Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

STUDENT HANDBOOK

MSc MATERIALS ENGINEERING WITH INDUSTRY (FHEQ LEVEL 7)

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 26 September 2022

Full term dates can be found here

DATES OF 22-23 TERMS

26 September 2022 – 16 December 2022

9 January 2023 – 31 March 2023

24 April 2023 – 09 June 2023

SEMESTER 1

26 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 Materials Science and Engineering	Professor Dave Worsley
Materials Science and Engineering Programme Director	Dr Mark Coleman m.p.coleman@swansea.ac.uk
Materials Science and Engineering with Industry Course Coordinator	Dr Amit Das a.das@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/

2-year MScs with Industry - Student FAQs

<table>
<tr><td>1.Which courses will be offering 2-year MSc with Industry</td><td>a. MSc Electronic and Electrical Engineering with Industry
b. MSc Materials Engineering with Industry
c. MSc Mechanical Engineering with Industry
d. MSc Computational Engineering with Industry
e. MSc Civil Engineering with Industry
f. MSc Structural Engineering with Industry</td></tr>
<tr><td>2. What is the Course break down:</td><td>
<table>
<tr><th>Year</th><th></th><th>Credits</th><th>Description</th></tr>
<tr><td>1</td><td>Taught Modules</td><td>120</td><td>As per existing MSc</td></tr>
<tr><td>1</td><td>EG-M194 Preparatory Module</td><td>0</td><td>EG-M194 MSc Industrial Preparation - A pre-placement module providing support and guidance.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>2</td><td>Module dissertation

EG-D05
EG-D06
EG-D03
EG-D04
EG-D12</td><td>60</td><td>Same as existing 1-year MSc dissertation. Deadline is September 30th, or if a student resit examinations then the deadline extended to December 15th.
Dissertation projects can be assigned before placements are secured so students may complete the two elements separately.
If a placement is secured in time to undertake the dissertation and the industrial experience within the same placement then this will be possible.</td></tr>
<tr><td>2</td><td>EG-M39 Industrial experience module</td><td>60</td><td>32 weeks of industrial experience. This can either be with a paid industrial placement, or via an internal placement at the University.

In some cases, the entire 32 weeks will be based at the University and in others it could be based entirely in Industry. All students placed in Industry will be under close guidance of academic staff at Swansea.

The industrial experience module (EG-M39) will be assessed with three components on a pass / fail basis, and the learning outcomes and assessment will be closely linked to the requirements of professional engineering accreditation.</td></tr>
<tr><td colspan="4">Total Credits 240</td></tr>
</table>
</td></tr>
<tr><td>3. Who will be providing support to me during my placement?</td><td>The academic coordinator of the ‘with Industry’ programme will oversee the support and monitoring. They will also act as supervisor for the industrial experience module and they guide students via weekly interactions. Attendance will be monitored by the academic supervisor, in conjunction with the placement company as relevant. UKVI requirements will be met with regular meetings with the supervisor (face to face). There will also be resource within Academic Registry to monitor the students in Year 2 to ensure UKVI compliance.</td></tr>
</table>

<table>
<tr><td>4. Are there any conditions for progression to Year 2?:</td><td>To remain on the MSc with Industry, students will need to have successfully completed Part 1 and to have secured an appropriate placement(s). Any student who does not meet these criteria will be transferred to the normal one-year MSc.</td></tr>
<tr><td>5. What about my Visa?</td><td>Swansea University will support the application for a 2-year Visa.</td></tr>
<tr><td>6. What are the entry requirements</td><td>Entry requirements for the 2-year MSc schemes will be a 2:1 in a relevant degree (higher than the 1-year MSc entry requirement).</td></tr>
<tr><td>7. What is the application process?</td><td>Intake will be capped at 10 students per MSc and we are anticipating high demand. If we cannot offer the 2-year MSc we may be able to offer the existing 1-year MSc courses.</td></tr>
<tr><td>8. Will I be able to work alongside my study?</td><td>You will be able to work for 20 hours per week on top of the MSc.</td></tr>
<tr><td>9. How will I secure a placement?</td><td>Where possible, placements will be secured in advance of recruitment.
Some placement opportunities will be available as students apply and competitive applications against these will take place. The remaining placement projects will need to be secured by students with support of University staff and this process will take place during October – June of the first year.</td></tr>
<tr><td>10. Is my placement guaranteed?</td><td>No.
It is the responsibility of the student to secure a suitable placement with the assistance of University staff. Any student who does not meet these criteria will be transferred to the normal one-year MSc working to the same dissertation deadline as the 1-year MSc.</td></tr>
<tr><td>11. What is the course timeline?</td><td>
<table>
<tr><td colspan="2">YEAR 1</td></tr>
<tr><td>Sept – June</td><td>Year 1 Taught Modules (120 credits) and also alongside this MSc Industrial Experience Preparation module (EG-M194). The pre-placement sessions will take place to prepare you ahead of the placement and will cover academic requirements that you will have to fulfil during your time in industry.</td></tr>
<tr><td>Oct – June</td><td>Process to apply for and secure placement/s (subject to successful completion of Part 1 in June)</td></tr>
<tr><td>June/August</td><td>Exams and check point for Part 1 completion.
- If you've passed all modules (no toleration allowed) - Board confirmation of completion of Part 1.
- Board confirmation of placement secured.
If both confirmed, then you can proceed to dissertation and placement year.

If placement has not been secured, then you will be transferred to standard 1-year MSc and submit the dissertation in line with the deadline.

If Part 1 is not completed due to academic failure, then you will fail the degree. You may be awarded a post-graduate certificate as an exit qualification.</td></tr>
<tr><td colspan="2">YEAR 2</td></tr>
</table>
</td></tr>
</table>

	Y2 June – September	Part A: Dissertation (60 credits): September submission: Learning outcomes and assessment as per 1-year MSc dissertation. Part B: Industrial experience - module EG-M39 (60 credits): 32 weeks of industrial experience Assessment points (Three pass/fail components): 1 - Placement Report: The student is expected within the first few months of the placement to complete a report which includes an overview health and safety as well as your main responsibilities in the placement (December 20%) 2 - Final Placement Report: This report summarises the students year in industry placement/ project experience. The report will include a reflective section covering the student's role in the engineering placement / project, highlighting their personal initiative and their role in the evaluation of new engineering concepts (May 60%) 3 - Recorded Presentation: Every student is expected to record and submit through Canvas a maximum 5-minutes PowerPoint presentation video summarising your MSc Year in Industry placement (May 20%)

12. What happens if I pass Part 1 but have not secured a suitable placement or project?	You will be transferred to the standard 1-year MSc Course and have until September to complete the dissertation. If you were required to undertake resit examinations the dissertation deadline will be moved on to December.
13. What happens if I fail to complete Part 1 by June?	You will be entered in for resit examinations for the taught modules will take place in August and you will have until December to complete your dissertation.
14. What happens if I fail to complete Part 1 following resits in August?	If you fail to pass all August resists, then you will fail the degree. You may be awarded a post-graduate certificate as an exit qualification.
14. What happens if I fail any of Year 2 assessments	You will have one opportunity to repeat or resubmit assessment (capped at 50%). These must be completed by August of Year 2, so within the UKVI time allowance. If you fail any repeat / resubmission, then you will fail the degree and may be awarded a post-graduate certificate as an exit qualification.
15. What happens if I drop out of Year 2 at any point in Year 2?	Drop out will result in failure of the degree. You may be awarded a post-graduate certificate as an exit qualification. If student has valid extenuating circumstances Extensions may be applied / deferred fairly and extensions to UKVI time allowance will be sought on an individual basis
16. What if I don't complete the Industrial Module (EG-M39)?	Failure to complete the industrial experience module (EG-M39) will lead to failure of the degree, even if the dissertation module has been passed. After June of Year 1, there will be no scope to transfer from the 2-year MSc to the 1-year MSc equivalent.

