Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 3 (FHEQ LEVEL 6)

MATERIALS ENGINEERING

DEGREE PROGRAMMES

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

DISCLAIMER

The Faculty of Science and Engineering has made all reasonable efforts to ensure that the information contained within this publication is accurate and up-to-date when published but can accept no responsibility for any errors or omissions.

The Faculty of Science and Engineering reserves the right to revise, alter or discontinue degree programmes or modules and to amend regulations and procedures at any time, but every effort will be made to notify interested parties.

It should be noted that not every module listed in this handbook may be available every year, and changes may be made to the details of the modules. You are advised to contact the Faculty of Science and Engineering directly if you require further information.

The 22-23 academic year begins on 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
Year 3 Coordinator	Prof Trystan Watson t.m.watson@swansea.ac.uk

STUDENT SUPPORT

The Faculty of Science and Engineering has two **Reception** areas - Engineering Central (Bay Campus) and Wallace 223c (Singleton Park Campus).

Standard Reception opening hours are Monday-Friday 9am-5pm.

The **Student Support Team** provides dedicated and professional support to all studentsin the Faculty of Science and Engineering. Should you require assistance, have any questions, be unsure what to do or are experiencing difficulties with your studies or in your personal life, our team can offer direct help and advice, plus signpost you to further sources of support within the University. There are lots of ways to get information and contact the team:

Email: studentsupport-scienceengineering@swansea.ac.uk (Monday–Friday, 9am–5pm)

Call: +44 (0) 1792 295514 and 01792 6062522 (Monday-Friday, 10am–12pm, 2–4pm).

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

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

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

READING LISTS

Reading lists for each module are available on the course Canvas page and are also accessible via http://ifindreading.swan.ac.uk/. We've removed reading lists from the 22-23 handbooks to ensure that you have access to the most up-to-date versions. Access to print material in the library may be limited due to CV-19; your reading lists will link to on-line material whenever possible. We do not expect you to purchase textbooks, unless it is a specified key text for the course.

THE DIFFERENCE BETWEEN COMPULSORY AND CORE MODULES

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

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

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

Year 3 (FHEQ Level 6) 2022/23
Materials Engineering

BEng Materials Science and Engineering[J500,J505]
BEng Materials Science and Engineering with a Year Abroad[J510]
BEng Materials Science and Engineering with a Year in Industry[J502]
MEng Materials Science and Engineering[J504]
MEng Materials Science and Engineering with a Year Abroad[J506]
MEng Materials Science and Engineering with a Year in Industry

Coordinator: Prof TM Watson

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-3071 **Advanced Optical Materials and Devices** **10 Credits** **Dr WC Tsoi** **CORE**	**EG-385** **Polymers: Properties and Design** **10 Credits** **Dr S Sharma** **CORE**
EG-381 **Fracture and Fatigue** **10 Credits** **Prof RE Johnston** **CORE**	
EG-391 **Microstructure and Characterisation** **10 Credits** **Dr L Prakash** **CORE**	
EG-392 **Physical Metallurgy of Steels** **10 Credits** **Dr E Sackett** **CORE**	
EG-353 **Research Project** **30 Credits** **Dr MR Brown/Mr A Goodfellow/Prof PJ Holliman/Dr AC Tappenden** **CORE**	
EG-386 **Engineering Management** **10 Credits** **Prof SG Bott/Prof AR Barron/Dr JM Courtney/Dr M Evans** **CORE**	
Total 120 Credits	

Optional Modules

Choose exactly 30 credits

EG-383	Ceramics	Prof DA Worsley/Dr RS Bolton	TB2	10 (CORE)
EG-387	Materials Degradation and Protection	Prof JH Sullivan/Prof G Williams	TB2	10 (CORE)
EG-397	Propulsion	Prof MT Whittaker	TB2	10 (CORE)
EGA301	Composite Materials	Dr FA Korkees	TB2	10 (CORE)

Year 3 (FHEQ Level 6) 2022/23
Materials Engineering
MEng Materials Science and Engineering with a Year in Industry[J503]

