CORE**
EG-323 **Finite Element Method** **10 Credits** **Dr W Harrison** **CORE**	
EGA336 **Biomedical Flows in Physiology and Medical Devices** **10 Credits** **Dr R Van Loon** **CORE**	
EG-353 **Research Project** **30 Credits** **Dr MR Brown/Mr A Goodfellow/Prof PJ Holliman/Dr AC Tappenden** **CORE**	
EG-386 **Engineering Management** **10 Credits** **Prof SG Bott/Prof AR Barron/Dr JM Courtney/Dr M Evans** **CORE**	
EGA325 **Medical Engineering Group Design Project** **20 Credits** **Dr AM Higgins/Dr AS Ademiloye/Prof P Rees** **CORE**	
Total 120 Credits	

Year 3 (FHEQ Level 6) 2022/23
Medical Engineering
MEng Medical Engineering with a Year in Industry[HB1W]

Semester 1 Modules	Semester 2 Modules
EG-3055 **Tissue Engineering** **10 Credits** **Dr CJ Wright** **CORE**	**EG-3070** **Biomedical Instrumentation** **10 Credits** **Prof PM Holland** **CORE**
EG-318 **Computer Aided Product Design** **10 Credits** **Dr MJ Clee** **CORE**	**EGA308** **Implant and prosthetic Technology** **10 Credits** **Dr CJ Wright/Dr F Zhao** **CORE**
EG-323 **Finite Element Method** **10 Credits** **Dr W Harrison** **CORE**	
EGA336 **Biomedical Flows in Physiology and Medical Devices** **10 Credits** **Dr R Van Loon** **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-353 **Research Project** **30 Credits** **Dr MR Brown/Mr A Goodfellow/Prof PJ Holliman/Dr AC Tappenden** **CORE**	
EG-386 **Engineering Management** **10 Credits** **Prof SG Bott/Prof AR Barron/Dr JM Courtney/Dr M Evans** **CORE**	
EGA325 **Medical Engineering Group Design Project** **20 Credits** **Dr AM Higgins/Dr AS Ademiloye/Prof P Rees** **CORE**	
Total 120 Credits	

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: 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-3055 Tissue Engineering

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules: EG-120; EG-215; EGA219

Lecturer(s): Dr CJ Wright

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

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

Assessment: 80% written examination, 20% assignment.

Module Aims: Modern medicine is looking to tissue engineering to solve many disease states through the harnessing of the body's own repair mechanisms. Every day in the news we are seeing exciting glimpses into the application of tissue engineering for the replacement of tissues and eventually organs within the human body. Thus, the aim of the module is to provide the students with a rigorous understanding of the underlying themes of tissue engineering and equip them for the future developments that will impact significantly on their career as biomedical engineers. The module starts with an examination of how cells grow and differentiate into tissues, this is from an engineering prospective looking at the cell interactions, adhesion and mechanics. The importance of stem cells in regenerative medicine will also be discussed. In order to engineer tissue the cells environment must be controlled so the module features a comprehensive examination on the design and production of scaffolding to guide cell growth and differentiation. This is accompanied by a similar assessment on the use of specialist bioreactors to amplify cell numbers, entrap cells in scaffolds and condition them so that they will survive implantation. In the latter part of the module case studies are used to reinforce the processes involved in tissue engineering. Thus, the module finishes with a consideration of the current state of the art of tissue engineering with applications including cartilage, bone, skin and artificial organ engineering.

Module Content: • Introduction and orientation - Medical relevance and regenerative medicine (1 lecture)

• Cell biology - revision of cell structure, cell growth, proliferation and differentiation, cellular communications; tissue dynamics, cell adhesion. (2 lectures)

• Mechanical forces on cells, cellular structure and mechanics, interaction with the extra-cellular matrix (2 lectures)

• Fundamentals of stem cell tissue engineering (2 lectures)

• Scaffolds for tissue engineering applications - design criteria, materials and fabrication techniques (3 lectures)

• Collagen (1 lecture)

• 3D printing and additive manufacturing (1 lecture)

• Bioreactors for tissue engineering - Suspension Cell Cultures; perfusion bioreactors, airlift reactors, hollow fibre reactors, Micro encapsulation. Anchorage dependent cell cultures, cell retention, micro carrier STR; fluidized bed bioreactor, packed bed bioreactor. Bioreactor operation modes. Kinetics of cells culture. Influence of environmental and physiological conditions on rate equations, cell densities. cell growth and death. (4 lectures).