MSc (FHEQ Level 7) 2022/23
Materials Engineering with Industry
MSc Materials Engineering with Industry

Coordinator: Dr A Das

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-M106 **Polymer Processing** **10 Credits** **Dr A Rees** **CORE**	**EG-M37** **Additive Manufacturing** **10 Credits** **Prof NPN Lavery** **CORE**
EG-M85 **Strategic Project Planning** **10 Credits** **Dr K Wada** **CORE**	**EG-M83** **Simulation Based Product Design** **10 Credits** **Dr AJ Williams/Mr B Morgan** **CORE**
EGTM60 **Aerospace Materials Engineering** **10 Credits** **Prof C Pleydell-Pearce** **CORE**	**EGSM00** **Structural Integrity of Aerospace Metals** **10 Credits** **Prof C Pleydell-Pearce** **CORE**
EGTM79 **Environmental Analysis and Legislation** **10 Credits** **Prof GTM Bunting** **CORE**	
EG-M194 **MSc Industrial Experience Preparation** **0 Credits** **Dr V Samaras**	
EG-M39 **MSc Industrial Experience** **60 Credits** **Dr V Samaras** **CORE**	
Dissertation	
EG-D06 **MSc Dissertation - Materials Engineering** **60 Credits** **Dr A Das** **CORE**	
Total 180 Credits	

Optional Modules

Choose exactly 50 credits

The following modules must be chosen by graduates without Swansea Materials degree

EG-M73	Composite Materials	Dr FA Korkees	TB2	10 (CORE)
EGIM16	Communication Skills for Research Engineers	Dr SA Rolland/Dr T Lake	TB1	10 (CORE)
EGTM88	Ceramics	Prof DA Worsley/Dr RS Bolton	TB2	10 (CORE)
EGTM89	Polymers: Properties and Design	Dr S Sharma	TB2	10 (CORE)
EGTM92	Physical Metallurgy of Steels	Dr E Sackett	TB1	10 (CORE)

Or

Choose exactly 50 credits
The following modules must be chosen by Swansea Materials graduates

EG-M122	Group Project (Mechanical & Materials)	Prof DT Gethin	TB1+2	30 (CORE)
EG-M47	Business Leadership for Engineers	Dr A Munnangi/Dr AS Walters	TB2	10 (CORE)
EGTM71	Power Generation Systems	Dr M Togneri	TB1	10 (CORE)

EG-D06 MSc Dissertation - Materials Engineering

Credits: 60 Session: 2022/23 June-September

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr A Das

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

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

Module Aims: The module aims to develop fundamental research skills. It comprises the development of supervised research work leading to a dissertation in the field of the Master's degree programme. The specific research topic will be chosen by the student following consultation with academic staff.

Module Content: Study for the dissertation, which may be based on practical, industrial, or literature work, or any combination of these, is primarily carried out over a period of about 12 weeks, with the dissertation being submitted at the end of September. Preparatory work on the dissertation may take place during Part One of the programme but students will only be permitted to submit their dissertation following successful completion of Part One.

In conducting the research project and dissertation the student will be exposed to all aspects of modern information retrieval processes, the organisation and resourcing of research and the organising and presentation of experimental data. The student must make inferences on conclusions, based on the evidence provided and supported by the research work. Furthermore they must assess the significance of this work in relation to the field and make suggestions about how further work could improve or clarify the research problem. The results of the project will be disseminated in a substantial dissertation demonstrating the student's ability to research a subject in depth.

The student will meet regularly with the supervisor to ensure that the project is well developed and organised. Progress will be monitored.

Intended Learning Outcomes: Technical Outcomes
On completion of this module, students should have the ability to:
• Investigate a research topic in detail;
• Formulate research aims;
• Devise and plan a research strategy to fulfil the aims;
• Carry out research work - undertake a literature search, a laboratory based or computer based investigation or a combination of these;
• Gather, organize and use evidence, data and information from a variety of primary and secondary sources;
• Critically analyse information;
• Make conclusions supported by the work and identify their relevance to the broader research area;
• Resolve or refine a research problem, with reasoned suggestions about how to improve future research efforts in the field; and
• Produce a report (dissertation), with the findings presented in a well organised and reasoned manner.

Accreditation outcomes (AHEP)
- A comprehensive understanding of the relevant scientific principles of the specialisation (SM7m)
- A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM8m)
- Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects (SM9m)
- Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA6m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods (EA7m)
- Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies (D9m)
- Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D10m)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL11m)
- Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk (EL13m)
- Advanced level knowledge and understanding of a wide range of engineering materials and components (P12m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9m)
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)
Monitor and adjust a personal programme of work on an on-going basis (G3)

Assessment: Report (100%)

Assessment Description: The research project and dissertation forms Part Two of the Masters degree.

Students should refer to:
https://www.swansea.ac.uk/academic-services/academic-guide/postgraduate-taught-awards-regulations/standard-taught-masters/

In particular, section 14 will provide further Information about dissertation preparation and submission.

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

Each student is to submit an electronic copy of their dissertation through the Turnitin link on Canvas. The online system will automatically check the similarity of the report.

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

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

Deadlines as follows:

MSc Materials Engineering (without resits) - September 30th

MSc Materials Engineering (with resits) - December 15th

Moderation approach to main assessment: Universal double-blind marking

Assessment Feedback: Informal feedback will be given during regular meetings with supervisors. The supervisor will also provide an assessment of the project drafting skills during the planning of the dissertation. Work will be returned according to specified deadlines and accompanied by constructive comment.

A Feedback session will be given to any student who fails their dissertation and is permitted by the Award Board to resubmit their work.

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

Additional Notes: 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.

If an extension is deemed appropriate a Postgraduate Taught Masters 'Application for Extension to the Submission Deadline/ Period of Candidature' Form will need to be submitted as follows:

• 30 September – deadline for Part Two students (non-resit students).
• 15 December – deadline for Part Two Students (students who had resits).

EG-M106 Polymer Processing

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules: EG-M103

Lecturer(s): Dr A Rees

Format: 20 hrs lectures
10 hrs laboratory
70 hrs Directed private 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

Lectures/Laboratory demonstrations

Module Aims: The module will provide a deeper understanding of the technology of plastics processing. The material covered will cross cut the engineering disciplines of advanced manufacturing technology and polymer science to broaden the technical and industrial context of polymer processing. Within the content of the module simulation software will be applied to industrial case study examples for critical evaluation. In addition, the application of polymer replication technologies within the emerging field of micro manufacturing will be presented, focusing on the advantage and limitations of size effect and length scale integration. The module will include practical demonstration laboratories and also include industrial visits.

Module Content:

• Injection moulding: processing cycle
• Material selection criteria and processing consideration
• Computational simulation
• Microcellular injection moulding
• Polymer melt rheology
• Mould cooling systems

Intended Learning Outcomes:

Accreditation Outcomes (AHEP)
MEng:
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9m)
- Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes (EA1m)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- Understanding of appropriate codes of practice and industry standards (P6)

MSc:
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9m)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL11m)

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

Assessment Description: Two hour examination, choice of three questions out of four.

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

Assessment Feedback: Examination feedback is given using the Faculty of Science and Engineering standard form.

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

MEng finalists 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.

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

Available to visiting and exchange students.

The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment. Late assignments will not be marked.

EG-M122 Group Project (Mechanical & Materials)

Credits: 30 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof DT Gethin

Format: Group allocation and team building at start of the project followed by practical sessions group and individual work, meetings with Industrialists as arranged. At least 6 meetings per session with academic and industrial supervisors.

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

Project briefing (module coordinator/academic supervisor(s)), group meetings, preparation of initial and final design (supervision and group work), report writing, poster and viva presentations and/or interview sessions.

After a team and project allocation there will be an initial discussion with the academic and/or industrial supervisors. Students will be in direct contact with the supervisors as appropriate. Thereafter, regular group meetings will be arranged typically biweekly during the term time. The project progression will be made in accordance with the project requirements and guideline. Details on the project requirements for students (i.e. deliverables with respective submission deadline) will be announced by the module coordinator at the project briefing session and/or via Canvas.

Module Aims: This module enables students to participate in a group activity involving a multi-disciplinary approach to achieve a solution to a specific engineering problem. In most instances it will involve either direct interaction with industry or will be an industrially-related project. Issues other than providing a purely technical solution to the problem will have to be considered in order to achieve a satisfactory outcome to the project.

Module Content: Formulating a full design specification that meets all the likely requirements throughout the working life of the 'product' or 'system'. Consideration of aspects such as: material selection, failure and risk, safety and environmental impact, sustainability, health and safety, maintenance and serviceability, also fitness for purpose and cost implications. Production of a construction/manufacturing/assembly/integration/testing strategy. Consideration of Economic Considerations and Business Plan.