Coordinator: Prof TM Watson

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-3071 **Advanced Optical Materials and Devices** **10 Credits** **Dr WC Tsoi** **CORE**	**EG-385** **Polymers: Properties and Design** **10 Credits** **Dr S Sharma** **CORE**
EG-381 **Fracture and Fatigue** **10 Credits** **Prof RE Johnston** **CORE**	
EG-391 **Microstructure and Characterisation** **10 Credits** **Dr L Prakash** **CORE**	
EG-392 **Physical Metallurgy of Steels** **10 Credits** **Dr E Sackett** **CORE**	
EG-233 **Placement Preparation: Engineering Industrial Year** **0 Credits** **Prof GTM Bunting/Dr CME Charbonneau/Dr P Esteban/Dr SA Rolland/Dr V Samaras/Dr S Sharma**	
EG-353 **Research Project** **30 Credits** **Dr MR Brown/Mr A Goodfellow/Prof PJ Holliman/Dr AC Tappenden** **CORE**	
EG-386 **Engineering Management** **10 Credits** **Prof SG Bott/Prof AR Barron/Dr JM Courtney/Dr M Evans** **CORE**	
Total 120 Credits	

Optional Modules

Choose exactly 30 credits

EG-383	Ceramics	Prof DA Worsley/Dr RS Bolton	TB2	10 (CORE)
EG-387	Materials Degradation and Protection	Prof JH Sullivan/Prof G Williams	TB2	10 (CORE)
EG-397	Propulsion	Prof MT Whittaker	TB2	10 (CORE)
EGA301	Composite Materials	Dr FA Korkees	TB2	10 (CORE)

EG-233 Placement Preparation: Engineering Industrial Year

Credits: 0 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

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

Format: 11 hours consisting of a mix of seminars and workshops. 11 one hour drop-in advice sessions. Review of CV and cover letter.
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

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

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

Module Content:

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

1) Engineering Industrial Placements - what they are, how to search and how to apply.
2) CV writing, cover letters and application processes.
3) Assessment centres, interview techniques and mock interviews.
4) Recognising and developing employability skills.
5) Reflecting and maximising the placement experience.
6) One to one meeting with careers and employability staff.
7) Health and safety in the workplace.

Intended Learning Outcomes:

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

Accreditation Outcomes (AHEP)
EL5b Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues
EL6b Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk,

Assessment: Placements (100%)

Assessment Description:

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

Moderation approach to main assessment: Not applicable

Assessment Feedback:

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

Failure Redemption:

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

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

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

EG-3071 Advanced Optical Materials and Devices

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr WC Tsoi

Format: 11 weeks, each week 2 hours lecture (+demonstration if possible) + 1 hour example class (+Lab tour if possible)

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

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

Lectures, example classes, experimental demonstrations if possible, lab tours if possible.

Module Aims: This module covers advanced printable semiconducting materials for optical devices, with particular focus on their applications for new type of photovoltaic cells and light emitting diodes, and the working principles and engineering of the devices.

Module Content: • Introduction to semiconductors
• Introduction to organic semiconductors
• Introduction to perovskite semiconductors
• Organic and perovskite photovoltaic devices
• Organic and perovskite light emitting diodes
• Light absorption and excitons
• Charge separation and recombination
• Charge transport and injection
• Electroluminescence and outcoupling

Intended Learning Outcomes: Technical Outcomes
After completing this module, students should be able to:
• Define what are organic and perovskite semiconductors
• Identify and describe their optical and electrical properties
• Understand their applications, working principles and engineering for photovoltaic devices and light emitting diodes
• Know the facilities to fabricate and test photovoltaic devices and light emitting diodes

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline. (SM3b)
- 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 analyse key engineering processes (EA1b)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA5m)

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

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

Assessment Description: 15% Assignment one: online multiple choices test
10% Assignment two: online multiple choices test
75% Exam: Open book (through Canvas)

Moderation approach to main assessment: Universal second marking as check or audit
Assessment Feedback: The assignments will be marked by the Canvas system immediately after the submissions. The statistics of the performance and the solutions to the questions will be provided shortly after each assignment. Furthermore, oral clarification of issues is available at student¿s request. Feedback on the written examination will be in a standard format on the College of Engineering Intranet. Information provided includes average mark, maximum and minimum marks, for the examination as a whole and for individual questions. Besides, the common mistakes for each question will be provided, with suggestions on how to improve.
Failure Redemption: Resit in August: This supplementary examination is based on a written examination only, which is worth 100% of the total module mark.
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. Available for Visiting and Exchange Students PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION.

