Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 1 (FHEQ LEVEL 4)

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 1 Coordinator	Dr Hollie Cockings H.L.Cockings@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 1 (FHEQ Level 4) 2022/23
Materials Engineering

BEng Materials Science and Engineering[J500,J505]
BEng Materials Science and Engineering with a Year Abroad[J510]
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: Dr HL Cockings

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-133 **Engineering for People Hackathon** **10 Credits** **Prof JC Arnold/Dr WG Bennett/Dr JW Jones/Dr S Potts/...** **CORE**	**EG-182** **Manufacturing Technology I** **10 Credits** **Prof HM Davies** **CORE**
EG-180 **Introduction to Materials Engineering** **10 Credits** **Dr MP Coleman** **CORE**	**EG-184** **Mechanical Properties of Materials** **10 Credits** **Dr HL Cockings/Prof MT Whittaker** **CORE**
EG-183 **Materials Resources** **10 Credits** **Prof TM Watson** **CORE**	**EG-185** **Materials Practicals 1: structure / property links in metals** **10 Credits** **Prof HM Davies** **CORE**
EG-187 **Engineering Analysis for Materials 1** **10 Credits** **Dr L Prakash/Dr JD Mcgettrick** **CORE**	**EG-188** **Engineering Analysis for Materials 2** **10 Credits** **Dr L Prakash/Dr JD Mcgettrick** **CORE**
EGA163 **Design and Laboratory Classes 1** **10 Credits** **Prof RE Johnston/Dr F Zhao** **CORE**	**EGA110** **Instrumental and Analytical Chemistry** **10 Credits** **Dr A Munnangi/Prof S Margadonna** **CORE**
	EGA113 **Case Studies in Materials** **10 Credits** **Dr A Das/Dr MP Coleman** **CORE**
Total 120 Credits	

Optional Modules

Choose exactly 10 credits
If a student has done A level (or equivalent) Chemistry but not Physics they must opt for EGA106.
If a student has done A level (or equivalent) Physics but not Chemistry they must opt for EGA103.
If a student has done A level (or equivalent) Physics and Chemistry they must opt for EG-137.
In the unlikely event that a student has no chemistry or physics background they would be best advised to do EGA106.

EG-137	Data analysis and simulation	Dr EH Jewell/Dr S Potts/Dr AC Tappenden/..	TB1	10 (CORE)
EGA103	Foundation Chemistry	Prof G Williams	TB1	10 (CORE)
EGA106	Engineering Science	Dr WC Tsoi	TB1	10 (CORE)

Year 1 (FHEQ Level 4) 2022/23
Materials Engineering

BEng Materials Science and Engineering with a Year in Industry[J502]
MEng Materials Science and Engineering with a Year in Industry[J503]

Coordinator: Dr HL Cockings

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-133 **Engineering for People Hackathon** **10 Credits** **Prof JC Arnold/Dr WG Bennett/Dr JW Jones/Dr S Potts/...** **CORE**	**EG-135** **Placement Preparation: Science and Engineering Year in Industry** **0 Credits** **Prof GTM Bunting/Dr SA Rolland/Dr V Samaras**
EG-180 **Introduction to Materials Engineering** **10 Credits** **Dr MP Coleman** **CORE**	**EG-182** **Manufacturing Technology I** **10 Credits** **Prof HM Davies** **CORE**
EG-183 **Materials Resources** **10 Credits** **Prof TM Watson** **CORE**	**EG-184** **Mechanical Properties of Materials** **10 Credits** **Dr HL Cockings/Prof MT Whittaker** **CORE**
EG-187 **Engineering Analysis for Materials 1** **10 Credits** **Dr L Prakash/Dr JD Mcgettrick** **CORE**	**EG-185** **Materials Practicals 1: structure / property links in metals** **10 Credits** **Prof HM Davies** **CORE**
EGA163 **Design and Laboratory Classes 1** **10 Credits** **Prof RE Johnston/Dr F Zhao** **CORE**	**EG-188** **Engineering Analysis for Materials 2** **10 Credits** **Dr L Prakash/Dr JD Mcgettrick** **CORE**
	EGA110 **Instrumental and Analytical Chemistry** **10 Credits** **Dr A Munnangi/Prof S Margadonna** **CORE**
	EGA113 **Case Studies in Materials** **10 Credits** **Dr A Das/Dr MP Coleman** **CORE**
Total 120 Credits	

Optional Modules

Choose exactly 10 credits

If a student has done A level (or equivalent) Chemistry but not Physics they must opt for EGA106.
If a student has done A level (or equivalent) Physics but not Chemistry they must opt for EGA103.
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EG-137	Data analysis and simulation	Dr EH Jewell/Dr S Potts/Dr AC Tappenden/..	TB1	10 (CORE)
EGA103	Foundation Chemistry	Prof G Williams	TB1	10 (CORE)
EGA106	Engineering Science	Dr WC Tsoi	TB1	10 (CORE)

EG-133 Engineering for People Hackathon

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof JC Arnold, Dr WG Bennett, Dr JW Jones, Dr S Potts, Dr S Salim, Dr N Wint, Dr W Zhang

Format: One lecture per week: 10 hours
3-hour group session each week for each discipline: 30 hours
Contact Hours will be delivered through a blend of live on-campus activities online work, and some aspects will take part in Academic Mentoring sessions.

Delivery Method: The delivery method is primarily on-Campus, although the 1 hour lecture each week will be recorded and be made available for on-line review. Students are required to participate in the group work sessions and this will require on-campus participation.

Module Aims: Engineering is more than understanding technical design, it is often the social, environmental and economic context underpinning engineering solutions that determine success or failure,

This has never been more relevant since the world is currently planning a radical transition to a low carbon economy while facing increased risks due to climate crisis which will bring with it unprecedented change to the world. Engineers will be at the forefront of this, and need to be equipped to tackle open-ended, unstructured and complex problems in collaboration with others.