• Case studies (4 lectures)

• Bioengineering of human skin substitutes

• Cartilage tissue engineering

• Bone tissue engineering

• Tissue engineering and artificial organs

Many aspects of the course will be discussed with reference to the regulations for safe handling and manufacture of materials from human cells.

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to demonstrate:
• (Knowledge and understanding): Current applications and state of the art within tissue engineering. The design and analysis of scaffolds and bioreactors used in tissue engineering. The basic processes controlling cell division and differentiation; the structural properties of biological cells. The role of kinetics, mass transfer and materials balancing in scaffold and bioreactor design. (Evaluated in assignment and exam; SM1 SM2 SM3)
The application of engineering principles to biological systems.
An ability understand and communicate between the diverse disciplines that encompass tissue engineering for problem diagnosis. (Evaluated in assignment and exam SM3 P1)

• (Thinking skills): Interpret data and models. Manipulate models of cell mechanics to analyse cellular interactions with engineered matrices and processes within a bioreactor. Recognise the methods that will allow the successful design and analysis of those systems. (Evaluated in exam and assignment; EA1-4; SM3)

• (Practical skills): Identify the key assumptions and facts that will enable the specification of artificial scaffold constructs and bioreactors for tissue engineering. (Evaluated in exam P2)

Assess safety issues required for the use of human cell culture and tissue engineering, and to be able to assess the relevant EU and UK regulatory framework. (Evaluated in assignment; D2 EL5 and EL6)

• (Key skills): To formulate models and carry out calculations. Critically assess design criteria for equipment selection. Logically analyse performance. (Evaluated in exam EA1-4)

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline. (SM3b)
- 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)
- 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)
- Communicate their work to technical and non-technical audiences (D6)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues (EL5)
- 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:	Examination 1 (80%) Coursework 1 (10%) Coursework 2 (10%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Written examination

Coursework 1 problem sheet

Coursework 2 problem sheet

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

Assessment Feedback: The marks of the continual assessments will be given to the students with a written description of their performance and how it could have been improved.

Optional office surgery towards the end of term specifically timetabled for individual discussion and feedback on the course.

The students will have the standard Faculty of Science & Engineering feedback from the exam with a diagnostic description of each answer provided by the student cohort. This will include identification of common errors and shortfalls in the answering of the question, description of good and poor answers and recommendations as to how answers could have been improved.

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

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

Available to visiting and exchange students

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

Notes, useful journal publications and past papers for this module can be found on Canvas.

EG-3070 Biomedical Instrumentation

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof PM Holland

Format:
Laboratory work 30 hours
Online preparation and tests 30 hours
Writing reports 16 hours
Directed study 24 hous

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

Zoom theory session: 1 hour per week
E-laboratory: 3 hours per week
Practical laboratory: Will depend upon Covid-19 restrictions.
Assessment: 100% Continuous Assessment.
Directed private study: 60 hours

Online materials, assessments and notes will be delivered via Canvas.

Module Aims: The module covers aspects of Biomedical Instrumentation. It is designed to give medical engineers the knowledge and experience to design, fabricate and use a range of medical devices based on sensors and electronic circuits and systems to interact with the body. The use of medical devices are common in clinical practice and common areas of use include the recording of body or medical device temperature which will form the focus of the module.

Module Content: With the aid of the commercial simulation package, Sim-electronics, the practical laboratory work in this module develops topics such as:
• Sensors for biomedical applications.
• Practical op-amp circuits.
• Real circuit components.
• Filters.
• Arduino technology.

Practical work includes:
• The preparation, performance and reporting on a structured series of experiments supporting the taught modules at this level.
• Practice in using IT packages to assist with report writing and presentations.
• The use of Simelectronics for circuit design and analysis.
• The construction of a hands free switch for people with a disability.

Intended Learning Outcomes: There are several blocks common to all biomedical instrumentations systems with some additional ones depending upon the particular application. The common blocks are measurand; sensor; signal conditioning; signal processing and a data presentation element. Students will be able to conceptualise and understand the theory underpinning the whole instrumentation system whilst understanding the purpose and function of each block and the interfacing between them. (Evaluated in formative online tests and technical lab reports, EA4)

Students will be set an authentic example(s) of NHS projects where they will investigate and define the problem. They will identify typical constraints including environmental and sustainability limitations; ethical, health, safety, security, risk and medical device directives. They will design solutions using simulation software before physical build, test, and evaluation in the electronics lab.
(Evaluated in technical laboratory report 1 and 2, D2, D3, G4, P3, P6)

The students will write technical laboratory reports and reflective statements to develop metacognition and other lifelong learning skills. (Evaluated in technical laboratory report 1 and 2, G1, G2)

Accreditation Outcomes (AHEP)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems. (EA4b)
- 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)
- Ability to apply relevant practical and laboratory skills (P3)
- Understanding of appropriate codes of practice and industry standards (P6)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)

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

Assessment Description: Students will be assessed on the following components:

i) Coursework 1 is the laboratory diary covering the whole module and worth 20% total. Coursework 1 will be assessed towards the end of the module.

ii) Coursework 2,3,4 and 5 worth 20% total are online tests of theory 5% x 4 individual assessments.

iii) Report 1: is a technical laboratory report worth 30% individual assessment.

iv) Report 2: is a technical laboratory report worth 30% total, it includes reflections on professionalism and feedback.

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

Assessment Feedback: Students will receive feedback through the Faculty's Feedback Summary Sheet, which provides both the statistics and analysis of each question.

Failure Redemption: If a student is awarded a re-sit at least one piece of coursework will be set. If eligible, the failure redemption is only available to students who have at least 80% attendance at laboratory classes during the teaching semester.

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

• NOT AVAILABLE TO Visiting and Exchange Students due to pre-requisite requirements.

• LABORATORY CLASSES ARE COMPULSORY. Students must have at least 80% attendance at laboratory classes in order to be allowed to be assessed for the module.

• PRE-LABORATORY PREPARATION IS COMPULSORY. Students must complete the necessary laboratory preparation by successfully engaging with electronically delivered theory lectures, software simulations in simscape and Canvas assessments before coming to practical laboratories.

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

EG-318 Computer Aided Product Design

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules: EG-163

Co-requisite Modules:

Lecturer(s): Dr MJ Clee

Format: Lectures 1 hour per week for 10 weeks
Directed private study 7 hours per week for 10 weeks
Laboratory 2 hours for 10 weeks

Delivery Method: Lectures and assisted computer laboratory sessions possibly combined with online support that MAY include a range of file types including videos, slideshows, text documents and examples, to put the design project into context, but the majority of work will involve independent working, individually and as a group.

Assessment: continual assessment 100% comprising a series of 'short' assignments culminating in a final group report.

Module Aims: Students engaged in this module will be expected to use design skills learnt in previous undergraduate levels and develop additional skills to design and possibly manufacturable prototype products that could be placed within the market sphere. Working in teams you will be expected to step outside the 'normal' engineering sphere to ensure that the designs can compete within all aspects of the product market.

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Module Content: Engineering Software and use it to design an 'engineering' product then use software analysis tools or otherwise to predict mechanical failure (stress analysis) of the main components of the product.
Where appropriate the students may be required to use significant hardware tools, such as rapid prototyping equipment, to aid his/her design for optimisation or otherwise.

Product Design, Design Practice, Computer Aided Design, Applied Finite Element Analysis, Rapid Prototyping and Reverse Engineering techniques.

Intended Learning Outcomes: After completing this module you should be able to demonstrate a knowledge and understanding of:
The significance and versatility of computer software and hardware as a practical design tool.

A knowledge and understanding of the multidisciplinary nature of design and understand the implications of many design decisions market considerations. and the link between design and manufacture of a product /prototype product.

KU2 Have an appreciation of the wider multidisciplinary engineering context and its underlying principles, particularly when applied to design.

KU3 Appreciate the social, environmental, ethical, economic and commercial considerations affecting the exercise of their engineering judgement.

D1 Investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues.

D4 Use creativity to establish innovative solutions.

D5 Ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal

D6 Manage the design process and evaluate outcomes.

P1 Knowledge of characteristics of particular equipment, processes or products

P2 Workshop and laboratory skills

P6 Understanding of appropriate codes of practice and industry standards

P8 Ability to work with technical uncertainty

PS1 Possess practical engineering skills acquired through, work carried out in laboratories and workshops; in individual and group project work; in design work; and in the use of computer software in design, analysis and control.

S2 Knowledge of management techniques which may be used to achieve engineering objectives within that context.

S3 Understanding of the requirement for engineering activities to promote sustainable development.

S4 Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues.

S5 Understanding of the need for a high level of professional and ethical conduct in engineering.

Assessment: Assignment 1 (30%)
Assignment 2 (20%)
Assignment 3 (50%)
Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: • Research Study.
• Financial Planning in Engineering Products.
• Concept designs.
• Final Design Report.

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

Assessment Feedback: Lectures will provide feedback on presentations during lecture and laboratory sessions. Tutorial sessions may also be used for general feedback and guidance.

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of 100% supplementary coursework.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of 100% supplementary coursework.

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

Not available to visiting and exchange students

EG-323 Finite Element Method

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr W Harrison

Format: This module will be taught with a combination of lectures and examples classes. Pre-recorded videos and online content will also be provided. Office hours will be available for additional support..

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

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

The module is delivered by lectures, example classes and additional support sessions.
Communication and course announcements, including office hours details, will be made via Canvas.
Course materials, including the course notes, will be available for download from Canvas.

Lectures: 1 hour per week
Examples classes: 1-2 hours per week
Additional support sessions: 10 hours in total
Directed private study: 3 hours per week

Module Aims: This module provides a concise introduction to the elementary concepts and methods of finite element analysis, with applications to heat flow, solid mechanics, groundwater flow and other engineering problems. It also provides practice in using finite element software/codes.

Module Content:

1D problems: Introduction. FE Formulation of 1-D Problems - Physical problem; conceptual model. 1-D problem of heat conduction and elastostatics. Analytical solution. Strong and weak forms. Galerkin approximation. Finite element discretisation. The linear 1-D bar: shape functions, load vector and stiffness matrix. Assembly procedure. Examples [9]

2D scalar problems: FE Modelling of 2-D Potential Flow Problems - Physical problem; conceptual model. Porous media flow; heat conduction; torsion of cylindrical members. Strong and weak forms. Galerkin approximation. Finite element discretisation. The linear shape triangle: shape functions, load vector and stiffness matrix. Assembly procedure. Solution. Examples. [8]

2D elasticity: FE Modelling of 2-D Elastic Solids - Plane strain and plane stress problems of 2-D elastostatics. Strong and weak forms. Galerkin approximation. Finite element discretisation. The linear shape triangle: shape functions, load vector and stiffness matrix. Examples [6]

Review [2] and Assessment.

Attendance is a course requirement. The module is assessed by an exam (open book) and two assignments that will require both hand calculation and computer simulations. Computer simulations will be using the existing finite element software, which includes small finite element programs.

Intended Learning Outcomes:
Technical Outcomes
Upon completion of this module, the student should be able to demonstrate:
- A knowledge and understanding of [SM2b]:
(i) Fundamentals of the finite element method as an approximation method for analysis of a variety of engineering problems.
(ii) Differences between mathematical (conceptual) and computer models.
- An ability to (practical skills) [EA3b]:
(i) Develop finite element formulation for analysis of a variety of engineering problems including: (a) elastostatics of 1-D bars and cables (b) heat conduction, potential flow, porous media flow, torsion (c) plane strain and plane stress problems.
(ii) Use finite element method to solve engineering problems (a)-(d).
(iii) Use a computer to model and analyse engineering problems (a)-(d).

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

Assessment: Examination 1 (75%)
Assignment 1 (10%)
Assignment 2 (15%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description:
(i) Assignment 1: Solve 1D problems using both hand calculations and computer codes (10%).
(ii) Assignment 2: Solve multidimensional problems using both hand calculations and computer codes (15%).
(iii) Final examination (75%).

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

Assessment Feedback:
Assignments 1 and 2 are assessed via Canvas submissions. Individual student feedback will be provided through Canvas. An overall feedback on the final examination will be posted online.

Failure Redemption:
Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

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

Penalty for late submission of continuous assessment assignments: zero tolerance.

Available to visiting and exchange students.

EG-353 Research Project

Credits: 30 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr MR Brown, Mr A Goodfellow, Prof PJ Holliman, Dr AC Tappenden

Format: Formal Lectures 16 hours;
Directed private study (incl. meetings with supervisors) 284 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

Weekly briefings on all aspects of project work, risk assessment, planning, research methods, and ethics as it applies to engineering and research work.

English for academic purposes, writing up, referencing and presenting, the engineering institutions, continuing professional development.

These will be backed up by regular one-on-one meetings with a supervisor who will provide guidance and feedback on an ongoing basis.

Module Aims:

The module involves the application of scientific and engineering principles to the solution of a practical problem associated with engineering systems and processes.

The student 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.

Module Content:

A series of compulsory weekly briefings in Semester 1 will cover topics such as:

- Introduction to the module
- Health, Safety and Risk Assessment
- Project Planning
- Using the Library for Research
- Engineering and Research Ethics
- Academic Integrity
- Referencing

There will also be a series of sessions delivered as part of the Academic Success Programme in Semester 2 to help students with writing of their final paper and preparing for their viva.

The schedule for all taught sessions will be available on Canvas, all briefings will be recorded and also available on Canvas.

Intended Learning Outcomes:
Learning Outcomes are mapped to those required to partially satisfy the educational requirements for Engineering Council Registration as a Chartered Engineer as part of an Accredited BEng Honours Degree Standard (UK HEQF Level 6) as defined by the UK Standard for Professional Engineering Competence (UK-SPEC) and the Accreditation of Higher Education Programmes 3rd Edition (AHEP 3).

The AHEP Learning Outcomes are categorised under six headings:
• Science and mathematics (SM1b, SM2b, SM3b)
• Engineering analysis (EA1b, EA2, EA3b, EA4b)
• Design (D1, D2, D3b, D4, D5, D6)
• Economic, legal, social, ethical and environmental context (EL1, EL2, EL3, EL4. EL5, EL6)
• Engineering practice (P1, P2, P3, P4, P5, P6, P7, P8, P11)
• Additional general skills (G1, G2, G3, G4)

Precisely which subset of skills and learning outcomes will be covered in any particular project will vary, but all projects are expected to demonstrate the following Learning Outcomes at a threshold level:

• SM1b (all assessment components)
• SM3b (all assessment components)
• EA1b (all assessment components)
• EA2 (final paper and viva)
• EA3b (final paper and viva)
• D6 (final paper and viva)
• EL1 (ethics assessment)
• EL3 (project plan, project management)
• P1 (final paper and viva)
• P2 (final paper and viva)
• P4 (final paper and draft introduction)
• P8 (final paper, viva and project management)
• G1 (all assessment components)
• G2 (all assessment components)
• G3 (all assessment components)
• G4 (all assessment components)

Please see the Accreditation of Higher Education Programmes 3rd Edition for full descriptions of the above Learning Outcomes.

Assessment:	Project Planning Statement (5%) Project Management (0%) Progress Report (5%) Project Management (5%) Ethics Assessment (0%) Final Paper (60%) Oral Presentation (20%) Project Management (5%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Credit bearing assessments:
- Project Planning Statement (5%)
- Progress Report (5%)
- Project Management 1 (5%)
- Final Paper (60%)
- Oral Presentation/Viva (20%)
- Project Management 2 (5%)

Non-credit bearing assessments:
- Ethics Assessment (pass/fail COMPULSORY assessment, must be passed to pass the module)
- Project Management check-in (0%)

Full assessment criteria will be on Canvas.

Moderation approach to main assessment: Universal double-blind marking

Assessment Feedback:
Continuous feedback on progress will be delivered via meetings with supervisors.

Written feedback on assessment components will be delivered via the Feedback Studio.

There will be a formal opportunity to submit a Draft paper for preliminary review to provide detailed feedback to the student and provide the student with an opportunity to make modifications to the paper before final submission.

Failure Redemption: There is no failure redemption for this module. Failure in this module would normally result in an exit qualification due to insufficient credits having been attained.

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

Only available to students following an Engineering Degree Programme.

The nature of the research project varies from one student to another. Projects may involve design, theoretical, experimental or computational studies.

The academic staff of the Faculty of Science and Engineering produce a list of project descriptors and students are given a chance to select a project over the summer before the start of the academic year. Alternatively students are offered the opportunity to define the topic of their own research project.

Students must attend all relevant weekly briefings, a detailed schedule of which will be available on Canvas.

Each student will be allocated a supervisor and it is recommended that students meet their supervisors at least once a fortnight to discuss progress.

There are a number of compulsory submissions (a project plan; an ethics assessment; a draft introduction; a progress report; a 10-page research paper; evidence of project management and a viva examination).
Precise assessment criteria, deadlines, submission formats and instructions will be disseminated via Canvas.

The Faculty of Science and Engineering ZERO TOLERANCE penalty policy for late submission of coursework and continuous assessment will apply to all assessment elements apart from the final paper submission and viva.

Any late submissions on the final paper (not covered by extenuating circumstances) will be capped at 40%.

If a student fails to attend their scheduled Viva (not covered by extenuating circumstances) rescheduling may be permitted but both elements (presentation and defense) will be capped at 40%.

EG-386 Engineering Management

Credits: 10 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof SG Bott, Prof AR Barron, Dr JM Courtney, Dr M Evans

Format: Core Lectures 20 hours
Discipline Specific Lectures 10 hours
Private Study 70 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

Series of lectures, discipline-specific sections will cover the first 3 weeks and core components will follow.

Important - Careers Services Support lectures will take place in TB1 but formal assessment marks will be released in TB2. Please be aware that this is compulsory and will appear on the TB1 timetable.

One individual assignment for the discipline-specific component (30%) and two canvas-based electronic examinations (65% (2 x 32.5%)) for the core component, plus 5% careers services assessment .

Module Aims: The goal of this course is to provide the skills for science and engineering to meet the challenges of their future careers, whether they be in academia, industry, or as an entrepreneur. Irrespective of future careers engineers will be involved in projects and an awareness of the factors that enable a successful project is important for all team members. It should be recognized that the topics included in the course are not limited to scientists and engineers, they are useful for people in any careers. This course is not aimed at making you a certified project manager, but to provide the skills that will allow you to be a more effective project team member and also when you are dragged screaming and kicking into the role of accidental project manager.

With respect to human resources, the course will cover the basic concept of entrepreneurship before breaking down the essential elements of a business plan. The course will give the more entrepreneurial students guidance about how to go about commercialising their ideas and the less entrepreneurial students an understanding of what makes some of their colleagues tick. The learn by example approach adopted for this module guides the student through the complexities of financial and human resource management and encourages students to develop their own business plans. Students will also be introduced to the subject area of ethics within business. This module will also provide support on careers services with students creating CVs and Linked-In accounts.

Module Content: Pre-component
Careers Services Support - CV and Linked-In account

Section A. Programme Specific Component
There are four programme specific components:
•Civil, Chemical (including Environmental), Mechanical and Aerospace/Materials/Electrical/Medical Engineering.
•Chemical Engineering - Lectures on project appraisal in the chemical industries.
•Mechanical and Aerospace - Lectures on manufacturing processes and producing costing worksheets for specific processes.
•Materials/Electrical/Medical Engineering - Lectures on modelling, simulating and then optimising manufacturing products and processes.

Section B. Core Component
Project Management
• What is a Project?
Definition of a project and the stages within a project; project characteristics;
• Project Stakeholders
Who is involved in a project? The Politics of a project
• What is Project management and a Project manager?
Areas of expertise; what makes a successful project manager; triple constraint; standards and knowledge; management knowledge and skills
• Project Life Cycle
Initiation, planning, execution and closure; Project charter; Objectives and Scope; Project planning; Scope; Requirements; Work breakdown structure; network diagram; resource planning; Contract type; Risk management

• Entrepreneurship: Team building & Finance / Business Start-ups / The Business Plan including:
Team building and Entrepreneurial Finance.
Risk and Reward. How to set up a new company.
How to write a business plan.

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student should be aware of:
- Some of the "tools" that assist in the efficient use of financial & human resources in manufacturing;
- Writing a project plan
- How to determine if a project is a success
- Legal, human and economic aspects of entrepreneurship;

Accreditation Outcomes (AHEP)
- Knowledge of relevant legal and contractual issues (P5)
- Apply their skills in problem-solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)
- Understanding of, and the ability to work in, different roles within an engineering team (P11)
- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques (EL6)
- Work with information that may be incomplete or uncertain and quantify the effect of this on the design (D3B).
-Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety, and liability issue (EL5)
- Understanding of appropriate codes of practice and industry standards (P6)
- Awareness of quality issues and their application to continuous improvement (P7)

Assessment: Coursework 1 (3%)
Assignment 1 (30%)
Examination 1 (65%)
Coursework 2 (2%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description:
The core component is assessed via two 1 hour canvas-based electronic examinations. (Equally weighted and contributing 65% to the module grade).

The program specific components are assessed through one piece of coursework that is program specific (contributing 30% to the module grade).

There will also be a 5% component on Careers Support that will be completed in TB1 - 3% for completion of 5 specified units of the ‘career development course’ and 2% for CV (which will be assessed using ‘VMOCK’).

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

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

Assessment Feedback:
Students will receive feedback on their coursework, together with a model answer, within three weeks of submission. Feedback for the examination will be released via the exam feedback form.

Failure Redemption:
Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of 100% supplementary examination.

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

Penalty for late submission of work: ZERO TOLERANCE.

The module is available to exchange students.

Notes and worked examples can be found on Canvas.

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

EGA308 Implant and prosthetic Technology

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules: BIZ241

Co-requisite Modules:

Lecturer(s): Dr CJ Wright, Dr F Zhao

Format: 15 Hours Lectures
5 Hours Tutorial
75 Hours directed learning
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

On campus

Module Aims: This module looks at medical devices implanted within the human body and prosthetics, from two perspectives; i) how to engineer devices/implants to best deliver the required biological function and ii) the impact of implants on the human body.

Module Content: Module content: This module looks at medical devices implanted within the human body and prosthetics, from two perspectives; i) how to engineer devices/implants to best deliver the required biological function and ii) how to deal with the impact of implants on the human body.

The module will first consider the following areas before looking in detail at several specific case studies:
• Immune response to implants and prevention of rejection.
• Biofilms - prevention/control of infection.
• Biocompatibilility, biomaterials (eg using PEG to prevent non-specific protein adsorption).
• Materials considerations; structure, function and lifetime of components (inc. patterns of wear/failure mechanisms).
• Biomechanics; looking at the mechanical requirements of artificial structures, and the materials that are used to meet these requirements.
• Sterilisation methods, assessment and development for implants.

Detailed case studies include:
Biliary Stenting
Cochlear implants
Artificial hip replacement.

The module will also have the cross cutting themes regulation, procurement and commericalisation of medical devices.

Intended Learning Outcomes: Technical Outcomes
At the end of this module, you should:
• Understand both the medical and engineering considerations that need to be made when designing medical implants and prosthetics..
• Apply mathematical concepts .(Assessed in exam SM1 SM2 SM3).
• Have knowledge of the physical principles behind implant design and operation (EA1-4, SM1 SM2 SM3).
• Appraise the design of medical implants in terms of biocompatabillity and biofilm associated malfunction, (assessed during a group project looking at procurement of implants and exam SM1 SM2 SM3).
• Draw together various pieces of basic engineering from different disciplines to design effective implants and prosthetic devices. (Assessed during a group project looking at procurement of implants and exam EA1-4).
• Practical skills with the identification and understanding of regulatory frameworks (UK and EU) associated with implant design and application With consideration of the commercialisation and intellectual property constraints.(Assessed during a group project looking at procurement of implants and Exam; D2 EL5 and EL6).

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline. (SM3b)
- 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)
- 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)
- Communicate their work to technical and non-technical audiences (D6)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues (EL5)
- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques (EL6)

Assessment: Examination 1 (80%)
Coursework 1 (20%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: 80% Written Exam.

20% Project and Presentation.
Working in pairs the team will be allocated an implant device to research and appraise as if they are consultants advising a medical institution on the purchase and future of the relevant technology.
This coursework is conducted and assessed in groups.

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

Assessment Feedback: The students will have the standard Faculty of Science & Engineering feedback from the exam with a diagnostic description of each answer provided by the student cohort. This will include identification of common errors and shortfalls in the answering of the question, description of good and poor answers and recommendations as to how answers could have been improved.

The marks of the continual assessments will be given to the students with a written description of their performance and how it could have been improved.

An office surgery will be held to discuss progress on the course and the delivery of the project assignment.

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of 100% supplementary examination.

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

This module is delivered by three lecturers working directly within Medical Engineering

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

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

EGA325 Medical Engineering Group Design Project

Credits: 20 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules: EG-353; EGA308

Lecturer(s): Dr AM Higgins, Dr AS Ademiloye, Prof P Rees

Format: 20
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

Students will be supervised by an academic, whom they will meet (at least) fortnightly.

Module Aims: Students will carry out a medical engineering design project in groups of up to 6 people.

Module Content: Module content:

Students will carry out a design project working together as a team of up to four people. The group will design a product to meet a specific need within the healthcare industry. The group will assume the role of a team within the healthcare sector that is asked to produce designs to meet a particular objective, as would be laid down by a 'client' such as the NHS. It will be the job of the team to;
i) Determine the specific criteria that must be satisfied to meet the overall objective,
ii) Come up with a design and demonstrate (quantitatively) that the design will meet the specified criteria.

Projects will be of a multi-disciplinary nature and will require students to draw on their knowledge from previous modules, as well as researching, assessing and applying knowledge from new and sometimes unfamiliar subjects. The focus will mostly be on the technical and patient-outcome-related aspects of the design, but students may also need to consider some of the following; manufacturing implications, costs/economic viability of the product, health and safety, environmental and ethical implications, maintenance, serviceability and product lifecycle management issues.

While retaining the group activity, each student will be required to take responsibility for particular aspects of the project, which will form an important part of the assessment process.

Intended Learning Outcomes: Technical Outcomes

• Students will demonstrate an ability to carry out an extensive design project including learning how to interact with peers effectively.
• Students will design products by putting together basic engineering and biomedical knowledge, and new knowledge to meet a specific goal.
• Students will perform a specific role within the team and also contribute effectively to the overall direction of the effort.
• Students will solve problems and perform critical analysis of technical and non-technical issues.

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 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)
- 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)
- Plan and manage the design process, including cost drivers, and evaluate outcomes (D5)
- Communicate their work to technical and non-technical audiences (D6)
- Knowledge and understanding of management techniques, including project management, that may be used to achieve engineering objectives (EL3)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques (EL6)
- Understanding of appropriate codes of practice and industry standards (P6)
- Awareness of quality issues and their application to continuous improvement (P7)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9m)
- Ability to apply engineering techniques taking account of a range of commercial and industrial constraints (P10m)
- 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)
- Plan and carry out a personal programme of work, adjusting where appropriate (G3)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)

Assessment:

Assignment 1 (12%)
Assignment 2 (18%)
Assignment 3 (30%)
Presentation (15%)
Coursework 1 (25%)

Assessment Description: Semester 1 Group Assessments.
Assignment 1; Literature review - 12% (Deadline November).
Assignment 2; Calculations and differential equations - 18% (Deadline December).

End of Project Group Assessments.
Assignment 3; Final report - 30% (Deadline March/April).
Presentation/Defence - 15%.

End of Project Individual Assessment by Group Supervisor (these marks are designated as module component Coursework 1) - 25%; Consisting of contribution to project, evidence of initiative, evidence of teamworking and attendance at weekly tutorials.

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

Assessment Feedback: Students will be given written feedback on the literature review and semester 1 calculations. Verbal feedback will be given at the presentation/defence at the end of the project.

Failure Redemption: There is no opportunity to redeem a failure in this module due to the nature of the work (group work).

Failure of this module will mean that the student must repeat the module or repeat the year during the next academic session. Failure to attend classes and activities related to this module will mean that the student will fail the module; hence the student will repeat the module/year, subject to University regulations.

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

Not available to visiting and exchange students.

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

EGA336 Biomedical Flows in Physiology and Medical Devices

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules: EG-211; eg-235

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

Module Aims: .

Module Content: Module content: [approximate lecture hours]

Introduction [2]

PART I: Governing equations [7]
• Physical forces on a representative volume unit (normal stresses, shear stresses, pressures)
• Deriving Navier Stokes: Conservation of mass and momentum on a fluid volume
• Derivation of Bernoulli, Stokes, Euler equations from Navier Stokes
• Navier Stokes in its dimensionless form

PART 2: Rheology of non-Newtonian fluids and Hemo-rheology [7]
• Non-Newtonian/viscoelastic biofluids, shear-rate dependent viscosity, thixotropic/rheopectic behaviour, transient response
• Multi-component flows, Non-Newtonian inelastic models, pseudo-plastic fluid, dilatant fluid, Bingham fluid, viscoelastic
models.
• Blood composition, rheological properties and constitutive modeling, inelastic models, refined blood models.
• The Fahraeus-Lindqvist effect, hematocrit distribution, the Fahraeus effect.

PART 3: Physiological Flows [6]
• The heart, anatomy of the heart, principle of heart valve closure, mechanism of cardiac pumping: systole and diastole.
• Unsteady pulsatile pipe flow, the Windkessel model, Korteweg-Moens wave speed, the Womersley solution, Womersley
number and Stokes layer, limit of small Womersley number, unsteady flow rate, applications to real physiological conditions.
• Hemodynamics flow structures, curved vessels: secondary flows, flow separation and recirculation, wall Shear stress,
oscillatory shear index.
• The progression and development of atherosclerosis, initiation and development, the role of hemodynamics, inks between
LDL accumulation and the hemodynamic environment.

Intended Learning Outcomes: Understand the momentum and mass balances applied to a representative volume unit of fluid. Understand the Navier-Stokes equations and the physical meaning of each of its terms. Understand how to reduce the Navier-Stokes equations to more easily used equations depending on a set of assumptions. Apply these skills to a variety of flow problems in physiology and medical devices. (Evaluated in: Assignment and Exam, SM4, SM5, EA2, EA3)

An understanding of flows in the human physiology, medical devices and its clinical relevance. This will include cardiac, vascular, lymphatic, and respiratory flows. The students will gain an appreciation of the various types of fluids and flow regimes found in physiology. Understand the role of biofluid mechanics in health and disease. (Evaluated in: Assignment and Exam, SM4, SM5, EA2, EA3)

Assessment: Examination (80%)
Assignment 1 (20%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: The examination will be a 2 hour written examination where students have to answer all questions.

The assignment will be in groups and will focus around real-life applications of fluid flow such as human physiology and medical devices.

The resit examination will be a 2 hour written examination where students have to answer all questions. The resit is worth 100% of the final mark.

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

Assessment Feedback: The answers and typical mistakes to the assignment will be discussed in class.

Engineering has designed a standard feedback form that will be filled out. This way the students will get an appreciation of the detailed statistics of the exam and the most common mistakes made.

Failure Redemption: Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

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

Available to visiting and exchange students.

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