EG-353 Research Project

Credits: 30 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

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

Format: Formal Lectures 16 hours;
Directed private study (incl. meetings with supervisors) 284 hours
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

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

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

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

Module Aims:

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

The student will gain experience in working independently on a substantial, individually assigned task, using accepted planning procedures. It will require and develop self-organisation and the critical evaluation of options and results, as well as developing technical knowledge in the chosen topic.

Module Content:

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

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

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

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

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

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

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

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

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

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

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

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

Full assessment criteria will be on Canvas.

Moderation approach to main assessment: Universal double-blind marking

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

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

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

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

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

Only available to students following an Engineering Degree Programme.

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

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

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

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

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

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

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

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

EG-381 Fracture and Fatigue

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules: EG-184

Co-requisite Modules:

Lecturer(s): Prof RE Johnston

Format: Lectures: 20 hours
Directed private study: 50 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

The module will be taught mainly through the medium of lectures and tutorials delivered on campus, supplemented by case studies.

Module Aims:
To provide a detailed understanding of fracture mechanics and fatigue of materials; relating to real-world case studies and current cutting-edge research. Failure of biological and engineered materials.

Module Content:
• Static Fracture; theoretical strengths, ductile failure, brittle failure mechanisms, ductile to brittle transitions, recognising microstructures features of damage and artificial intelligence ways of classifying.
• Biological material failure and toughening mechanisms.
• Stress intensity factors; plane strain and plane stress, crack opening modes, stress concentrations, local yielding.
• Measurement of fracture toughness, KQ and K1C.
• Fatigue; mechanisms, initiation and growth, mechanisms of initiation, fatigue fracture surfaces.
• Stress and strain dependence of fatigue; S-N curves, low & high cycle fatigue, cycle softening & hardening, hysteresis loops.
• Damage tolerance approach to fatigue; stress intensity range, the Paris relationship, measurement of crack propagation.
• Fatigue crack thresholds.
• Crack closure mechanisms; R values, stress reversals.

Intended Learning Outcomes: Technical Outcomes
On successful completion of the module, students should be able to demonstrate knowledge and understanding of:
• The behaviour of cracks in materials and the associated theoretical modelling of them.
• Failure in biological materials, and natural mechanisms to prevent failure
• Fracture mechanics and how it can be used to prevent static and fatigue failure.
• How the structure of materials can be used to control the crack-growth behaviour.
• How to apply mathematical concepts to predicting crack behaviour and use this to design to avoid failure.
• The use of modern fracture mechanics methods to undertake materials design, predict lifetimes, and undertake failure analysis.
• How to relate underlying microstructural details to engineering applications.
• The application of mathematical techniques to solve engineering design issues.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline (SM3b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Knowledge of characteristics of particular materials, equipment, processes, or products (P2)

Assessment:	Coursework 1 (35%) Coursework 2 (5%) Coursework 3 (30%) Coursework 4 (10%) Coursework 5 (20%)

Assessment Description: C1: Fracture and microstructures
C2: Escape Room
C3: K1C
C4: Miner's Rule
C5: Course wrap up

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

Assessment Feedback:
Feedback will be provided via a document that highlights potential areas for improvement, based on the examination. This will highlight common areas where mistakes were made, where improvements could be included, and also good practice.
During the coursework, discussion classes will be held after coursework is complete to discuss the students' approaches and to give the opportunity for questions and discussion.

Also, standard Feedback Forms will be completed and made available to students

Failure Redemption: Students will be expected to undertake a resit in all failed components.

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

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

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
Detailed course notes provided as slides, screencasts, recorded lectures, with accompanying background notes.

EG-383 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. As a result of the COVID 19 pandemic for this session only the principal delivery will be through online provision. This will be reviewed following lockdown guidance at the mid point of the course however provision will be available fully online in all cases so that students safety is prioritised.

Assessment will be in the form of some short in class tests (20%) and a longer assignment (80%); at this stage this will likely follow an open book format to enable students to sit the exam without the need to travel to the 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. A number of case studies will show how diverse the applications are for this class of materials from conventional refractories to solar devices.

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: Technical 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)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies. (SM1b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes. (EA1b)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2)
- Understanding of the use of technical literature and other information source (P4)

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

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

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

Available to visiting and exchange students

EG-385 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 30% 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 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.