The module will allow students to explore these issues within their chosen discipline with the following structure:

Each week there will be a 1-hour lecture, introducing engineering thinking and contemporary issues in global engineering design. Most activity will then take place in group-work sessions (3 hours per week), where groups of around 6 students will work in a facilitated way towards a Engineering design solution. Students will be presented with a range of Global Challenges (e.g. access to water/ off-grid energy), and over the course of the term will work to research, design and critique possible engineering solutions.

The groups with the best performance in this module may have opportunities to represent Swansea University in the national Engineers without Borders UK competition.

Module Content: 1. Engineering Mindset/ Self Awareness
2. Ethics and Professional Responsibilities and Sustainability
3. Failure and Learning through Mistakes/ Design mindset
4. Design Method
5. Teamwork
6. Positionality and Personal Design Perspectives
7. Reflection

Intended Learning Outcomes: The main learning outcomes of this module are:

D2 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

EL1 Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct

EL4 Understanding of the requirement for engineering activities to promote sustainable development

Supported learning outcomes are:

D1 Be aware of business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics

P11 Awareness of team roles and the ability to work as a member of an engineering team

Assessment:	Coursework 1 (10%) Coursework 2 (10%) Coursework 3 (70%) Coursework 4 (10%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Coursework 1: (10%)
Team work building tasks - puzzles

Coursework 2: (10%)
Professional development assignments

Coursework 3: Presentation (70%)
The final poster with show all stages of project conception and development:
-need identification
-evaluation criteria
-long list of options
-short list of options

The mark will be given to the group and peer assessment will be used

Coursework 4: A group reflection task (10%)

Moderation approach to main assessment: Partial second marking

Assessment Feedback: Formal feedback from online test

10% of marks are available for completion of specified professional development course units. There are 5 units for students to complete.
To complete a unit a student must gain 8/10 in the unit test, and they get 5 attempts to sit each unit test. A student can gain 2% for each unit they pass.
When they complete a test canvas will let the students know how many marks out of 10 they have gained. If they have not gained 8/10 they will need to take the test again.

Regular informal feedback given throughout the term, with structured group feedback sessions at intervals, reflecting on progress, including some peer feedback.
Formal feedback on presentation and reflection task will be provided on Canvas.

Failure Redemption: Supplementary Assessment to be submitted in August.

Reassessment: Design Reflection & Report (100%)

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

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EG-135 Placement Preparation: Science and Engineering Year in Industry

Credits: 0 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof GTM Bunting, Dr SA Rolland, Dr V Samaras

Format: 11 hours consisting of a mix of seminars and workshops and drop-in advice 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

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 Faculty of Science and 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; and (d) key employability skills; getting the most from your Industrial Placement.

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) 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

Intended Learning Outcomes: By the end of this module, students should be able to:

1) Demonstrate the essential skills needed to apply for and secure placement opportunities.
2) Perform effectively in an interview process and apply the tools and attributes that make a good interview.
3) Discuss and share what is expected within the workplace including behavioural and professional conduct.
4) Identify personal employability skills and how these will be used in a workplace setting.
5) Express a reflective view of the placement demonstrating the ability to maximise the placement experience in future career decisions

Assessment: Participation Exercise (100%)

Assessment Description: Not assessed

Moderation approach to main assessment: Not applicable

Assessment Feedback: Not assessed

Failure Redemption: Not assessed

Additional Notes: Module to support students on the Year in Industry programmes.

EG-137 Data analysis and simulation

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr EH Jewell, Dr S Potts, Dr AC Tappenden

Format: Lectures and PC lab class

Delivery Method: The module will be delivered through in person lectures and PC laboratory classes. These will vary through the module, with appropriate choices made for each element of the course. Although specified as in person classes, although there may need to adjust the delivery model should Covid restrictions apply. Module material including lectures, notes, example case studies and additional resources will available on Canvas.

Module Aims: The module will examine how data gathering and computational methods can be used to solve real world engineering problems. It brings together the need to capture real world information in a date centric engineering world with the need to predict performance using fundamental understanding of the engineering science. The module will develop the key IT analysis (Excel and Matlab) and technical writing skills which are applicable to many of the modules within the programme.

Module Content: The syllabus aims to develop the student's appreciation of the role that data analysis and programming plays in solving real world problems.

1. Why data analysis and simulation the key to future engineering data
2. Data from sensors in the real world
3. Types and forms of data
4. Capturing data from a real-world experiments and Excel data analysis
5. MATLAB as an engineering tool
6. Basics of programming, introduction to MATLAB, input and output of data, operations, functions, plotting, simple programming, conditional statements and debugging.
7. MATLAB programming for engineering problem solving

Intended Learning Outcomes: Accreditation Outcomes (AHEP)

- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4B)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

Assessment:
Coursework 1 (5%)
Assignment 1 (40%)
Coursework 2 (10%)
In class test (Invigilated on campus) (15%)
Class Test 2 - Held under exam conditions (20%)
Coursework 3 (10%)

Assessment Description: Assessments

1. 1 x 5% quiz on academic malpractice. Open for the entirety of the module.
2. 1 x 40% Assignment on Arduino experimentation and write up
3. 1 x 10% quiz on taught elements of data capture and handling.
4. 1 x 10% Matlab Onramp beginner assessment
5. 1 x 15% Matlab classroom assessment under exam conditions in PC labs. Students prepare code from scratch, submit results and m-code within 1.5 hours. Run within a 2 hour lab class).
6. 1 x 20% Matlab classroom assessment under exam conditions in PC labs. Students prepare code from scratch, submit results and m-code within 1.5 hours. Run within a 2 hour lab class).

Requirements to pass the module:
Class test 1, Class test 2 and Coursework 3 must be passed with a combined mark of 40% in order to pass the module.

Moderation approach to main assessment: Partial second marking

Assessment Feedback: There will be no feedback on the online test beyond the mark. Students will receive generic feedback on their coursework submissions in a lecture/ lab. This will highlight good practice and where common mistakes have been made. In addition, office hours will allow students receive feedback on individual pieces of work.

Failure Redemption: Failure redemption

Additional Notes: Available to visiting and exchange students.