Intended Learning Outcomes:

Technical Outcomes

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

- Demonstrate a comprehensive knowledge and understanding of the integral 'total design' process (i.e. understanding and evaluating business, customer and user needs) and project management skills in relation to decision-making and business development in a typical group environment.
- Critically evaluate the design problems and understand how to apply a range of mathematical and statistical methods, tools and notations proficiently and lead to the solution of engineering design problems.
- Demonstrate self-direction and originality in tackling and solving problems, use of computational models relevant to the engineering discipline and an appreciation of their limitations, and act autonomously in planning and implementing tasks at a professional or equivalent level.
- Identify, classify and describe the performance of systems, subsystems and components through the use of engineering principles, analytical methods and modelling techniques.
- Identify any constraints such as environmental and sustainability limitations, health and safety, security and risk issues, legal, intellectual property, codes of practice and standards wherever relevant and applicable.
- Have awareness of developing technologies related to the fields of mechanical/materials engineering in particular and thereby generating an innovative design for products, systems, components or processes to fulfill new needs (i.e. the design to be verified against the specification and validated against the customer requirement, if any).
- Apply advanced problem-solving skills, technical knowledge relevant to the engineering discipline 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.
- Deal with complex issues both systematically and creatively, use fundamental knowledge to investigate new and emerging technologies, make sound engineering judgement in the absence of complete data, and communicate their conclusions clearly.

Plan for effective project implementation. This includes an ability to:

- Plan and manage the design process, including change control (project plan and conceptual phases to preliminary and detail design phases);
- Identify the factors affecting the project implementation (e.g. commercial, economic and social context of engineering processes and their industrial constraints, current practice and its limitations, technical uncertainty, etc.);
- Understand the key drivers for achieving business success (e.g. competitive advantage, innovation, commercial risks and customer satisfaction, etc.).

Plan, organise, delegate, monitor-control tasks, people and resources to deliver a project. This includes an ability to:

- Apply skills in problem solving, communication, working with peers, information gathering and management, and the effective use of computing and laboratory facilities;
- Plan self-learning and make necessary adjustment to improve performance through monitor-control cycle on an on-going basis;
- Organise and lead work teams, coordinating project activities (understanding of different roles within a project team and take initiative and personal responsibility).

Accreditation Outcomes (AHEP)

- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems (SM2m)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively (SM3m)
- Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes (EA1m)
- Awareness of developing technologies related to own specialisation (SM4m)
- Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects (SM6m)
- Ability to 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, using alternative approaches and understanding their limitations, in order to solve engineering problems and implement appropriate action (EA3m)
- Understanding of, and the ability to apply, an integrated or systems approach to solving complex engineering problems (EA4m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- 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)
- 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)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
- Knowledge and understanding of management techniques, including project and change management, that may be used to achieve engineering objectives, their limitations, and how they may be applied appropriately (EL3m)
- Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction (EL7m)
- 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 different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader (P11m)
- 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)
- Monitor and adjust a personal programme of work on an on-going basis (G3m)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)
- Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards (M5)

MSc
- A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM8m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA6m)
- Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods (EA7m)
- Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D10m)
- Awareness of the need for a high level of professional and ethical conduct in engineering (EL8m)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9m)
- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation (EL10m)
- Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk (EL13m)
- Ability to apply engineering techniques taking account of a range of commercial and industrial constraints (P10m)
- Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader (P11m)
- 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)
- Monitor and adjust a personal programme of work on an on-going basis (G3m)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)

Assessment: Group Work - Project (100%)

Assessment Description: Assessment will be 60% for the group and 40% for the individual's contribution to the group. In assessing the project, considerable importance will be placed on the following aspects:
• Final design specification;
• Technical engineering analysis (hand calculations, numerical and computational analysis, 3D modelling and simulation, prototyping and testing wherever relevant to the project);
• Material selection;
• Cost analysis;
• Manufacturing techniques;
• Sociological impact on the environment, sustainability, etc.
• Business plan.

The group mark will be based on the written report, together with the assessment of a poster display that each group will be required to produce, and will be scaled by using peer review assessment.

The individual mark will be based on the assessment of three aspects:
• The individual project management and progress report;
• The individual contribution to the final report;
• The oral interview.

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

Assessment Feedback: Feedback will be given by supervisors as regular part of meetings with students. Formal verbal/written feedback will be provided on the assessed parts of the project.

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.

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

NOT AVAILABLE to visiting and exchange students.

EG-M194 MSc Industrial Experience Preparation

Credits: 0 Session: 2022/23 Academic Year

Pre-requisite Modules: EG-M39

Co-requisite Modules:

Lecturer(s): Dr V Samaras

Format: 11 hours consisting of a mix of seminars and workshops. 11 one hour drop-in advice sessions. Review of CV and cover letter.

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

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

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

Module Aims: This module aims to prepare students for the 60 credit industrial experience module - EG-M39 MSc Industrial Experience
which is required as part of the MSc with Industry programmes.

Preparation will include meetings with the assigned academic staff member who will act as supervisor for the industrial experience module and they will guide students via weekly interactions.

Module Content: NA

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)
- Plan and carry out a personal programme of work, adjusting where appropriate (G3)
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)

Assessment: Participation Exercise (100%)

Assessment Description: Pass/Fail for engagement.

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

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: NA

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 to students undertaking one of the 2-year MSc schemes "with industry" within the Faculty of Science and Engineering.

This module is non-credit bearing and has no assessments, instead it aims to prepare students for the 60 credit industrial experience module - EG-M39 MSc Industrial Experience which is required as part of the MSc with Industry programmes.

EG-M37 Additive Manufacturing

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules: EG-M103

Lecturer(s): Prof NPN Lavery

Format: 10x2hr lectures/seminars/example classes
10x2hr practical demonstrations
8x1hr office 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

- There will be 10 x 1hr lectures over the full semester, 5 x 1hr seminars, which will include 2-3 revision classes.
- There will be 2 x 1hr invited guest lectures with speakers from industry working in additive manufacturing and the production of metal powders.
- A group project (30%) - Each week there will be a 2hr practical laboratory where which students will undertake studies on AM components as set per their projects. At the end of the assignment, students will give a short presentation (5%), and upload their CAD files (5%). A short report (20%) will be required on their practical assignment which will be due at the end of the term.
- There will be 5 Canvas tests (20%) based on online video learning, which will be done every other week throughout term.
- The remaining 50% weighting will be assessed by examination.
- There will be 10x1hr office hours.

Module Aims: 1.1 Introduction to Additive Manufacturing
1.3 Additive Manufacturing Processes
1.3 Applications of Additive Manufacturing
1.4 Mechanics of the Powder Bed System
1.5 Physics of Additive Manufacturing
1.6 AM Defects and Process Control
1.7 Measurement and analysis of AM properties
1.8 Computer Aided Engineering of AM Parts
1.9 Powder Metals
1.10 Design for AM and part preparation

Module Content:
Chapter 1 – Module overview (1 lecture)

Chapter 2 – Additive Manufacturing Processes (1 lecture)
This chapter gives a refresher of manufacturing processes, and places additive manufacturing processes in the general context of manufacturing. In this chapter you will also revise how to perform techno-economic calculations on manufacturing processes which later on will help you decide which production route is most suitable for a given component. The second part of this chapter gives a bit of recent history, describing the evolution of additive manufacturing from its origins in rapid prototyping. The final section of this chapter gives a top-down approach to the classification of different additive manufacturing technologies, and a machine-by-machine description of commercially available systems. It will be reiterated that due to the rapidly changing nature of AM, only a small number of case-studies are included in these notes, and that more complete and up-to-date case-studies will be given in the lecture presentations.

Chapter 3 – Additive Manufacturing Applications (1 lecture)
This chapter describes applications via a series of case studies. Only a number of case studies are included in these notes, and that more complete and up-to-date case studies will be given in the lectures. We introduce the concept of a TRL level to be able to differentiate between the readiness of additive manufacturing technologies with respect to more mainstream (traditional) processes. Finally, some case studies will be shown for various sectors.

Chapter 4 – Mechanics of Additive manufacturing (1-2 lectures)
This chapter comes in two parts. In the first part you will get a practical overview of a specific powder bed system, with a breakdown of each of the different parts of the machine much the same way as you would in an operator training course. Hopefully this will be accompanied by a visit to the ALM laboratory as seeing the machine in action is a much better way to learn about it. In the second part of this chapter we will go into more details about the specific interaction of the laser and the powder, and the consolidation process leading to process maps for specific process control parameters such as exposure time, point distance and hatch spacing.

Chapter 5 – Physics of Additive Manufacturing (1-2 lectures)
In this chapter we will go into more depth into the physics of additive manufacturing processes, specifically processes which use a laser as a heating source. Some aspects are specific to metal powder-bed based systems, but others could equally be applicable to extrusion plastic systems, wire extrusion or electron beam systems, basically anything that requires a thermal heat source for the material consolidation. The chapter builds a fundamental knowledge which will lead to a better understanding of some of the root causes of defects and best material properties available from AM.

Chapter 6 – AM Defects and Process Control (1-2 lectures)
In this chapter we introduce some of the common defects which are associated with parts made by Additive Manufacturing. We will go into more details about the specific interaction of the laser and the powder, and the consolidation process leading to process maps for specific process control parameters such as exposure time, point distance and hatch spacing. These are related to AM defects. Additionally, we introduce Taguchi or ANOVA (Analysis of variances) in the context of AM process parameters, as a means of optimising the machine settings.

Chapter 7 – Measurement and analysis of AM material properties (2 lectures)
This chapter gives an overview of material properties and measurement techniques used for parts/materials made by AM. The content is mainly used to emphasise some of the sections in previous chapters where the material properties have already been introduced. There will be no worked examples for this chapter as the content is embedded within examples introduced in the other sections.

Chapter 8 – Computer Aided Engineering of AM parts (1 lecture)
This chapter gives an overview of the many ways in which Computer Aided Engineering can be applied to Additive Manufacturing. Modelling is playing an increasingly important role in AM. Currently most efforts continue to go towards the understanding of the process, at multiple different length scales. However, the digital nature of AM will mean that at some point in the future there will be a convergence of the modelling to enable a full virtual design of the component prior to the build.

Chapter 9 – Powder Metals (1-2 lectures)
In this chapter, you will learn how powders are characterised using Powder Size Distributions, Morphology and Physical properties (tap density, apparent density …). You will learn about the various metal powder production routes from both a primary and secondary feedstock, including Physical/gas atomisation processes which are the main

route for AM powder production. Of these, gas or plasma atomisation can produce powders which are ideal for AM processes, due to tight powder size distributions, low impurities and a good (rounded) morphology which can be repeated from batch to batch, leading to more reliable mechanical properties in AM parts.

Chapter 10 – Design for AM and component preparation (1-2 lectures)
This chapter will cover some of the design and part preparation procedures associated with powder bed fusion systems. General design rules arise due to the digital fabrication nature of AM, and these have consequences on the mechanical properties of the build. These are discussed and put in the more general context of efforts to standardise AM processes and materials. The combination of design constraints and material properties have to be considered when selecting the appropriate AM process, but this is by no means straight forward or definitive at the current time. This work will link directly into the practical project.

Practical Project (Group project worth 20% of module)
The learning objectives of the practical on this module is to maximise your knowledge of AM by exposing you to the practical nature of 3D metal printing. Specifically developing your knowledge of products designed specifically for AM looks to bring out the creative side of your engineering skills guided by knowledge of the process limitations of 3D printing.

The assignment, worth 20% of this 10-credit module, is comprised of a report which should not be more than 10 pages (excluding appendices but including 4-5 references). The report can be written together as a group, but there needs to be a clear indication of the contribution of each individual student, and this is weighted at 20%.
To maintain the creative nature of the assignment the overall structure of the report is left free to be determined by the group, except for two sections and the appendices. Namely, the "Executive Summary" and the "Individual Contribution" which should be written in the individual student’s own words.
In the first week after the Easter Recess, on the Monday, each group must present a short 5 minute/3 slide presentation on their project and component. This will be judged but not marked and will provide feedback for the assignment report.
The assignment should be uploaded by each student to Turnitin on Canvas in PDF format by the deadline.

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the students will:
LO1 learn the basic terminology and principles of AM technologies
LO2 learn general capabilities and limitations of AM with respect to other manufacturing technologies
LO3 learn classifications of metal-based AM technologies
LO4 be able to compare AM technologies and select for specific design/manufacturing applications
LO5 develop an in-depth understanding of specific metal-based laser powder-bed system
LO6 learn about design constraints, and the practicalities of setting-up builds and running AM machines
LO7 learn about the underlying physics of lasers, and thermal transfer of laser-powder interaction
LO8 learn how process maps are developed for specific materials and AM machines
LO9 learn how to select optimal machine parameters from process maps
LO10 understand the causes of errors and failures in AM parts, how to identify and avoid them
LO11 learn to identify features of part design and material which will be problematic for AM, and suggest alternatives
LO12 learn how scientific methodologies such as Design of Experiments are used to optimise machine parameters
LO13 learn about important research challenges in AM such CAE of melt pool/residual stress modelling
LO14 learn how to evaluate and select best build orientations and prepare a build report
LO15 plan, produce and evaluate a novel 3D metal printed component specifically designed for AM

Accreditation Outcomes (AHEP)

MEng:
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems (SM2m)
- Awareness of developing technologies related to own specialisation (SM4m)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- Ability to apply relevant practical and laboratory skills (P3)

MSc:
A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM8m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- Monitor and adjust a personal programme of work on an on-going basis (G3)

Assessment: Examination 1 (50%)
Coursework 1 (30%)
Coursework 2 (20%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: 2 hr examination where students attempt 3 out of 4 questions (50%).

A practical done in a group worth 30% of the module, but which is graded individually per student.

5 Canvas tests each worth 4% throughout term (20%).

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

Assessment Feedback: Coursework 1 (C1) - A practical done in a group worth 30% of the module, but which is graded individually per student. The learning objectives of the practical on this module is to maximise your knowledge of AM by exposing you to the practical nature of 3D metal printing. Specifically developing your knowledge of products designed specifically for AM looks to bring out the creative side of your engineering skills guided by knowledge of the process limitations of 3D printing. The assignment is comprised of a report which should not be more than 10 pages (excluding appendices but including 4-5 references). The report can be written together as a group, but there needs to be a clear indication of the contribution of each individual student, and this is weighted at 20%. To maintain the creative nature of the assignment the overall structure of the report is left free to be determined by the group, except for two sections and the appendices. Namely, the "Executive Summary" and the "Individual Contribution" which should be written in the individual student¿s own words. In the first week after the Easter Recess on the Monday each group must present a short 5 minute/3 slide presentations on their project (5%) and the actual CAD of the component (5%). This will be judged and provide feedback for the assignment report. The assignment should be uploaded by each student to Turnitin on Canvas in PDF format by the deadline.

During lectures the students will go through example questions. Standard examination feedback form is available for students after the exam.

Coursework 2 (C2) - worth a total of 20% will be made up of 5 Cavas tests (4% each) done at intervals throughout term. The tests will be a combination of multiple choice and calculated questions with automated feedback on Canvas. Students will have up to 5 attempts to get the highest scores.

Failure Redemption: 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.

EG-M39 MSc Industrial Experience

Credits: 60 Session: 2022/23 Academic Year

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr V Samaras

Format: 10 hours introductory teaching
28 hours individual supervision meetings
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

There will be an intensive period of taught delivery, covering the roles of a professional engineer, health and safety, environmental and ethical concerns, working practices and project / time / resource management.
This will be followed with an industrial experience placement either spent entirely in the University on a collaborative project within the University with shorter industrial site visits or partly within paid industrial employment with close supervision from the University supervisor.

Module Aims: This module provides industrial experience within an Engineering context in the UK. The experience will be gained through a 32 week industrial placement, at least part of which will be spent within the University on a collaborative R&D project undertaken with significant industrial collaboration. Some of the placement may be spent in a paid industrial role in some cases. The module will be assessed on a pass / fail basis against criteria matching the some of the Engineering Council's requirements for professional engineering recognition in the UK.

Module Content: Prior to the placement a number of pre-placement sessions will take place in order to provide further explanation on

Health and Safety assessment.
Placement academic requirement

This will be followed by industrial experience which will extend these abilities in real-world environments.
The industrial experience will be guided by an academic supervisor with interaction on a regular basis.

Intended Learning Outcomes: A knowledge and understanding of:
The working environment in an Engineering context

An ability to:
Apply their developed knowledge to an industrial project(s)
Work independently and/or as a member of a team
Make a significant contribution to the project(s)

Learning Outcomes (AHEP)
- Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects (SM9m/SM3fl)
- Ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D11m/D3fl)
- Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk (EL13m/ET6fl)
- Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints (P10m/EP3fl)
- 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: Report (20%)
Report (60%)
Poster (20%)

Assessment Description: Assessment will be via three pass / fail components. These will comprise:

1 Placement Report: The student is expected within the first few months of the placement to complete a report which includes an overview health and safety as well as his/her main responsibilities in the placement.

2 Final Placement Report: This report summarise the students year in industry placement/ project experience. The report will include a reflective section covering the student's role in the engineering placement / project, highlighting their personal initiative and their role in the evaluation of new engineering concepts.

3 Recorded Presentation: Every student is expected to record and submit through canvas a maximum 5 minutes PowerPoint presentation video summarising his/her MSc Year in Industry placement.

A number of formative assessments will be assigned during the course and based on the nature of student placement/ project.

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

Assessment Feedback: Individual written feedback will be provided for components 1 to 3 above. Verbal feedback on the presentation will be provided.

Failure Redemption: Resubmission of any failed component by August of year 2.

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 to students undertaking one of the 2-year MSc schemes "with industry" within the Faculty of Science and Engineering.

EG-M47 Business Leadership for Engineers

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr A Munnangi, Dr AS Walters

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

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

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

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

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

Intended Learning Outcomes:
Technical Outcomes
On successful completion of this module students will be expected, at threshold level, to be:
- Demonstrate an understanding of current leadership issues. Critically appraise theories and approaches to leadership and at the same time reflect on personal leadership aspects.
- Knowledge to assess the basic factors that must be considered for a business formation. Use of basic level strategy and innovation methods in order for an organisation to gain competitive advantage. Critically evaluate the rationale for utilising methods for idea generation/innovation.
- Have awareness of theoretical perspectives and approaches to change management in organisational environments. Synthesise the relationship between the external context of an organisation and its internal context and their impact on its strategic direction.
- Demonstrate and appraise, entrepreneurial way of working, team development and communication skills

Accreditation Outcomes (AHEP)

- 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)
- Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D8m)
- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation, (ET3fl)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate, (ET4fl)
- Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk. (ET6fl)
- Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction. (ET7m)

Assessment:	Group Work - Coursework (80%) Online Class Test (10%) Online Class Test (10%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Online Test 1 Assessment level marking - PGTM March 10%
Online Test 2 Assessment level marking - PGTM March 10%
Group Work Coursework Assessment level marking - PGTM April 80%

The group (5/6) assignment will require application of the "key skills" and innovation development tools to generate solutions for real-world scenarios – report (40 pages) and development of Business Canvas.

This module is assessed by a combination of group-based and individual assignments (quiz-1 and quiz-2). In the main exam, the marks students get in quiz -1 and quiz-2 will add to the marks the individual gets in the group assignment project. For the resit exam, the quiz-1 and quiz-2 marks will not add to the project.

Moderation approach to main assessment: Partial second marking

Assessment Feedback:
Continuous group feedback on "out-comes" of workshops, after submission of coursework 1 at request during open-tutorials.

Failure Redemption:
Exam resits according to University regulations.
100% coursework.

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

Related assignments are used to assess this module.

This module is assessed by a combination of group-based and individual assignments. In order for the individual assessment marks to count, you must achieve at least 40% in the group-based assignment. If you achieve less than 40% in the group-based assignment, then the module mark will be just the group-based assignment mark.

EG-M73 Composite Materials

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr FA Korkees

Format: 20 hrs Lectures
6 hrs Example classes/Tutorials
46 hrs Directed private study
30 hrs Preparation for assessment
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

Lectures and examples classes will be delivered on-campus.
Assessment is via an in-person (on campus) Examination (75%), and Assignment (25%).

Module Aims: A detailed coverage of current polymer, metal and ceramic matrix composite systems for engineering applications focusing on their performance envelope, advantages and limitations.

The units will cover the following:
- The components and their attributes - an overview (reinforcements, matrices and interfaces),
- Properties of the matrix materials (Thermosets/thermoplastics, metals, ceramics, structure and mechanical behaviour),
- Properties of fibres and particles (Glass fibres, organic fibres, carbon fibres, ceramic particles and fibres; processing, structure, mechanical response),
- Composite manufacture (Piles, weaves, preforms, moulding pultrusion, filament winding, powder metallurgy, casting spraying),
- Mechanics of reinforcement (Rule of mixtures, anisotropy, laminate structures, stress- strain response),
- Basic stress analysis and failure mechanisms (Stress transfer and partitioning, multiple failure events, progression of fracture, toughness),
- Fatigue design considerations (Damage progression, reinforcement effects); Calculations.
- Environmental effect on / of composites and joining techniques

Module Content: A detailed coverage of current polymer, metal and ceramic matrix composite systems, focusing on their performance envelope, advantages and limitations.

The units will cover the following:
• The components and their attributes - an overview (reinforcements, matrices and interfaces), (3 hrs)
• Properties of the matrix materials (Thermosets/thermoplastics, metals, ceramics, structure & mechanical behaviour), (2 hrs)
• Properties of fibres and particles (Glass fibres, organic fibres, carbon fibres, ceramic particles and fibres; processing, structure, mechanical response), (2 hrs)
• Composite manufacture (Plies, weaves, preforms, moulding, pultrusion, filament winding, powder metallurgy, casting spraying), (2 hrs)
• Mechanics of reinforcement (Rule of mixtures, anisotropy, laminate structures, stress- strain response), (3 hrs)
• Basic stress analysis and failure mechanisms (Stress transfer and partitioning, multiple failure events, progression of fracture, toughness), (3 hrs)
• Fatigue design considerations (Damage progression, reinforcement effects); (3 hrs)
• Environmental effect on / of composites and joining techniques ; (2hrs)

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student will have:
- A detailed understanding and wide-ranging knowledge of the engineering usage of composite materials.
- Appreciation of the important inter-relationship between structure, processing and properties for advanced materials.
- The ability to undertake structural design calculations for composite materials.

Accreditation Outcomes (AHEP)
MEng
- A comprehensive knowledge and understanding of the scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1m)
- Awareness of developing technologies related to own specialisation (SM4m)
- Understanding of, and the ability to apply, an integrated or systems approach to solving complex engineering problems (EA4m)

MSc
- A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM8m)
- Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects (SM9m)
- Advanced level knowledge and understanding of a wide range of engineering materials and components (P12m)
- 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)

Assessment: Examination (75%)
Assignment 1 (25%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Assessment is via an Examination, worth 75% and Assignment 1 (25%) which is a 1500 word report. The quality of English does not form part of the assessment.

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

Assessment Feedback: Standard examination feedback form available for all students after the examination. Students will receive individual feedback comments for the assignment via Canvas.

Failure Redemption: Resit examination worth 100% in August.

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.

Detailed course material provided on Canvas which students should engage with in their own time.

PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

EG-M83 Simulation Based Product Design

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr AJ Williams, Mr B Morgan

Format: Lectures 6, Computer Lab 20, Reading/Private Study 20, Preparation for Assessment 54

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

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

Lectures and Computer Laboratory sessions will be delivered on campus.

Module Aims: This module provides an overview of the role that simulation can play in the design process of a product. A series of lectures introduce computational modelling and the computational tools and techniques employed in the design process. The application of simulation in the design of a number of industry based research projects is presented. Computer workshops lead students in using simulation tools and applying the tools in the optimisation of the design of a product.

Module Content:

• Introduction to computational modelling and the use of simulation in the design process: Examples, advantages, disadvantages.
• Information about commercial packages for each stage of the design process.
• Overview of steps involved in the modelling process; Identification of the physics involved, The effect of problem simplifications and assumptions on the solution, Determining an appropriate analysis type, The importance of validation.
• Introduction to steps involved in computational modelling, CAD and meshing: Examples of common problems associated with these stages of the design process and techniques to avoid them; importance of solution mesh independence, Solution procedures, simulation solver software, Post-processing, Interpretation of results, visualisation and optimisation,
• Introduction to software tools used in this module, CAD, meshing, analysis and visualisation packages.
• Analysis techniques: Overview of finite difference, finite volume and finite element methods, their advantages and disadvantages, and common applications for each method type.
• Case studies: application of the knowledge gained during the lectures to a) investigate the importance of solution mesh independence and b) optimise the design of a product using simulation.

Intended Learning Outcomes:
Technical Outcomes
On completion of this module the student will:
- Have the ability to apply computer-based models for solving problems in engineering and recognise the factors that influence model limitations. Assessed using Assignment 1 and 2.
- Demonstrate the ability to develop and apply a test strategy to produce an optimised design. Assessed using Assignment 2.
- Demonstrate an understanding of the modelling process and the role of simulation in design. Assessed using Assignment 2.

Accreditation Outcomes (AHEP):

MEng:
- Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and implement appropriate action (EA3m)
- A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations (SM5m)
- Work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies (D3m)
- Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D7m)
- Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics (D1)

MSc:
- Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA6m)
- Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies (D9m)
- Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D10m)

Assessment: Assignment 1 (20%)
Assignment 2 (80%)
Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description:
• Assignment 1: Mesh Sensitivity Study.This is an individual piece of coursework.This coursework will involve the investigation of the influence of mesh dependence, convergence criteria and physical phenomena on a simulation solution. The results of the investigation will be presented in a written report (maximum of 15 pages).
• Assignment 2: Design Optimisation. This is an individual piece of coursework.This coursework will require the student to use simulation tools to optimise the design of a component subject to given criteria.The student will also be required to show their understanding of the role that simulation plays in the design process using examples presented within the module.This coursework will be presented in a written report (maximum of 20 pages).
• Assignment 3: Supplementary Coursework.This is an individual piece of coursework.This coursework will require the student to use simulation tools to investigate and optimise the design of a given device.This coursework will be presented in a written report (maximum of 20 pages).

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

Assessment Feedback: Individual written feedback will be given using Canvas. An overall assessment of the cohort's performance for the coursework will also be published on Canvas.

Failure Redemption: A supplementary piece of coursework will be set which will form 100% of the mark. This assessment will cover the learning outcomes of both coursework 1 & 2.

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

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

EG-M85 Strategic Project Planning

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr K Wada

Format: Lectures and Case Studies 13-15 hours; Project Monitoring 7 hours (project briefing, project update and presentations); Private Study 78-80 hours (reading, group work, exam preparation)
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 combination of case study, project briefing/update and group work sessions.
Practical group work sessions (50%) will be arranged in order to grasp the project management techniques and effectively apply them to form a 'High Performance Team'. This coursework assessment (CA) is comprised of a group project and group presentation.
Examination - Closed Book (50%) at the end of the semester.

Module Aims: This module has been accredited by the professional body - the Association for Project Management (APM). At the end of this course students will be able to recognise and define the key characteristics and components of a project, understand the advantages/disadvantages associated with the management of both small and large projects, and have an appreciation of the strategic tools and techniques available to enable effective or efficient project management leading to a 'High Performance Team'. The acquired skills will be reinforced by the completion of a group project to produce an initial feasibility report (e.g. a business case/project management plan document) for a major regional project.

Module Content: 1) Lectures: series of lectures will be conducted and/or recorded to cover the fundamentals of strategy and project management. Various tools and techniques used by a project manager at large in the industry will be demonstrated with figures/diagrams/tables/videos and further elaborated through relevant examples.
Intended coverage of syllabus (as recommended by APM):
1. Structure of organisations and projects
2. Project life cycle
3. Project contexts and environments
4. Governance and structured methodologies
5. Communication
6. Leadership and teamwork
7. Planning for success
8. Scope management
9. Schedule and resource management
10. Procurement
11. Project risk management and issue management
12. Project quality management

2) Case study/Webinar: internal/external guest speaker(s) will be invited to give talks on some of the topics on project management, an hour session each.

3) Project briefing and update: information on CA (including but not limited to project titles, group allocation, project manager/assistant manager nominations, marking scheme, report format, and presentation arrangement) will be announced during these sessions. Frequently asked questions (FAQs) will be answered in the meantime.

4) Group work and Presentation: dedicated hours will be provided for the group work (i.e. dealing with CA task). No lectures during these sessions. With regard to CA, dedicated time slots will be arranged for the final presentation.

Intended Learning Outcomes: Technical Outcomes
On successful completion of this module students will be expected, at threshold level, to be able to:
- Demonstrate a comprehensive knowledge and understanding of project management - the nature of both small and large projects, the issues and constraints such as environmental and sustainability limitations; ethical, legal, health, safety, security and risk issues; the tools available to manage the project - and critically evaluate them and apply the tools effectively in projects to communicate the outputs to technical and non-technical audiences. (Assessed by Coursework report, Presentation and Exam; or Resit Exam)
- Use fundamental knowledge to investigate new and emerging technologies via application of strategy such as PESTLE analysis, SWOT analysis and Porter's generic strategies as a means not only to understand the key drivers for business success pertaining to the commercial, economic and social context of engineering processes, but also to identify, compare and evaluate competitive advantage, cost leadership, differentiated product/services, or niche markets. (Assessed by Coursework report, Presentation and Exam; or Resit Exam)
- Have awareness of relevant legal and contractual issues, as well as quality issues and their application to continuous improvement (i.e. quality planning, quality assurance, quality control and continuous improvement). This requires the demonstration of knowledge, interpretation and application of project management theory and practice. (Assessed by Coursework report, Presentation and Exam; or Resit Exam)
- Demonstrate a comprehensive knowledge and understanding of the role of a project manager - an ability to exercise initiative and personal responsibility: i) understand the team members' characteristic and their needs; ii) delegate project activities and find ways to resolve conflicts through effective communication to build a 'High Performance Team'; and iii) understand and evaluate business, customer and user needs. (Assessed by Coursework report, Presentation and/or Resit Exam)

Accreditation Outcomes (AHEP)
- 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)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (ET2fl)
- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation (ET3fl)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (ET4fl)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP2fl)
- Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints (EP3fl)
- Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader (EP4fl)

Assessment: Examination 1 (50%)
Coursework 1 (50%)

Assessment Description: Coursework 1 is a group project allocated during the lecture series. Examination 1 is a standard closed book examination.

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

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

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

Assessment Feedback: Informal feedback is given during lectures, project briefing/update sessions, group presentations, and at group work meetings. Formal feedback is given via standard College of Engineering feedback protocols.

Failure Redemption: Failure Redemption of this module will be by repeating an equivalent coursework and/or exam to any component in which a pass mark was not achieved.

Marks achieved in assessment component passed during the first attempt will automatically be transferred to the equivalent component in the resit.

No opportunity to resit the passed component.

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.
Available to visiting and exchange students wishing to enhance project management skills.

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

Office hours, lecture notes and other teaching materials and notifications will be posted on Canvas.

EGIM16 Communication Skills for Research Engineers

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr SA Rolland, Dr T Lake

Format: Lectures (10h), Exercises (20h), Reading / Private Study (30h), Preparation for Assessment (40h)

Delivery Method: The module will be delivered on campus and partially online.

Module Aims: Communication at a research level differs from that at the undergraduate level in that it is usually driven by an output or result rather than the requirement to show knowledge or understanding. The skill of a good communicator at research level lies in efficiently and rigorously conveying the ideas behind the theory and proof of the research output. Verbal, written, visual and group communication will be explored through a series of lectures and formative exercises.

Module Content:

Written Communication: [6 hours]
• The usual layout of reports, theses, journal & conference papers.
• How to write a good abstract for a research output.
• What should be in the introduction
• Contents of the main body of a research output.
• Effective conclusions
• Writing style
• Cross-referencing, captions, references
• Critical review of self and others
• Design concepts for research posters

Oral Communication: [6 hours]
• The usual layout of a research presentation
• Slide design for a research presentation
• Delivery of a presentation, do's and don'ts
• Maintaining the audience's interest.

Other topics: [3 hours]
• Attending & chairing meetings
• Conferences – submissions and attendance
• Submission of papers and peer review.

Intended Learning Outcomes: Technical Outcomes:
By the end of this module the student will be able to:
• Write a paper or equivalent employing the structure and rigour required at research level (assessed by assignments 1 and 4)
• Efficiently communicate the concepts associated with complex ideas (assessed by the first written assignment and the oral presentation)
• Critically evaluate a written output (assessed within the second assessment component)
• Verbally present a complex idea using the presentation structure, slide content and delivery techniques expected of a research engineer (assessed through the oral presentation)
• Demonstrate an awareness of the other modes of communication of ideas at a research level such as posters and group discussions (assessed in the second assessment component)

Accreditation Outcomes (AHEP)
- Awareness of the need for a high level of professional and ethical conduct in engineering (EL8M / ET1fl)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M / ET2fl)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL11M / ET4fl)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9M / EP2fl)

Assessment: Assignment 1 (10%)
Assignment 2 (10%)
Oral Examination (40%)
Writing (40%)

Assessment Description:
The first sit assessment will consist of 4 assignments.

The first assessment component will be a short written piece, up to two pages long, which will test the students understanding of the concepts with respect to the written work and to allow feedback to the participants in the module prior to the final assessment. This is an individual piece of coursework.

The second component will feature a small number of tasks which are aimed to evaluate the students understanding of the other ideas, beyond the written word and oral presentations, which are covered in the module. This will include the critical review of a written output. Other possible tasks include group meetings and the creation of a poster. The coursework may be done individually or in groups, this will be confirmed at the time of setting the work.

The oral examination will involve the students presenting an example of the work they have undertaken in the past, typically a project, through an oral presentation. The target duration of the oral presentation will usually be between 8 to 10 minutes. The exact duration will be specified in the assignment descriptor. This is an individual piece of coursework.

The final, fourth, component will require the student to write a paper or equivalent. This paper will be between four to five pages in length and will be written to a format described in the assignment descriptor. This is an individual piece of coursework.

The pass mark for a module at Level 4/M is 50%. In addition to this Students must achieve at least 40% in the Oral Examination AND 40% in the Writing assessment to pass the module.

The reassessment will consist of 2 assignments, details of which are provided in a later section.

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

Assessment Feedback: CANVAS will be used to provide individual feedback to the students on all the components that contribute to the final mark. For the first assessment component a class feedback document is also generally included on CANVAS.

As part of the practical sessions the students will receive verbal feedback on their performance. These sessions do not contribute to the final mark.

Failure Redemption: Candidates shall be given one opportunity to redeem a failure in the module during the summer supplementary period.
All components are redeemable individually in the event of failure across the module.

In addition, the 40 % oral and written assignments of the first must be passed individually to pass the module, and will have to be redeemed even if a pass mark is achieved for the module overall on first sit. A pass mark on both main assessment components will be required to pass the module.

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

All lectures and course material will be provided on CANVAS.

The pass mark for a module at Level 4/M is 50%. In addition to this Students must achieve at least 40% in the Oral Examination AND 40% in the Writing assessment to pass the module.

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

EGSM00 Structural Integrity of Aerospace Metals

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules: EGTM60

Lecturer(s): Prof C Pleydell-Pearce

Format: Lectures 20 hours
Examples classes 8 hours
Directed private study 36 hours
Preparation for examination 36 hours

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

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

Lecture based.

Module Aims: This module aims to instill a detailed understanding of the mechanism of failure that can occur in service with aerospace metals, how they can be predicted through lifetime modelling, how they can be monitored and how they can be prevented by changes to material structure and processing. The module covers a wide range of content from fundamental deformation mechanisms at the atomic scale to the design and maintenance of large engineering structures.

Module Content:

Unit 1: The Application – Gas Turbine Technology – Thrust or Bust?
Unit 2: Material Deformation and Dislocation Theory
Unit 3: Failure modes in materials
Unit 4: Cracks and Fracture Mechanics
Unit 5: Fatigue
Unit 6: Fatigue lifing methods
Unit 7: Creep
Unit 8: Creep lifing methods
Unit 9: Mixed mode regimes – TMF – Creep-Fatigue interaction.
Unit 10: Forensic Characterisation of Failure

Intended Learning Outcomes: Technical Outcomes:
• To develop an in-depth understanding of the potential in-service failure modes with aerospace metals, including creep fatigue, stress-corrosion cracking, thermal oxidation and impact.
• To instill a good understanding of how the material structure can affect the occurence of failure.
• To instill a good understanding of how the processing of the material can affect the occurence of failure.
• To provide a working knowledge of how failure can be predicted through lifetime modelling, and how performance can be assessed with in-service monitoring.

Learning Outcomes (AHEP)
- A comprehensive knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1m)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems (SM2m)
- Awareness of developing technologies related to own specialisation (SM4m)
- 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 undertake critical analysis of key engineering processes (EA1m)
-Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and to implement appropriate action (EA3m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems (EA6m)
- 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)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk (EL6)
- Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction (EL7m)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (P1)
- Knowledge of characteristics of particular equipment, processes, or products, with extensive knowledge and understanding of a wide range of engineering materials and components (P2m)
- Understanding of appropriate codes of practice and industry standards (P6)
- Ability to work with technical uncertainty (P8)
- 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)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

MSc
- A comprehensive understanding of the relevant scientific principles of the specialisation (SM7m)
- A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM8m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA6m)
- Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies (D9)
- Awareness of the need for a high level of professional and ethical conduct in engineering (EL8m)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9m)

- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation (EL10m)
- Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation (EL12m)
- Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk (EL13m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9m)
- Advanced level knowledge and understanding of a wide range of engineering materials and components (P12m)
- Ability to apply engineering techniques taking account of a range of commercial and industrial constraints (P10m)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

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

Assessment Description: A two-hour examination.

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

Assessment Feedback: There is no assessed work in this module, but during example classes students will be able to attempt and discuss past exam questions to prepare them for the final examination. Standard examination feedback form available for all students after the examination.

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.

EGTM60 Aerospace Materials Engineering

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof C Pleydell-Pearce

Format: Combination of interactive lectures and self study
18 hours formal contact
15 hours pre module preparation
37 hours post module directed study
30 hours preparation for assessment

Delivery Method: 2 hour examination and an assignment.

Module Aims: This module will relate the sources of stress and mechanical design requirements in aerospace power plant and structures to the development, optimisation and selection of high performance materials.
Principles of materials development: Material types and structure: metals, alloys, composites.
Mechanical behaviour of materials: Stress-strain response, deformation mechanisms, single and poly-crystals, failure modes.
Sources of stress in power plant: CF loading, direct stress, bend, pressure, thermal, complex, stress concentrations.
Optimising microstructure and properties: Solidification processing, heat-treatment: alloy strengthening.
Performance of specific material systems: Titanium alloys, nickel alloys, steels, metal matrix/ceramic matrix composites.
Materials selection: codes, specification, design requirements for creep, fatigue, static fracture and environmental resistance.
Advanced material developments: New materials and processes for the next millenium.

Module Content: The course focuses on key materials used in the aerospace industry including titanium alloys, nickel alloys and composites highlighting how their properties and processing relate to structural integrity requirements in engines and airframes. Specific themes include:
• Basic structural integrity requirements: sources of stress, material strength and ductility, toughness, fatigue, creep and environmental degradation.
• Principles of materials development and selection.
• Alloy types for each class of material (titanium, nickel).
• Optimising properties through processing methods, heat treatment schedules and microstructural evolution.
• Casting, forging and thermo mechanical processing.
• Solid solution strengthening, precipitation hardening, Tempering and texture (directional) strengthening.
• Advanced composite systems for airframes and engines: metal matrix, ceramic, mechanisms of reinforcement; specific design requirements and applications.
• New materials and processes for the next decade - their advantages and disadvantages.
• Case studies and in-service issues

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to demonstrate a knowledge and understanding of:
• Aerospace material types and their applications.
• Optimisation of materials for particular applications through composition, processing and heat treatment.
• Structural integrity requirements for selected components in engines and airframes.
• Strengthening mechanisms in materials.

Learning Outcomes (AHEP)

MEng
- A comprehensive knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1m)
- Awareness of developing technologies related to own specialisation (SM4m)
- Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes (EA1m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- 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 key drivers for business success, including innovation, calculated commercial risks and customer satisfaction (EL7m)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (P1)
- Knowledge of characteristics of particular equipment, processes, or products, with extensive knowledge and understanding of a wide range of engineering materials and components (P2m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9m)

MSc
- A comprehensive understanding of the relevant scientific principles of the specialisation (SM7m)
- A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM8m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies (D9m)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9m)
- Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation (EL12m)
- Advanced level knowledge and understanding of a wide range of engineering materials and components (P12m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9m)
- Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader (P11m)

Assessment:	Examination 1 (80%) Assignment 1 (20%)
Resit Assessment:	Examination (Resit instrument) (100%)
Assessment Description: Examination worth 80% Assignment worth 20%. This is an individual piece of coursework.	
Moderation approach to main assessment: Universal second marking as check or audit	
Assessment Feedback: Written feedback on assignment. Examples classes.	
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. Failure to sit an examination or submit work by the specified date will result in a mark of 0% being recorded. Available to visiting and exchange students	

EGTM71 Power Generation Systems

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr M Togneri

Format: Lectures and directed private study

Delivery Method: Seminar style lectures which include Q&A, informal discussion and class debate sessions. Assessment 100% Exam.

Module Aims: This module will provide a detailed introduction to the technology, politics and economics of power generation and its distribution, with an emphasis on the UK network. The main topics include power for transport applications and electricity generation. Case studies of traditional power plant (including coal, oil, gas, nuclear) will be followed by an assessment of current and future low carbon and sustainable technologies (wind, wave, tidal, solar, biomass).

Module Content: Definitions of energy, work and power; energy conversion.
Steam engines, internal combustion and diesel engines; aeroengine variants, low emissions vehicles.
Conventional power generation: Fundamentals and nuclear reactor types.
Hydroelectric, geothermal, wind, solar, biomass, wave, tidal and other energy sources.
UK energy policy.
Changing patterns of energy requirements in the UK and the world; climate change.

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student should be able to demonstrate:
- Comprehensive knowledge of existing power generation systems.
- Awareness of future energy requirements, constraints and emerging generation systems.
- Power generation systems for transport and electricity supply.
- An ability to (thinking skills): Evaluate alternative power systems in light of social, economical and environmental concerns.
- An ability to (key skills): Present a coherent (even personal) view of energy requirements, supply and use on regional, national and international scales.

Accreditation Outcomes (AHEP)
MEng:
- LO1 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)
- LO2 Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
- LO3 Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)
- LO4 Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction (EL7m)

MSc:
- LO5 Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M)
- LO6 Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (EL11M)

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

Assessment Description: Formal Exam. 100%. All learning Outcomes. Questions based on course notes and the "Energy Plans" given in the textbook "Sustainable energy without the hot air".

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

Assessment Feedback: Standard college exam 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.

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

AVAILABLE TO visiting and exchange students.

EGTM79 Environmental Analysis and Legislation

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof GTM Bunting

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

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

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

On Campus

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

Module Content:

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

Intended Learning Outcomes:

Technical Outcomes

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

Accreditation Outcomes (AHEP)

MEng:

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

MSc:

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

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

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description:

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

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

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

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

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

Failure Redemption: Submission of additional assignment worth 100%.

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

Available to visiting and exchange students.

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

EGTM88 Ceramics

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof DA Worsley, Dr RS Bolton

Format:
Lectures 20 hours
Tutorials / Example classes 10 hours
Directed private study 36 hours
Preparation for assessment 34 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: This module provides a detailed coverage of the structure, properties and engineering use of advanced structural ceramics. It focusses on how control of the microstructure can lead to material improvements, especially in regard to toughness.

Module Content: • Basic ceramic types; typical properties, mechanical properties and dislocations.
• Preparation routes for ceramics; single crystals, polycrystalline ceramics, sintering methods.
• Toughness of ceramics; Griffith flaws, high-strength sintered ceramics.
• Silicate glasses; structure, properties, processing routes.
• Refractory materials; properties required, test methods, thermal shock and spalling.
• Glass ceramic materials; composite microstructure development by partial devitrification, control of microstructure by nucleation and growth, properties.
• Transformation toughened ceramics; Zirconia - Yttria ceramics, PSZ, toughening mechanisms and engineering applications
• Fibre and whisker reinforced ceramics; fabrication routes, toughening mechanisms and properties.
• High temperature ceramics; silicon nitride, silicon carbide, boron nitride, sialons, oxidation resistance.
• Comparison of ceramic materials and materials selection issues.
• Electroceramics; solid electrolytes, fuel cells, sensors, oxygen pumps.

Intended Learning Outcomes: After completing this module you should be able to demonstrate:
• A knowledge of the structure, properties, and engineering applications of a wide range of ceramic materials.
• A knowledge of the processing routes available for ceramic materials.
• How the microstructure of ceramics can be used to tailor the properties.
• How to relate the structure / property relationships seen with metals and polymers to ceramic materials.
• How to undertake materials selection and engineering design with ceramic materials.
• The application of fundamental materials science concepts to the engineering use of ceramic materials.

Accreditation Outcomes (AHEP)

MEng:
- 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. (SM1m)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes. (EA1m)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2m)
- Understanding of the use of technical literature and other information source (P4m)

MSc:
- A comprehensive understanding of the relevant scientific principles of the specialisation (SM7m)
- A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM8m)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9m)

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

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

Assessment Description: There will be two class tests in an online format that will each be made up of short answer questions and a single (up to) 4 hour assignment which will comprise three sections with more detailed written content on different aspects of the course. This latter element will be open book enabling students to work from home or accommodation for 2021 in light of COVID 19 restrictions.

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

Assessment Feedback: Standard examination feedback form available for all students after the examination.

Failure Redemption: Resit - 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

EGTM89 Polymers: Properties and Design

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Sharma

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

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

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

Lectures and examples classes delivered on campus and on-line

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

Module Aims: To instil an understanding of design methods with polymeric materials, dealing especially with viscoelastic behaviour.

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

Module Content:

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

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

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

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

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

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

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

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

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

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

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

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

PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

EGTM92 Physical Metallurgy of Steels

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr E Sackett

Format: Lectures 2 hours per week
Example classes 1 hour per week
Office hours: 1 hour per week
Directed private study and preparation for assessment: 6 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

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Module Aims: This module will provide you with comprehensive theoretical understanding of the uses of ferrous alloys which will be of critical value in the design and implementation of your research project and in the appreciation of value added products. It is also the case that you will have a greater awareness of the potential for multi-material design solutions.

Module Content: • Revision on Phase Transformations: The Iron-carbon phase diagram, Steels and Cast Irons, TTT and CCT diagrams.
• Study of equilibrium and non equilibrium Ferrous transformations: Pearlitic, Bainitic and Martensitic Transformations.
• Effect of alloy additions on steel properties: Martensitic quench, Hardenability issues.
• High Strength Low Alloy Steels, Interstitial Free Steels: Properties with particular emphasis on automotive applications.
• Tool Steels , creep resistant steels, High temperature oxidation resistant steels.
• Cast Irons
• Surface treatment and coating technology for steel products.
• Microstuctural characterisation Techniques for Steel Products.
• Applications of Cast Irons and Steels.

Intended Learning Outcomes: Technical Outcomes:
After completing this module you should be able to demonstrate:
• Advanced understanding of the metallurgical principles of ferrous alloys, their development and applications.
• Advanced knowledge of the design and development of novel ferrous alloys.
• Establish relationships between processing routes and microstructure to properties, facilitating prediction of engineering properties.
• Advanced materials selections with steels and cast irons.
• Promoting the ability of carrying out self-directed study, including communication skills and computing skills.

Accreditation Outcomes (AHEP)
- A comprehensive understanding of the relevant scientific principles of the specialisation (SM7m)
- Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D10m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9m)
- Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader (P11m)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

Assessment: Examination 1 (70%)
Assignment 1 (10%)
Group Work - Coursework (20%)

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

Assessment Description: Examination - 70% - Exam
Coursework - 10% - Multiple choice
Group Assessment - 20%

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

Assessment Feedback: Feedback will be provided via tutorial sessions (results released via personal tutors).
Data on Class exam performance and breakdown of marks will be provided through the College of Engineering Canvas Community page.

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

Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.
Available to visiting and exchange students.
The Faculty of Science and Engineering has a ZERO TOLERANCE PENALTY policy for late submission of all coursework and continuous assessment.

Full course notes based on the Powerpoint presentation provided.