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)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Knowledge of characteristics of particular materials, equipment, processes, or products (P2)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

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 30% 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 to be completed by May.

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

EG-386 Engineering Management

Credits: 10 Session: 2022/23 September-June

Pre-requisite Modules:

Co-requisite Modules:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Penalty for late submission of work: ZERO TOLERANCE.

The module is available to exchange students.

Notes and worked examples can be found on Canvas.

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

EG-387 Materials Degradation and Protection

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof JH Sullivan, Prof G Williams

Format: Lectures 24 hours
Tutorials / Example classes 12 hours
Directed private study 36 hours
Preparation for assessment 28 hours

Delivery Method: This module will be delivered via a combination of lectures, case studies and discussion.

Module Aims: Materials degradation, the loss in performance of an engineering system, is an evitable part of product life cycle. This can result in a loss of efficiency or even total component failure. Materials degradation processes can therefore lead to severe risks to safety, as well as economic loss.

This module will familiarize students with industrially relevant physical, chemical and biological failure mechanisms and provide them with the tools needed to provide feasible engineering solutions to ensure that materials are protected.

Module Content: This module will examine major methods of materials degradation focussed around aqueous corrosion of metals and high temperature oxidation that are critical failure methods in real world applications.
The module will examine these areas from a fundamental scientific understanding of the many and varied mechanisms through which degradation can happen. Students will then learn how to apply this knowledge to solve real world problems through case studies and research examples. Students will also gain an insight into the state of the art experimental techniques that are being used to explore degradation mechanisms providing them with knowledge about how these issues can be solved in the real world.

The module will also include an overview of the different ways by which materials can be protected, for example by coatings, and how engineering design can be used to limit degradation.
The advantages and disadvantages of different technologies, taking into consideration of economic, technological and environmental factors.

Intended Learning Outcomes:
Technical Outcomes?

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies. (SM1b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes. (EA1b)
- Knowledge and understanding of the commercial, economic and social context of engineering processes. (EL2)
- Knowledge of characteristics of particular materials, equipment, processes or products. (P2)
- Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities. (G1)

Assessment: Examination 1 (60%)
Assignment 1 (20%)
Assignment 2 (20%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: An examination in June will provided 60% of the module marks.
Two Canvas assessments worth 20% each will occur during the module linked to each half of the course (Corrosion and high temperature oxidation).

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

Assessment Feedback: Feedback will be provided via tutorial sessions (provisional results released via personal tutors).
Data on exam performance and breakdown of marks will be provided through the Faculty of Science and Engineering Intranet service.

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

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

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

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.
Full course notes provided (based on the PowerPoint presentations used during lectures).

EG-391 Microstructure and Characterisation

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr L Prakash

Format: Lectures 20 hours
Discussions/Example classes 10 hours
Directed private study 40 hours
Preparation for assessment 30 hours

Delivery Method: On Campus.

Module Aims: This module provides an in-depth coverage of quantitative metallographic techniques, and how they can be applied to characterise the microstructures in advanced metallic alloys.

Module Content: - Methodologies for investigating structure of materials; Bragg's law, reciprocal lattice.
- Properties of X-rays and electrons.
- Structure determination using X-ray diffraction.
- Microscopy with light and electrons.
- Transmission electron microscopy (TEM).
- Scanning electron microscopy (SEM) including chemical analysis.
- Applications of Electron backscatter diffraction (EBSD) in the SEM.
- Crystal interfaces and microstructure.
- Preferred crystallographic orientation (texture).
- Introduction to neutron and X-ray synchrotron techniques

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to demonstrate:
- An understanding of the use and limitations of a wide range of micro-structural characterisation methods.
- An understanding of how and why macroscopic properties relate to sub-microscopic detail.
- An appreciation of the challenges involved in characterisation of advanced materials.
- An in-depth knowledge of complex microstructure development in metallic alloys.
- An appreciation of the relationship between microstructures, physical and mechanical properties, and processing.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)

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

Assessment Description: 4-hour examination at the end of the Semester.

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

Assessment Feedback: Examination feedback will be provided via Faculty template which is made available to all students after the examination is marked.

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

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

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

Available to visiting and exchange students.