EG-180 Introduction to Materials Engineering

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr MP Coleman

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

Delivery Method: Assessment: The module will be assessed via an online course work assessment during the first semester, worth 20% followed by a standard 2 hour multiple choice examination at the end of the teaching block, worth 80%

Module Aims: The module aims to introduce year 1 Engineering students to the understanding of key concepts relating to materials selection and applications. Following completion of this module the student should be able to demonstrate an appreciation of materials selection in relation to the structure/mechanical and physical properties/applications of metallic, ceramic, polymeric and composite materials.

Module Content: Principles of Materials Selection: Classes and typical properties of materials, the role of materials selection in mechanical design [1].
Elastic and Plastic Behaviour of Solids: Stress and strain in solids, elastic behaviour. Plastic behaviour, tensile testing, stress-stain curves [3].
Toughness and Hardness Testing: Impact testing, hardness testing [1].
Atomic Structure: Atomic structure, atomic numbers and weights, electronic structure of atoms, types of atomic bonding including ionic, covalent, metallic, intermediate, Van de Waals, and hydrogen bonding [1].
Crystal Structure of Solids: Types of solid state structure (e.g. crystalline and amorphous), atomic packing in crystals, atomic arrangements (eg FCC, HCP, BCC), crystallography: Plane (Miller) indices, direction indices, crystal structure of ceramics [4].
Solidification: Volume change, nucleation and growth of crystals, grain boundaries, glasses: temperature dependence, silica glass structures, forms of silica glass, soda glass [2].
Cement and Concrete: Portland cement and its manufacture, hydration and its development, strength of concrete [1].
Vacancies and Diffusion: Diffusion and Fick's Law, crystal lattice defects, atomic vibration, probability of diffusion, mechanisms of diffusion [2].
Microstructure of Solids: Examples of microstructures, microstructural features, phases, diagrams (maps), unary diagrams and Gibbs Phase rule, solid solubility, solubility in a binary system, composition in a two-phase region, microstructural development, Lever rule [3].
Polymers and Composites: Polymerisation, skeletal structures, structure of polymers, homopolymers, copolymers, classification of polymers, classification of composites, manufacture routes, fibre-reinforced composites, fibre matrix interface [2].
Steels: Iron-Iron carbide system, eutectoid steel, effect of carbon content, effect of cooling rate, non-equilibrium steels, heat treatment of steels, diffusion, classification of steels: plain carbon steels (e.g. low-carbon, mild, medium-carbon, high-carbon steels) and alloy steels (e.g. high strength low-alloy steels (HSLA), tool/die steels, corrosion/heat-resistant steels) [4].

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student should be able to demonstrate a knowledge and understanding of:
- The fundamental concepts across a broad spectrum of material families and mechanical/material properties.
- The basic principles of materials selection in mechanical design, including characterisation of mechanical properties, atomic structure of materials, crystal structures, vacancies and diffusion, microstructure evolution (solidification), phase diagrams, the treatment of plain carbon steels, creep, corrosion and oxidation.

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)

Assessment:	Coursework 1 (20%) Exam - Multiple choice questions (80%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Online course work assessment - 20%
Formal MCQ in Jan exam period - 80%

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

Assessment Feedback: Feedback on CW1 will be provided during lecture time.

Failure Redemption: A 2 hour multiple choice examination in the supplementary exam period in August will form 100% of the module mark.

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

PENALTY: THE FACULTY OF SCIENCE AND ENGINEERING HAS A ZERO TOLERANCE FOR LATE SUBMISSION OF ALL COURSEWORK AND CONTINUOUS ASSESSMENT
Available to visiting and exchange students.
Full course notes provided. Additional Reading list provided.

EG-182 Manufacturing Technology I

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof HM Davies

Format: Lectures: 30 hours
Directed private study: 40 hours
Preparation for assessment: 30 hours

Delivery Method: Quizzes will be incorporated into the lectures.

Module Aims: Manufacturing makes a major contribution to the world economy and, engineering processes help solve some of the most serious challenges facing society today. The role of engineers in the manufacturing sector is crucial to generate sustainable high economic value products and jobs. To meet this ever-changing role, new graduates require an understanding of established and advanced processes. The module provides students with a holistic view of current, emerging and integrated manufacturing processes, providing a wide range of techniques required for producing product specifications based on process/technology selection. The taught material builds together with knowledge gained from materials and design modules. The topics are delivered by means of traditional lectures in each of the areas shown in the syllabus below.

Module Content: • Overview of Manufacturing and Materials
• Polymers and PMCs
• Ceramics and Cermets
• Glass Working
• Metal Casting
• Powder Metallurgy
• Metal Forming
• Sheet Metalworking
• Metal Machining
• Cutting Tools
• Grinding and other Abrasive Processes
• Heat Treatment of Metals
• Manufacturing Economics
• 21st Century Manufacturing

Intended Learning Outcomes:
Technical Outcomes
Upon completion of this module the student should be able to:
- Describe important manufacturing techniques.
- Understand the control of these techniques including metrology.
- Discuss how the forming techniques affect the material's structure.
- Understand that both materials selection and manufacturing processes are important in producing products with optimum performance at minimum cost.
- Undertake selection of production process for successful product manufacture.
- Perform quality metrology measurements.

Accreditation Outcomes (AHEP)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2)
- Understanding of the use of technical literature and other information sources (P4)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (P1)

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

Assessment Description: Assessment: 2 hour examination at the end of the Semester (100%). Resits in August will have 100% weighting.

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

Assessment Feedback: Via generic feedback form from written examinations.

Failure Redemption: Closed book exam in the supplementary exam period in August 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.
Assessment: examination.
Resource pack from lecturer. Available to visiting and exchange students.

EG-183 Materials Resources

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof TM Watson

Format: Lectures: 20 hours
Tutorials / Example classes: 2 hours
Directed private study/Tutorial sheets: 40 hours
Preparation for assessment: 38 hours

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

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

Assessment: 2 hour examination at end of Semester (80%) plus two assessed sheets (20% total).
Penalty for handing in late work: Zero tolerance.

Module Aims: Materials resources are and always have been a controlling factor in economic and social human development. This course assumes no prior knowledge and explores the development of materials exploitation from the earliest times illustrating how the availability of resources and the ingenuity of humankind to exploit and extract new materials has allowed the evolution of our modern world. In historical terms, materials exploitation has always been related to economic growth or military needs. Increasingly, sources of energy and materials are sought which are both economically attractive and sustainable. As such, in each section of the course, aspects of sustainability and economics will be addressed, to show how and why certain materials choices are made for specific applications.

Module Content: The course is broken up into a range of sections supported by printed notes [lecture hours]
1; No lay-bys at 35000 feet. The importance of materials properties to the aircraft; [1]
2; The geological principles that lay behind the importance of mineral and resource localisation; Stones for building; Rocks for Roads. Basic materials exploitation [4]
3; Cement and Concrete, Ceramics and Glass. Fairly simple processed materials.[4]
4; Metallurgy basics including precious metals, Copper, Tin and Bronze: Description of how metallic properties arise with illustration of the localisation and extraction of gold and detailed use of modern precious metals in catalytic converters to reduce pollution. [2]
5; Simple extraction metallurgy for bulk metal use. Iron exploitation: extraction, conversion and use. [2] Aluminium, extraction and use. [1]
6; Challenges for materials stability. Corrosion; Metal use in the automotive and construction sectors. [2]
7; Materials from chemicals. Introduction and resources for Polymers; Polyethyene manufacture and use; Addition and condensation polymerisation. [3]
8; Challenges for all Materials Resource Exploitation. Environmental issues: Implications for fossil fuel use; Ozone depletion as a result of CFC use and options for electricity generation; The benefits and disadvantages of recycling options vs re-use and incineration. [5]

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to:
1. Describe the origins of materials resources and mechanisms of mineral formation.
2. Discuss the key topic areas of methodologies for resource, recovery, use and recycling at end of life.
3. Gain an appreciation of the environmental impact of resource exploitation.
4. Gain an appreciation of a wide ranging spectrum of manufacturing technologies and be able to make considered judgements on environmental impact.
5. Undertake a basic environmental assessment of engineering use of specific materials.
6. Apply basic scientific and economic principles across a broad spectrum of application areas.

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)
- 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)
- 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 contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (P1)
- Understanding of appropriate codes of practice and industry standards (P6)

Assessment: Examination 1 (80%)
Assignment 1 (10%)
Assignment 2 (10%)
Resit Assessment: Examination (Resit instrument) (100%)

Assessment Description: The exam accounts for 80% of the course assessment; a further 20% comes from the two Canvas assessments.

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

Assessment Feedback: The module operates according to the standard College of Engineering Procedures and Feedback forms.
Feedback will come from returned marked example sheets and discussions within the classroom environment regarding class performance on tutorials.
Individual feedback can be obtained through contacting the course provider.

Failure Redemption: The module operates according to the standard College of Engineering Procedures; 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.
PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

EG-184 Mechanical Properties of Materials

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr HL Cockings, Prof MT Whittaker

Format: Lectures 20 hours
Office hours 10 hours
Directed 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 provides a basic understanding of the relationship between the microstructure and the mechanical properties of metals. It will build on certain aspects of mechanical performance introduced in EG-180 (Introduction to Materials Engineering) and provide a reference point for supplementary modules in Years 2 and 3.

Module Content:

- Deformation processes in crystals. Fundamentals of elastic and plastic deformation and the stress-strain curve, the theoretical shear stress and critical resolved shear stress. [2]
- Introduction to stress corrosion cracking [1]
- The concept of dislocations. Description of edge, screw and mixed dislocations and dislocation loops, and the definition of the Burgers vector. [2]
- The role of dislocations and pile-ups in work hardening and the corresponding stress-strain characteristics of materials. [2]
- Definition of the Hall-Petch equation and the role of grain size on mechanical properties [2]
- Precipitation and particle strengthening in metals. [1]
- Deformation of crystalline solids and the role of cold and hot work in metals and alloys, annealing - recovery, recrystallisation and grain growth. [2]
- Elementary description of fracture in a range of ductile and brittle materials. Ductile voids, brittle cleavage and the transition of fracture behaviour with temperature, concept of toughness. [2]
- Basic fatigue crack initiation mechanisms, fracture surface features under fatigue loading, Stage I and II cracks. [3]
- Introduction to creep and creep fracture. Distinctions between low and high temperature creep. [1]
- Temperature capabilities of materials - case study of an aero gas turbine. [2]

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

- Describe the relationship between microstructure and the resulting mechanical response measured on the macroscopic scale. Relate atomic / microstructural details to macroscopic behaviour.
- Describe the elastic and plastic deformation mechanisms in crystalline materials.
- Discuss alloy strengthening mechanisms and basic fracture mechanisms.
- Appreciate the important parameters describing mechanical behaviour and compare and contrast the performance of a range of engineering alloys.
- Undertake basic manipulation of stresses to determine stress fields.
- Relate fracture surface details to failure behaviour.

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

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

Assessment Description: 2 hour written examination at end of semester (80%)
Assignment 1 - continuous assessment (20%)

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

Assessment Feedback: Written feedback is provided on coursework assignments.
General module feedback provided on written examination.
Verbal feedback provided through example classes.

Failure Redemption: 100% supplementary examination in August.

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: ZERO TOLERANCE

Available to visiting and exchange students.

Detailed PowerPoint notes provided.

EG-185 Materials Practicals 1: structure / property links in metals

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof HM Davies

Format: Laboratory Work: 15 hours
Directed private study: 44 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

Module Aims: This course is designed to provide students with an introduction to the skills necessary to prepare materials for microscopic examination and to conduct standard mechanical tests. The course supports the Level 1 lecture courses, in particular the courses on Introduction to Materials (EG-180) and on Mechanical Properties (EG-184). The emphasis for this module is the development of practical, experimental, and scientific report writing skills.

Module Content: This course is designed to provide students with an introduction to the skills necessary to prepare materials for microscopic examination and to conduct standard mechanical tests. The course supports the Level 1 lecture courses, in particular the courses on Introduction to Materials Engineering (EG-180) and Mechanical Properties of Materials (EG-184).

Practical work: Five 3 hour practical sessions involving training in standard methods of sample preparation for microscopy and mechanical test methods including tensile tests, impact tests and hardness tests. Subsequently, metallographic examination and mechanical testing of a range of metallic materials will be undertaken. Specific aspects to be covered include:
- The effect of carbon content on steel structure and properties.
- The structure and properties of copper and brass.
- The effect of grain size on mechanical properties.
- The effect of deformation on structure and mechanical properties.
- The effect of temperature on mechanical properties.
- Scientific report writing.

Intended Learning Outcomes:
Technical Outcomes
After completing this module you should be able to:
- Explain how the structure affects basic mechanical properties in a range of metallic materials;
- Explain how temperature affects the properties of metallic materials;
- Understand the most important strengthening mechanisms for metals and alloys;
- Interpret the microstructures of metals in terms of alloy chemistry and processing history;
- Use practical metallography and standard mechanical testing procedures;
- Undertake data analysis, interpretation and presentation, writing of scientific reports;
- Conduct practical experimentation, including self-directed focus on quality and consistency.

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)
- Communicate their work to technical and non-technical audiences (D6)
- Knowledge and understanding of management techniques, including project management, that may be used to achieve engineering objectives (EL3)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

Assessment:	Report (70%) Class Test 1 - Coursework (20%) Laboratory work (10%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: • A Canvas online test which will be held under exam conditions in March or April (20% of overall mark).
• A written lab report, around 12 sides A4 (70% of total mark).
• Laboratory Work - practical classes or their on-line equivalent are compulsory. Students will complete a laboratory book at the end of EACH laboratory class which will be checked and signed by the lecturer or demonstrator. (10% of total mark).
To ensure that students are familiar with laboratory book skills and ensure attendance and participation at practical sessions laboratory books are to maintained and carry a 10% weighting.

Valid extenuating circumstances will be considered.

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

Assessment Feedback: Feedback on the class test will be given automatically via Canvas once the test has been completed.

Individual feedback on the lab report will be provided via the Turnitin system.

Failure Redemption: Supplementary coursework 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.

Please be aware that in this module students are unable to redeem their failure by supplementary coursework. Failure of this module will normally mean that the student must repeat the module(s) or repeat the year. Failure to attend classes and activities related to these modules will normally mean that you fail the module; hence you repeat the module/year.

To ensure that students are familiar with laboratory book skills and ensure attendance and participation at practical sessions laboratory books are to maintained and carry a 10% weighting.

THE FACULTY OF SCEINCE AND ENGINEERING HAS A ZERO TOLERANCE PENALTY POLICY FOR THE LATE SUBMISSION OF ALL COURSEWORK AND CONTINUOUS ASSESSMENT

EG-187 Engineering Analysis for Materials 1

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr L Prakash, Dr JD Mcgettrick

Format: Lectures: 11 hours
Exercise classes: 11 hours
Computer classes: 11 hours
Directed private study: 67 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

A combination of lectures, examples classes, extensive blended learning and on-line assessment (formative and summative).

Module Aims: To provide a grounding in engineering analysis methods for materials students.
The module will cover the most important analytical functions and methods used in engineering and will relate these to common materials-related examples.
The module will ensure the required grounding in methods and techniques for those who have not previously covered this area, or who are returning after a gap. It will also provide opportunities for extension to more complicated examples for those who have more prior experience.

Module Content: Basic algebra: indices, algebraic expressions, equation manipulation, use of brackets.
Functions and their graphs, lines, quadratics and polynomials.
Trigonometry: angles, trigonometrical functions, polar coordinates.
Exponentials and logarithms.
Inverse trigonometrical functions.
Simultaneous equations.
Basic differentiation.
Static mechanics - forces, moments, resolving in different directions.

Intended Learning Outcomes: Technical Outcomes
After completing this module, the student should be able to demonstrate:
- An ability to rearrange and solve equations including common mathematical expressions including indices, logarithms and trigonometric functions. (SM2b)
- An ability to represent equations in graphical terms and identify key features such as stationary points, asymptotes and discontinuities. (SM2b)
- An ability to differentiate basic mathematical functions. (SM2b)
- An ability to solve problems of static mechanics. (SM2b / EA1b)

Accreditation Outcomes (AHEP)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

Each LO is linked to the four class tests in turn.
G1 is assessed in Coursework 6.

Assessment: Class Test 1 - Coursework (0%)
Class Test 2 - Coursework (0%)
Class Test 3 - Coursework (0%)
Class Test 4 - Coursework (0%)
Coursework 5 (53%)
Coursework 6 (47%)

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

Assessment Description: This module will be assessed with 4 separate (pass/fail) tests, which cover the required basic understanding and abilities needed for the materials degree. The pass mark for each test will be 75%. Each of these components will be available for students to take each week throughout the semester, and students can have multiple attempts, as they feel they are ready. There will be one final attempt to pass each test in the January exam period. The best attempt will count, but all four tests need to be passed in order to pass the module. If you pass all four tests, the average of the test marks will make up Component 5, so you would get between 40% and 53%.

Further marks (up to 47%, in component 6) will be gained by successful completion of more challenging examples through the semester, but these will only count when you have passed all four tests.

If you do not meet the requirements of the Pass/Fail component, you will receive a QF outcome. This means that you will be required to repeat the failed component(s), even if your module mark is above 40%.

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

Assessment Feedback: The students receive feedback on coursework by comparing their solutions with step-by-step solutions available on MyMath student page. Students will be able to review their score and errors.
The example class contact hours will also be an opportunity to provide one-to-one feedback as required.

Failure Redemption: Additional attempt at any failed test during the supplementary period 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.

This module will be suppported with Canvas.

This module is assessed by four required pass/fail components. Students will need to pass each of these in order to pass the module, and will have several opportunities to do each of these. Successful completion of each of the pass / fail components will result in a 40% pass mark for the module. Higher marks for the module can be gained by completing further and more challenging assessed examples throughout the semester. For any students granted supplementaries, this will be done by further attempts at the components in the resit period.

EG-188 Engineering Analysis for Materials 2

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr L Prakash, Dr JD Mcgettrick

Format: Lectures 11 hours
Exercise classes 11 hours
Computer classes 11 hours
Directed private study 67 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

A combination of lectures, examples classes, extensive blended learning and on-line assessment (formative and summative).

Module Aims: To provide additional grounding in engineering analysis methods for materials students.
The module will cover the most important analytical tools and methods used in engineering and will relate these to common materials-related examples.
The module will ensure the required grounding in methods and techniques for those who have not previously covered this area, or who are returning after a gap. It will also provide opportunities for extension to more complicated examples for those who have more prior experience.

Module Content: Sequences and series: arithmetic and geometric series, summations of series.
Basic matrix algebra and manipulation.
Integration: geometrical basis and basics of integral calculus. Areas, volumes of revolution, simple techniques of integration.
Dynamic mechanics involving linear and rotational motion.
Statistics, including measures of averages, distribution functions and the relationship of these to experimental and materials variability.

Intended Learning Outcomes:
Technical Outcomes
After completing this module, the student should be able to demonstrate:
- An ability to integrate basic mathematical functions and appreciate the physical significance of this. (SMb2)
- An ability to solve problems of dynamic mechanics involving linear motion and rotation. (SM2b / G1)
- An ability to use basic series expansion and matrix algebra to formulate engineering problems. (SM2b / EA1b)
- An ability to use statistical methods to describe distributions of real data. (SM2b)

Accreditation Outcomes (AHEP)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1b)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

Each LO is linked to the class tests in turn.

Assessment: Class Test 1 - Coursework (0%)
Class Test 2 - Coursework (0%)
Class Test 3 - Coursework (0%)
Coursework 4 (53%)
Coursework 5 (24%)
Coursework 7 (23%)

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

Assessment Description: This module will be assessed with 3 separate (pass/fail) tests, which cover the required basic understanding and abilities needed for the materials degree. The pass mark for each test will be 75%. Each of these components will be available for students to take more than once throughout the semester. There will be one final attempt to pass each test in the May / June exam period. The best attempt will count, but all three tests need to be passed in order to pass the module. If you pass all three tests, the average of the test marks will make up Component 4, so you would get between 40% and 53%.

Further marks (up to 47%, in components 5 & 7) will be gained by successful completion of more challenging examples through the semester, but these will only count when you have passed all three tests.

If you do not meet the requirements of the Pass/Fail component, you will receive a QF outcome. This means that you will be required to repeat the failed component(s), even if your module mark is above 40%.

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

Assessment Feedback: The students receive feedback on coursework by comparing their solutions with step-by-step solutions available on MyMath student page. Students will be able to review their score and errors.
The example class contact hours will also be an opportunity to provide one-to-one feedback as required.

Failure Redemption: Additional attempt at any failed test during the supplementary period 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. This module will be supported with Canvas.

This module is assessed by three required pass/fail components. Students will need to pass each of these in order to pass the module, and will have several opportunities to do each of these. Successful completion of each of the pass / fail components will result in a 40% pass mark for the module. Higher marks for the module can be gained by completing further and more challenging assessed examples throughout the semester. For any students granted supplementaries, this will be done by further attempts at the components in the resit period.

EGA103 Foundation Chemistry

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof G Williams

Format: 20 lectures/ 4 examples classes/ 8 hours of practicals.
68 hours 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

Module Aims: This course is designed as an introduction to the chemical properties of materials used throughout engineering. To complement the taught theory, this course has a strong practical component during which students will develop the skills to carry out a number of basic laboratory manipulations in an accurate and safe manner.

Module Content: • Atoms: the proton, neutron and electron. Atomic number. Mass number. Elements and isotopes.
• Atomic trends: Relative atomic mass. Energy levels. Electronic configurations. The Periodic Table.
• Chemical Reactions: Writing Formulae. Chemical equations and their balancing. Scaling up from atoms and molecules to moles.
• Bonding and forces: Principles of ionic and metallic bonding. Covalent bonds. Intermolecular forces.
• Types of reaction: Redox, acid-base, precipitation and complexation. Organic Compounds: Functional groups and reactions. Hybridisation and aromaticity. Isomersim
• Energetics: Bond energy. Enthalpy changes. Heat capacities.
• Equilibria: Le Chatelier principle.
• Electrochemical cells: Electricity from chemical reactions. Electrode potentials.
• Rates of reaction: Rate equations. Orders of reaction. Effect of temperature on reaction rates. Activation energies. Effect of catalysts.

Intended Learning Outcomes: Knowledge Based
After completing this module you should be able to:

• Describe the fundamental structure of an atom and predict the properties associated with a given species.
• State the formula of common chemical species and construct balanced chemical equations. Carry out simple mole calculations.
• Describe and identify the presence of bonding types within compounds. Distinguish between types of intermolecular forces and use them to predict the physical properties of compounds.
• Identify reaction types and write relevant balanced equations.
• Recognise basic organic functional groups and identify/predict their reactions. Describe the different energy changes associated with matter. Use energy data to solve simple thermodynamic equations.
• Define Le Chatelier's principle and apply it to predict the effect of induced changes to a reaction.
• Describe a typical electrochemical cell. Use relevant data to calculate cell potentials.
• Construct rate equations and identify the order of a reaction. Discuss those factors that affect the rates of a reaction.

The following AHEP 3 Programme Learning outcomes at Partial CEng (p) are partially demonstrated at a threshold level by this module:

* Knowledge and understanding of scientific principles and methodology (SM1)
* Knowledge and understanding of mathematical and statistical methods (SM2)
* Knowledge of characteristics of particular materials, equipment, processes, or products (EP2)
* Ability to apply relevant practical and laboratory skills (EP3)

Assessment: Examination 1 (60%)
Laboratory work (20%)
Assignment 1 (10%)
Assignment 2 (10%)

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

Assessment Description: The examination paper consists of a series of multiple choice questions covering the entire syllabus.

Laboratory work consists of 3 practical classes totalling 10 hours, where experiments dealing with inorganic, organic and physical chemistry based experiments are carried out. Lab reports are completed within the allotted time and are handed in for marking at the end of each class.

The assignment consists of a two Canvas tests, to be completed before a specified deadline within the teaching block.

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

Assessment Feedback: As set out by Faculty of Science and Engineering guidelines.

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.

This module assumes no previous chemistry background.
PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

EGA106 Engineering Science

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr WC Tsoi

Format: Lectures: 22 hours
Examples classes: 11 hours

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: This module 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 course provides an introduction to the physical sciences (including thermal, electrical and optical properties of matter) and their application in engineering. A practical component will be used to complement taught theory.

Module Content: •Quantities, units, dimensions,
•Measurement accuracy, uncertainties, introduction to errors
•Use of large data sets and statistical treatment
•States of matter, phase changes
•Temperature and Heat; specific heats, latent heats
•Heat transfer; conduction, radiation, convection
•Electrical charges, current, voltages
•Introduction to sources of EMF, basic units
•Ohm's law, resistivity
•Resistors in series and parallel, solving resistor networks
•DC, series and parallel circuits
•Intro to capacitance and capacitors, static electricity
•Waves, rays and radiation – EM spectrum
•Reflection and mirrors
•Refraction and lenses, refractive index, Snell's law

Intended Learning Outcomes: After completing this module, students should be able to:
•Apply statistical methods to data sets to draw meaning from them
•Conduct dimensional analysis
•Identify sources of uncertainty and error
•Determine how uncertainty and errors in data impact engineering calculations
•Define the three states of matter and explain the processes which occur during phase changes
•Explain the difference between temperature and heat (specific heats, latent heats) and be able to perform calculations on these concepts
•Understand and explain the differences between the three methods of heat transfer: conduction, radiation, convection
•Understand basic electrical concepts of voltage, current, charge and identify sources of EMF
•Analyse resistive dc networks
•Understand and explain the differences between series and parallel circuits
•Define capacitance and explain the role of capacitors within a circuit and engineering applications
•Differentiate between the different parts of the electromagnetic spectrum
•Define reflection and the use of mirrors within engineering applications
•Define refraction and the use of lenses within engineering applications
•Apply Snell's law
AHEP 4
F1. Apply knowledge of mathematics, statistics, natural science and engineering principles to broadly-defined problems.
F12. Use practical laboratory and workshop skills to investigate broadly defined problems

Assessment: Assignment 1 (15%)
Assignment 2 (20%)
Examination (50%)
Practical (15%)

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

Assessment Description: Exam January 50% Practical 15% Assignment 1 (Canvas quiz) 15% Assignment 2 (Canvas quiz) 20%
Moderation approach to main assessment: Universal second marking as check or audit
Assessment Feedback: General feedback on the two assignments will be provided. Feedback during Q&As in lecture and example classes. Lecturer available for ad-hoc feedback during office hours. Feedback will be given to each individual student upon request. A general exam feedback pro-forma will be distributed after the exam marks are released.
Failure Redemption: If the overall marks (Practical + quiz + Exam) is less than 40%, they will be eligible to do a supplementary exam which count 100% marks.
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. PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION.

EGA110 Instrumental and Analytical Chemistry

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr A Munnangi, Prof S Margadonna

Format: 1 hour of synchronous session per week
(either on line, face-to-face, or streaming).
2 hours worth of asynchronous teaching
2 sessions of laboratory experience
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 course will be delivered as a mixture of synchronous (on line or face to face) and asynchronous sessions. It will include
lectures, example classes, 2 laboratory sessions, on-line laboratory preparation.

Assessment:
Examination 70%, 2 practical reports for a total weighting of 30%

Module Aims: This module deals with the principles and practice of analytical chemistry and gives an introduction to a number of important instrumental techniques in analytical chemistry for both qualitative and quantitative analysis including: gravimetric, titrimetric separation and spectroscopic techniques.

Module Content:

• Introduction to chemical analysis and analytical methods. General approach; sources and types of errors in analytical chemistry; reporting results, error estimates and significant figures.
• Gravimetric analysis: principles, methods and applications.
• Titrimetric analysis: principles, methods, and applications.
• Principles of spectroscopy. Regions of the electromagnetic spectrum and their interactions with atomic and molecular species. Absorption, emission and scattering, Beer-Lambert law. Deviations from Beer Lamber law.
• UV-Vis spectroscopy: principles and applications.
• Separation techniques: basic principles and applications.
• Atomic absorption and emission spectroscopy: principles and applications.

Intended Learning Outcomes: Technical Outcomes
On successful completion of this module students should:
- have knowledge of a range of analytical techniques from classical gravimetric and volumetric analysis through to modern spectroscopic and separation methods
- understand the principles of analytical chemistry including estimation of errors in measurements.
- have acquired practical experience of analytical chemistry.

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)
- Communicate their work to technical and non-technical audiences (D6)
- Ability to apply relevant practical and laboratory skills (P3)

Assessment: Examination 1 (70%)
Laboratory work (15%)
Laboratory work (15%)

Assessment Description:
Examination: unseen exam, typically requiring answers to three out of four equal weight questions.

Laboratory work: Two laboratory sessions involving
1) the analysis of a solution of zinc, requiring analytical results and a written report
2) the analysis of Fe and organic compounds contained in spinach using UV-Vis and chromatography techniques
Practical results and understanding to be assessed in the form of written reports.

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

Assessment Feedback: Individual and group feedback on laboratory work provided during laboratory sessions.
Individual marked laboratory reports returned to students.
Generic feedback on exams provided via College exam feedback procedures.

Failure Redemption: The practical component of this module is NOT REDEEMABLE.
However the exam component IS REDEEMABLE via a supplementary examination.
The resit mark will be therefore be made up as follows:
30% Laboratory mark (previously obtained)
70% Resit 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.

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

EGA113 Case Studies in Materials

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr A Das, Dr MP Coleman

Format: Lectures: 10 hours
Computer-based or lab based classes: 20 hours
Directed private study: 30 hours
Preparation for assessment: 30 hours

Delivery Method: On campus.
Continuous Assessment (100%).

Module Aims: This module is based around four separate case studies in Materials and Sports Materials. Each case study will focus on a particular engineering material, component or structure. Within each case study, students will be presented with some initial material, along with suggested links to further information. Students will then undertake independent study either individually or in groups, with a final report presented on the findings. In some case studies, presentations will be part of the assessment. The specific case studies will include engineering design, materials selection for engineering applications, failure analysis, materials characterisation techniques and investigation of material for solar cell.

Module Content: Engineering Design Case Study:
This follows a series of case studies as given in the course text. This covers a wide range of subjects including conceptual design, innovation, standardisation, reliability, safety, failure, ergonomics, materials and management. Students will work in multi-disciplinary groups to formulate design concepts and then to refine detail.

Materials Selection Case Study:
Materials selection case study will introduce the philosophy of selection of materials in the design process and teach the use of a materials selection software, CES Edupack. In the practical classes, students will be introduced to design problems involving selection of appropriate materials and manufacturing processes in a range of practical applications. Assessment will involve two components of coursework including the identification of material information and data as well as solving design and selection related problems using the CES Edupack software.

Failure Analysis Case Study:
The case study is a real example of catastrophic failure in service. The cause of failure will be examined during the course of practical classes in which groups of students will analyse the failed component via Optical and Scanning electron microscopy, energy dispersive X-Ray Spectroscopy and hands on visual inspection. In addition, other site information and personal statements will be reviewed.
The component will be assessed on the basis of a report into an engineering failure of the students choice that is expected to demonstrate knowledge and application of the techniques and skills developed during the course of the taught and practical classes. As all failure investigations rely heavily on functioning as part of a team, this will be assessed as a group exercise.

Materials Characterisation Case Study:
The case study is an example of Forensic Polymer Engineering, based on investigation of an in-service materials failure in relation to a possible legal action. It includes:
Presentation of initial evidence.
Introduction to Energy Dispersive X-ray Analysis, Fourier Transform Infrared Spectroscopy, Differential Scanning Calorimetry and tear strength testing, both theoretically and through practical demonstrations.
Provision of data from these techniques for the case being investigated.
The student is required to produce a report assessing the liability in the case, using analysis of the data provided and background research.

Intended Learning Outcomes: Technical Outcomes
Following completion of this module, students will have the ability to:
• Use information about properties of different materials to make sensible design decisions.
• Use commercial software to assist with Materials Selection issues.
• Understand the relationship between processing, structure, properties and applications.
• Appreciate the range of materials identification techniques available.
• Consider safety regulations within the design process.
• Think critically whilst solving complex Engineering problems.
• Knowledge of some materials characterisation techniques.
• Experience of using analysis of material test data and independent research to investigate a failure.

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)
- Ability to apply relevant practical and laboratory skills (P3)
- Understanding of the use of technical literature and other information sources (P4)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

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

Assessment Description: The specific case studies will be:

1 - Engineering design, considering form, structural requirements and manufacturing (30% of module grade).
2 and 3 - Materials Selection. This will use the CES Edupack software which will enable students to consider design requirements for specific example components, in terms of strength, stiffness, toughness, cost, density, ease and cost of manufacturing etc (40% of module grade).
4 - Failure Analysis. This will focus on a real-life example of catastrophic materials failure. Students will consider the causes of failure, and whether it was a design, materials selection or manufacturing fault (30% of module grade).

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

Assessment Feedback: Students will receive feedback within 3 weeks of submitting their pieces of coursework. This will take the form of either detailed comments written on the submitted work or generic statements stating what was expected for the coursework.

Failure Redemption: Additional coursework will be set during the summer vacation that must be completed by the start of the supplementary examination period.

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.

Penalty for late submission of work: ZERO TOLERANCE.

EGA163 Design and Laboratory Classes 1

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof RE Johnston, Dr F Zhao

Format: Lectures 10 hours
Example classes / Laboratory work 20 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

Continual Assessment. 40% from part A (CAD), 60% from lab assignments
PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION

Module Aims: This module is split into two parts. Firstly, Competence in engineering drawing using CAD. Secondly essential laboratory skills, including mechanical testing, microscopy (light, electron, X-ray), virtual reality to explore microstructures, and report writing.

Module Content: Engineering drawing skills using a CAD software package to the required British Standard.
Drawings: a dimensioning exercise, bike crank assembly.
Laboratory Work: The assessment of different materials classes; measurement of mechanical properties of a range of materials; interpretation of mechanical tests (tensile and hardness); microscopy of materials, report writing.

Intended Learning Outcomes: KU2 Have an appreciation of the wider multidisciplinary engineering context and its underlying principles.
IA1 Apply appropriate quantitative science and engineering tools to the analysis of problems.
PS1 Possess practical engineering skills acquired through, for example, work carried out in laboratories and workshops; in industry through supervised work experience; in individual and group project work; in design work; and in the development and use of computer software in design, analysis and control. Evidence of group working and of participation in a major project is expected. However, individual professional bodies may require particular approaches to this requirement.
A knowledge and understanding of: effective written and oral communications and standard IT tools.

After completing this module you should be able to:
Produce engineering drawings to the required standard using a CAD system.
Apply basic laboratory techniques including safety issues; data manipulation; development of report writing skills and teamworking. Hands-on skills with optical microscopy and mechanical testing, and observational competencies in scanning electron microscopy, X-ray microscopy, and virtual reality for 3D image analysis.

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 of characteristics of particular materials, equipment, processes, or products (P2)
- Ability to apply relevant practical and laboratory skills (P3)
- Understanding of the use of technical literature and other information sources (P4)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

Assessment:	Coursework 1 (40%) Coursework 2 (15%) Laboratory work (5%) Coursework 4 (40%)
Assessment Description: Coursework 1: CAD assignment (40%) Coursework 2: Mechanical testing report on alloy materials (15%) Coursework 3: Lab Work - completion of a laboratory notebook related to the practical activities and active note taking (5%) Coursework 4: Microscopy report on biological materials (40%)	
Moderation approach to main assessment: Second marking as sampling or moderation	
Assessment Feedback: Students will receive pro-forma marking sheets for each assignment. For the laboratory report, feedback developed from previous years' reports will be fed forward to each new year.	
Failure Redemption: Students will be expected to undertake a resit in all failed components.	
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. PENALTY: ZERO TOLERANCE FOR LATE SUBMISSION	