EG-392 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: • 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, Tool Steels , Creep resistant steels, High temperature oxidation resistant steels;
• Stainless Steels: Metallurgy, Fabrication, Properties, Applications (Automotive, Aerospace, Power generation);
• Surface treatment and coating technology for steel products;
• Microstructural characterisation techniques for steel products;
• Surface Analysis Techniques for steel products;
• Applications of Steels

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to demonstrate:
a) An understanding of the metallurgical principles of ferrous alloys, their development and applications;
b) A knowledge of the design and development of novel ferrous alloys;
c) An understanding of the general applications of alloy steels with particular emphasis on automotive and aerospace applications.
d) How to relate processing and microstructure to properties, with the ability to predict engineering properties.
e) An ability to conduct materials selection with steels.
f) An ability to carry out self-directed study, including communications skills and computing skills.
g) The ability to use fundamental materials knowledge to make appropriate materials design and selection issues.

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal (D4)
- Plan and manage the design process, including cost drivers, and evaluate outcomes (D5)
- Communicate their work to technical and non-technical audiences (D6)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (EL2)
- Understanding of the use of technical literature and other information sources (P2)
- Understanding of the use of technical literature and other information sources (P4)
- Understanding of, and the ability to work in, different roles within an engineering team (P11)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)

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 a document that highlights potential areas for improvement, based on the examination. This will highlight common areas where mistakes were made, where improvements could be included, and also good practice.

Also, standard Feedback Forms will be completed and made available to students

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

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

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

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.
Full course notes based on the powerpoint presentations used at lectures, are provided.

EG-397 Propulsion

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof MT Whittaker

Format: Lectures: 20 hours
Example classes: 10 hours
Reading/Private Study: 40 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

Lecture based at University campus

Module Aims: The course aims to provide a basic understanding of propulsion systems in order to contribute to graduating students obtaining a holistic understanding of the aerospace sector. The course includes:
• Propulsion unit requirements for subsonic and supersonic flight
• Piston engine components and operation
• Propeller theory
• Gas turbine engines: operation, components and cycle analysis
• Thermodynamics of high speed gas flow
• Efficiency of components
• Rocket motors: operation, components and design
• Dynamics of rocket flight
• Environmental issues

Module Content:
• Propulsion unit requirements for subsonic and supersonic flight
• Piston engine components and operation
• Propeller theory
• Gas turbine engines: operation, components and cycle analysis
• Thermodynamics of high speed gas flow
• Efficiency of components
• Rocket motors: operation, components and design
• Dynamics of rocket flight
• Environmental issues

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

• A knowledge and understanding of:
Propulsion techniques used for aircraft, spacecraft and helicopters (Coursework assessment, exam).

• An ability to:(assessed by)
- Analyse various types of propulsion system and where they are most applicable (exam)
- Evaluate the thermodynamic performance of a propulsion system (Coursework assessment, exam)
- Critically analyse the basic performance characteristics of engines relevant to the performance of the craft which they power (exam).

Accreditation Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline (SM3b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Knowledge of characteristics of particular materials, equipment, processes, or products (P2)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
- Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate (EL4)

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

Assessment Description: 2 hr examination (80%)

Coursework assignment (via Canvas) - Piston engines/Gas turbines/Rockets - Summative assessment (20%). This Canvas test aims to develop understanding of the workings of, and calculations for gas turbine and rocket engines including high speed gas flows. This is an individual piece of coursework.

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

Assessment Feedback: Written feedback provided on coursework assignments.
Verbal feedback provided through model answers on coursework assignments in examples classes.

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

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

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

Available to visiting students.

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

Assessment: 20% Coursework, 80% examination

Notes, past papers and supporting material for this module can be found on Canvas

EGA301 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 delivered on-campus.

Assessment will be by a combination of in-person (on-Campus) Exam (85%) and coursework (15%)

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 and 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 ; (2 hrs)

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

Learning Outcomes (AHEP)
- Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1b)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Communicate their work to technical and non-technical audiences (D6)
- Knowledge of characteristics of particular materials, equipment, processes, or products (P2)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

Assessment: Examination 1 (85%)
Coursework 1 (15%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: Assessment is via a take-home examination (85%) at the end of the Semester and a coursework assignment worth 15%.

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 coursework via Canvas.

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

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

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

Available to visiting and exchange students.

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

PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION