Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

STUDENT HANDBOOK

MSc (FHEQ LEVEL 7)

MSc NANOSCEINCE TO NANOTECHNOLOGY DEGREE PROGRAMME

SUBJECT SPECIFIC
(PART TWO OF TWO)
MODULE AND COURSE STRUCTURE
2022/23

DISCLAIMER

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

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

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

The 22-23 academic year begins on 19 September 2022

Full term dates can be found here

DATES OF 22-23 TERMS

19 September 2022 – 16 December 2022

9 January 2023 – 31 March 2023

24 April 2023 – 09 June 2023

SEMESTER 1

19 September 2022 – 27 January 2023

SEMESTER 2

30 January 2023 – 09 June 2023

SUMMER

12 June 2023 – 22 September 2023

IMPORTANT

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

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

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

Welcome to the Faculty of Science and Engineering!

Whether you are a new or a returning student, we could not be happier to be on this journey with you.

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

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

At Swansea University and in the Faculty of Science & Engineering, we believe in working in partnership with students. We work hard to break down barriers and value the contribution of everyone. Our goal is an inclusive community where everyone is respected, and everyone's contributions are valued. Always feel free to talk to academic staff, administrators, and your fellow students - I'm sure you will find many friendly helping hands ready to assist you.

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

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

Professor Johann (Hans) Sienz
Interim Pro-Vice Chancellor/Interim Executive Dean
Faculty of Science and Engineering

Faculty of Science and Engineering	
Interim Pro-Vice Chancellor/Interim Executive Dean	Professor Johann Sienz
Head of Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Professor Paul Holland
School of Aerospace, Civil, Electrical, General and Mechanical Engineering **Head of School: Professor Antonio Gil**	
School Education Lead	Professor Cris Arnold
Head of Electronic and Electrical Engineering	Professor Vincent Teng
Electronic and Electrical Engineering Programme Director	Dr Karin Ennser
Year Coordinators	Dr Thierry Maffeis

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/

Supporting Your Studies

- Centre for Academic Success
- Faculty of Science and Engineering- Student Support

Supporting Your Professional Development

As a student studying MSc Nanoscience to Nanotechnology at Swansea University you are continuing your educational journey which we hope will end with Engineering Council registration as a Chartered Engineer (CEng).

The Master of Science (MSc) programme Nanoscience to Nanotechnology has been accredited by the Institution of Engineering and Technology (IET) on behalf of the Engineering Council as meeting the requirements for Further Learning for registration as a Chartered Engineer (CEng). Candidates must hold a CEng accredited BEng/BSc (Hons) undergraduate first degree to comply with full CEng registration requirements.

What this means for you is that the learning outcomes of each year of your programme of study has been carefully designed to align with Version 3 of the Engineering Council's Accreditation of Higher Education Programmes (AHEP) which forms the educational foundation for the UK Standard for Professional Engineering Competence (UK-SPEC).

The knowledge and skills you will have demonstrated by completing your programme of study are defined by achieving a set of learning outcomes distributed across the following key areas of competence:

- Science and mathematics
- Engineering analysis
- Design and innovation
- The engineer and society
- Engineering practice

To find out more about Professional Registration and what the AHEP competences are, please refer to the Engineering Council's Student Guide to Professional Registration and the Accreditation of Higher Education Programmes collated learning outcomes

The IET – Your Professional Home for Life

As a student at Swansea University, you are privileged to be associated with one of the small groups of universities that have been selected to be Academic Partners of the IET. The most tangible benefit of this is that you can register as a student member of the IET at no cost to yourself for the duration of your study. And as a student member of the IET, you can take *full advantage* of the benefits that membership of the IET offers. These include an impressive range of services supporting *Networking*, *Professional Development*, *Learning Resources* and *Membership Benefits*. A summary of these is shown on the Get more from your partnership page.

As well as these benefits, as an Academic Partner of the IET, the University can offer you access to the IET's Graduate Advantage Scheme: that is, we will pay for your first year of full Membership of the IET, and you can use the post-nominals MIET straight after graduation for no cost. This will be especially useful as you start to gain and evidence the UK-SPEC competences you will need to complete your IEng or CEng professional registration.

IET on Campus

IET On Campus is designed to support everyone in the Department of Electronic and Electrical Engineering with students at the heart of it. The IET gives you access to tailored practical, technical, and career-related resources and helps you to create links with industry and other universities, building a platform for you to demonstrate your skills and raise your profile. At Swansea, the local branch of IET on Campus is run by the Electrical & Electronic Engineering Society (E&EESoc) and is supported by the IET South Wales Local Network.

For more information, please join E&EESoc and access their social media channels.

IET Student Advisor

Dr Chris Jobling (MIET, CEng) is the *IET Student Advisor* for Swansea University. Please get in touch with him if you want to find out more about the AHEP and UKSPEC, the IET, IET student membership, IET Scholarships, Graduate Advantage, IET Communities, or opportunities to get involved with Wales Southwest Local Network as an IET young professional volunteer. He will be happy to help.

Other members of staff associated with the IET at Swansea include:

- Dr Richard Cobley (MIET)
- Dr Timothy Davies (MIET, CEng)
- Dr Augustine Egwebe (MIET)
- Dr Karin Ennser (MIET, CEng)
- Prof Lijie Li (FIET)
- Mr David Moody (MIET)

UK Electronics Skills Foundation

Swansea University is an academic partner from the UK Electronics Skills Foundation. The partnership means that you can benefit from the UKESF scholarship scheme, competitions, awards and internship programme, which connects the most capable Electronics undergraduates with leading companies in the sector.

UKESF offers opportunities for undergraduates to take advantage of an industry placement, develop their employability skills, generous financial support, and the opportunity to network with professionals in the Electronics sector. Dr Karin Ennser is the *UKESF Student Advisor* for Swansea University. Please contact her if you want to find out more.

Faculty prizes

The Faculty of Science and Engineering awards graduation prizes to the best MSc Nanoscience to Nanotechnology student in each graduating year.

MSc (FHEQ Level 7) 2022/23
Nanoscience to Nanotechnology
MSc Nanoscience to Nanotechnology

Semester 1 Modules	Semester 2 Modules
EG-M85 **Strategic Project Planning** **10 Credits** **Dr K Wada** **CORE**	**EG-M190** **Social, environmental and economic context of research** **10 Credits** **Dr N Wint** **CORE**
EGIM16 **Communication Skills for Research Engineers** **10 Credits** **Dr SA Rolland/Dr T Lake** **CORE**	**EGDM01** **Colloid and Interface Science** **10 Credits** **Dr S Alexander** **CORE**
EGNM01 **Probing at the Nanoscale** **10 Credits** **Dr TGG Maffeis/Prof KS Teng/Dr CJ Wright** **CORE**	**EGLM01** **Wide band-gap Semiconductors** **10 Credits** **Dr TGG Maffeis/Prof OJ Guy** **CORE**
EGNM02 **Soft Nanotechnology** **10 Credits** **Dr AM Higgins/Prof OJ Guy/Prof PR Williams** **CORE**	**EGNM03** **Nanoscale Simulation** **10 Credits** **Prof P Rees/Dr MR Brown** **CORE**
EGNM05 **Bio-nanotechnology** **10 Credits** **Dr CJ Wright** **CORE**	**EGNM04** **Nanoscale Structures and Devices** **10 Credits** **Dr TGG Maffeis/Prof KS Teng** **CORE**
EGNM07 **Principles of Nanomedicine** **10 Credits** **Dr S Sharma/Prof OJ Guy** **CORE**	**EGNM09** **Micro and Nano Electro-Mechanical Systems** **10 Credits** **Prof L Li** **CORE**
Dissertation	
EG-D07 **MSc Dissertation - Nanoscience to Nanotechnology** **60 Credits** **Dr TGG Maffeis** **CORE**	
Total 180 Credits	

EG-D07 MSc Dissertation - Nanoscience to Nanotechnology

Credits: 60 Session: 2022/23 June-September

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr TGG Maffeis

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

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

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

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

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

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

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

Accreditation Outcomes (AHEP)
• A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
• A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
• Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA1fl)
• Ability to use fundamental knowledge to investigate new and emerging technologies (EA2fl)
• Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods (EA3fl)
• Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D2fl)
• Awareness of the need for a high level of professional and ethical conduct in engineering (ET1fl)
• Awareness that engineers need to take account of the commercial and social contexts in which they operate (ET2fl)
• Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation (ET3fl)
• Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation (ET5fl)
• Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk (ET6fl)
• Advanced level knowledge and understanding of a wide range of engineering materials and components (EP1fl)
• A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP2fl)
• Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints (EP3fl)

Assessment: Report (100%)

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

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

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

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

Each student is to submit an electronic copy of their dissertation through the Turnitin link on Canvas by the deadline of 30th September. The online system will automatically check the similarity of the report.

The dissertation must contain:

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

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

Moderation approach to main assessment: Universal double-blind marking

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

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

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

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

The College of Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.
If an extension is deemed appropriate a Postgraduate Taught Masters ‘Application for Extension to the Submission Deadline/ Period of Candidature’ Form will need to be submitted as follows:
• 30 September – deadline for Part Two students (non-resit students)
• 22 December – deadline for Part Two Students (students who had resits)

EG-M190 Social, environmental and economic context of research

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr N Wint

Format: 30 formal contact hours
10 x 1 hour lectures
10 x 2 hour interactive workshops

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 and workshops

Module Aims: There is an increasing need for engineers to work towards complex, so called 'wicked problems', for example the secure supply of energy. This necessitates a holistic approach and involves making decisions based on a range of different factors, and consideration for economic, ethical, social, political and environmental, as well as technical limitations.

Obtaining and making sense of such information involves types of knowledge and the use of tools and techniques that have not always been traditionally used within engineering disciplines. For example, ethical issues concerning negative impacts on environment or society may raise questions of value, duty or morality and requires the application of moral reasoning rather than scientific reasoning.

During this module we will make use of a variety of engineering case studies which exemplify the need to consider non-technical aspects of engineering projects. We will use qualitative research approaches and ethical frameworks to help in our engineering decision making. We will also consider the role of the engineer in policy making.

Module Content: Different types of knowledge and research approaches used to obtain different types of knowledge and information
The use of moral reasoning and ethical frameworks
Policy process and the role of the engineer in informing policy

Intended Learning Outcomes: Technical Outcomes
By the end of this module students should be able to:
Knowledge of the stages of a research project and how to select appropriate research methods.

Accreditation Outcomes (AHEP)
Awareness of the need for a high level of professional and ethical conduct in engineering (EL8M / ET1fl)
Awareness that engineers need to take account of the commercial and social contexts in which they operate (EL9M/ ET2fl)
Awareness that engineering activities should promote sustainable development (EL11M / ET4fl)

Assessment: Coursework 1 (60%)
Coursework 2 (40%)
Participation Exercise (0%)

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Assessment One: Selection of a contemporary engineering topic/project. Outline of the role of different types of knowledge and information needed to inform project. Ethical, economic, social and environmental evaluations of the engineering issues involved.
Assessment Two: A policy brief (choice of contemporary engineering topic)

PASS/FAIL COMPONENT Minimum attendance and contribution to workshop sessions
Note, that this module cannot be passed if this pass/fail element is not passed. 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 50%

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

Assessment Feedback: Formative and peer feedback will be given in group/workshop sessions Feedback during Q&As in lecture and example classes. Lecturer available for ad-hoc feedback during office hours. Written feedback on all coursework submitted
Failure Redemption: Students will be provided with the opportunity to resubmit failed components. If engagement in group project activities is below required level, no supplementary will be possible and module will have to be resat in the following year.
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. .

EG-M85 Strategic Project Planning

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr K Wada

Format: Lectures and Case Studies 13-15 hours; Project Monitoring 7 hours (project briefing, project update and presentations); Private Study 78-80 hours (reading, group work, exam preparation)
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

Series of lectures and combination of case study, project briefing/update and group work sessions.
Practical group work sessions (50%) will be arranged in order to grasp the project management techniques and effectively apply them to form a 'High Performance Team'. This coursework assessment (CA) is comprised of a group project and group presentation.
Examination - Closed Book (50%) at the end of the semester.

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

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

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

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

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

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

Accreditation Outcomes (AHEP)
- Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards (D2)
- Communicate their work to technical and non-technical audiences (D6)
- Awareness that engineers need to take account of the commercial and social contexts in which they operate (ET2fl)
- Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation (ET3fl)
- Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate (ET4fl)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP2fl)
- Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints (EP3fl)
- Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader (EP4fl)

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

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

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

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

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

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

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

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

No opportunity to resit the passed component.

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

Penalty for late submission of work: ZERO TOLERANCE.
Available to visiting and exchange students wishing to enhance project management skills.

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

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

EGDM01 Colloid and Interface Science

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Alexander

Format: Lectures: 20 hours
Example classes: 5 hours
Directed Private Study: 75 hours
Contact Hours will be delivered on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

Delivery Method: All lectures will be delivered onsite. But students are still required to use Canvas for self-directed online activities.

Module materials available at CANVAS.

Module Aims: Students will gain an in-depth understanding of the properties of colloids and their importance in industry.

Module Content: Introduction to the nature of the colloidal state
Particle size and its determination; theory and practice
Determination of zeta potential
Charge and potential distribution: the structure of the electrical double layer;
Interactions between particles: repulsive and attractive forces, DLVO theory; Van der Waals theory and Steric stabilisation
Determination of important properties for colloidal systems, e.g. Osmotic pressure, viscosity, diffusion coefficients;
Coagulation and Flocculation
Small-angle neutron and X-ray scattering
Solid-gas, liquid-gas and liquid-liquid interfaces
Surface tension and wetting
Emulsions, foams and aerosols

Intended Learning Outcomes: You should be able to demonstrate a knowledge and understanding of:

• What colloids are; their characteristics and properties;
• Techniques used to characterize colloid size and colloidal systems;
• Colloidal stability and charged particles;
• The importance and examples of colloidal science in industry;
• The relationship between properties at the nano, micro and bulk scales;

You should be able to demonstrate an ability to:

• Use scientific literature to evaluate information on colloidal systems;
• Analyse and present scientific findings and express ideas in a logical and coherent manner;
• Apply knowledge and understanding to calculate relevant parameters, e.g. different measures of size, zeta potential, molecular weight etc.

Accreditation Outcomes (AHEP)
• A comprehensive understanding of the relevant scientific principles of the specialisation
• A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation
• Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects
• Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations

Assessment: Examination 1 (70%)
Coursework 1 (30%)

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

Assessment Description: This module is assessed by examination and coursework.

Examination - Answer 3 Questions from 4 (70%).
Coursework 1- Case study: this is a teamwork assignment/presentation (30%)

Note: In order for continuous assessment marks to be included in your final module mark, you must achieve a mark of 40% in the final exam.

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

Assessment Feedback: Exam past papers will be available for students and general feedback on student performance in the exam is given via the University feedback system.
Coursework 1 will be marked and oral/written feedback will be given to students.

Failure Redemption: Eligibility for the redemption process is subject to the degree scheme and the associated progression/completion criteria; where permitted, a supplementary examination will form 100% of the mark.

Additional Notes: All lectures will be delivered on site. But students are still required to use Canvas for self-directed online activities.

This module will be supported with CANVAS.

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

This module is 70% assessed by examination and 30% by coursework.

EGIM16 Communication Skills for Research Engineers

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

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

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

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

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

Module Content:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

All lectures and course material will be provided on CANVAS.

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

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

EGLM01 Wide band-gap Semiconductors

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr TGG Maffeis, Prof OJ Guy

Format: 23 h lecture/on demand
2 h pc lab
55 hours private study
20 hours assessment preparation

Delivery Method: Lecture either online or face to face, and PC lab based module.
Assessment: 80% final exam, 20% continual assessment (2x10%).

Module Aims: State-of-the-art wide band gap semiconductor materials and technology will be considered with emphasis on diamond, silicon carbide, gallium nitride and metal oxides. The course will cover everything from materials growth through device processing technology, to devices and applications. Current commercial devices and anticipated devices will be highlighted and discussed. The semiconductor physics needed for devices simulation and an introduction to device simulation will be covered. Metal oxide wide band gap semiconductors and their applications in renewable energy generation will be discussed.

Module Content:

• Introduction to wide band-gap materials: structure and material properties of diamond, silicon carbide & gallium nitride.
• Materials Growth.
• Electronic properties and applications.
• Basic requirements of power devices.
• Types of wide bandgap devices.
• Diodes: Schottky diodes & PiN diodes.
• Field Effect Transistors (FETs): MOSFETs, MESFETs.
• Device processing technology: Material analysis, Contact formation, Implantation, Dielectrics, Etching.
• Semiconductor physics background.
• Device testing & characterisation; State of the art device technology.
• Electronic materials for renewable energy generation.
• Solar power and photo-voltaics.

Intended Learning Outcomes: Technical outcomes:
• A detailed knowledge and comprehensive understanding of wide band gap materials including the techniques for the design, fabrication and characterisation of devices
• A comprehensive understanding of the semiconductor physics governing device behaviour
• A critical awareness of the pros and cons of novel wide band gap materials.
• An ability to identify the key differences between simulation and experiment
• How to design and fabricate devices.

Accreditation outcomes (AHEP):

MEng
- A comprehensive knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies (SM1m)
- Awareness of developing technologies related to own specialisation (SM4m)
- Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes (EA1m)
- Communicate their work to technical and non-technical audiences (D6m)
- Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D7m)
- Knowledge of characteristics of particular equipment, processes, or products, with extensive knowledge and understanding of a wide range of engineering materials and components (EP2m)
- Understanding of the use of technical literature and other information sources (EP4m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP9m)

MSc
• A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
• A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
• Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA1fl)
• Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations (D2fl)
• Advanced level knowledge and understanding of a wide range of engineering materials and components (EP1fl)
• A thorough understanding of current practice and its limitations, and some appreciation of likely new developments. (EP2fl)
• The ability to apply engineering techniques, taking into account of a range of industrial and commercial constraints (EP3fl)
• Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader (EP4fl)

Assessment:	Examination 1 (80%) Coursework 1 (10%) Oral Presentation (10%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Assessments: Exam (80%), exercise sheet (10%) and oral presentation (10%)

Course work components:
Coursework 1: (Prof. Guy) Problem sheet (exam type questions): Assessment in April - worth 10%. This is an individual piece of coursework.
Groupwork Coursework: (Prof. Guy) Oral presentations - PowerPoint presentations given by small groups on course. related topics: Assessment in April - worth 10%. This is an individual piece of coursework.

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 40% in the exam component. If you achieve less than 40% 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: - Written feedback on formal exam.
- Oral feedback on CA.

Failure Redemption: If rules allow - standard University provisions with marks capped. Any re-examination of this module will be by written examination only (100%).

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

• There is a zero tolerance towards late submission of coursework.

• Advanced semiconductor materials like diamond, silicon carbide and gallium nitrate are necessary to increase energy efficiency of electronic devices to reduce carbon emissions. These new materials are expected to replace silicon in aerospace, energy and automotive (hybrid electric vehicles) sectors in the near future.

• 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 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

EGNM01 Probing at the Nanoscale

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr TGG Maffeis, Prof KS Teng, Dr CJ Wright

Format: Lectures: 17 hours
Revision classes: 3 hours
Laboratory: 3 hours
Directed private study: 24 hours
Personal revision: 50 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

Content delivered by lecture, with supervised lab sessions using scanning probe microscopes requiring a formal laboratory report. Additional data analysis exercises.

Module Aims: This module provides an introduction to the analysis techniques used in nanotechnology, and general surface science, including scanning probe microscopy, electron and diffraction techniques.

Module Content: A general introduction to nanotechnology including the principles of operation and useful applications of a variety of scanning probe microscopy (SPM) techniques, including atomic force microscopy (AFM), scanning tunnelling microscopy (STM), scanning near field optical microscopy (SNOM) and Kelvin probe force microscopy (KPFM). Consideration is given to their appropriate use, data analysis and benefits over conventional microscopy. In addition, novel SPM techniques are explored. Traditional surface science techniques such as x-ray photoelectron spectroscopy (XPS), auger electron spectroscopy (AES) and secondary ion mass spectroscopy (SIMS) are also covered within this module.

Intended Learning Outcomes: Technical Outcomes:
After completing this module you should be able to:
• Understand the demands and requirements of measuring, characterising and manipulating materials and devices at the nanoscale
• Explain a variety of different analysis tools used at this length scale, including scanning probes, diffraction and electron microscopy techniques.
• Apply the scientific principles behind nanoscale analysis to explain the different analysis techniques used
• To bring together all the above to design an experiment based on the required measurement, cost, accuracy level, device limitations and other requirements, across a range of materials and devices spanning semiconductors, metals, oxides and biological materials.
• To analyse data, extract physical quantities and assess a material or device with potentially incomplete data sets, and to use the literature to supplement missing knowledge.
• To operate and use scanning probe microscopes and be exposed to a wider range of analysis tools within the department, to collect, analyse and interpret data and to undertake a risk assessment exercise prior to using the laboratories
• To critically assess the results in terms of information resources and communicate the importance of the data and results and produce a report based on this information.

Accreditation Outcomes:
l Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects. (SM3fl)
Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations. (Ea1fl)
Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques. (EA2m)
Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies. (D1fl)
Advanced level knowledge and understanding of a wide range of engineering materials and components (EP1fl)
Knowledge of characteristics of particular equipment, processes, or products, materials and components; (Ep2M)

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

Assessment Description: Examination and Coursework
Written final exam: 80%
Assignment 1: Data Analysis Exercise 20%.

• 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 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

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

Assessment Feedback:
Written final exam: standard university examination feedback forms.
SPM lab report and lab diary: marked assignments returned to students.
STM, STS and AFM data analysis assignments: mark returned to students.

Failure Redemption: If rules allow - standard University provisions with marks capped. Any re-examination of this module will be by written examination only (100%).

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

Support material and past exam questions available 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 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

EGNM02 Soft Nanotechnology

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr AM Higgins, Prof OJ Guy, Prof PR Williams

Format: Lectures: 30 hours
Directed private study: 70 hours

Delivery Method: Lecture based

Module Aims: This module introduces fundamental concepts in soft condensed matter physics/chemistry, and looks at the use of this knowledge in a wide range of 'soft matter'-based applications, including organic electronics, micro/nano-fluidics and molecular motors. A strong emphasis of the course is the fundamental physical processes that control the structure/behaviour of macromolecules.

Module Content:

Soft condensed matter at the nanoscale; Intermolecular & surface forces. Statistical physics of polymers.Characterisation techniques in soft condensed matter. Organic electronic materials. Self assembly of synthetic organic materials at the micro and nanoscale.Macromolecules at interfaces. Surface patterning techniques. Microfluidics. Soft nanotechnology devices.

After completing this module you should be able to demonstrate a knowledge and understanding of:

• The importance of intermolecular forces, such as van der Waals forces, in condensed matter.
• The relationship between surface energies and intermolecular potentials.
• The generic properties of isolated polymer chains in solution and in the melt; random walks and self-avoiding walks.
• The origin of elasticity in polymeric materials; entropic springs.
• The statistical mechanics of polymer and small molecule mixtures (Flory-Huggins theory) and predictions regarding miscibility and phase separation.
• How to exploit the fundamental behaviour and properties of soft materials to make useful nanoscale and micron-scale structures, using top-down and bottom-up (self-assembly) techniques. This includes an understanding of how innovative structures can be designed to meet particular technological needs (in applications such as medicine and opto-electronics).
• Surface patterning techniques.This includes current practice (lithography) and more recent innovative methods involving soft materials.
• The behaviour of a new and exciting class of organic materials that can conduct electricity and emit/absorb visible light; conjugated molecules (including polymers). This will include materials and devices.
• The behaviour of fluids flowing through geometries characterised by nano or micron sized lengthscales. This includes how this regime of flow typically differs from flow at the macroscale.
• How to model the generic properties of synthetic macromolecules at the nanoscale by applying fundamental physical principles.
• How macromolecular properties are determined by physical & chemical parameters of the molecules, such as molecular weight, chain stiffness and chemical properties (such as Flory-Huggins interaction parameters).
• A range of sample preparation and sample characterisation techniques used on soft materials, including hands-on experience (including an awareness of health & safety aspects) of fabrication methods for thin polymer thins on inorganic substrates.

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to demonstrate a knowledge and understanding of soft condensed matter systems, from fundamental aspects to a variety of applications.
This includes polymer physics theory, characterisation techniques in soft condensed matter, organic electronic materials, self assembly, microfluidics and soft nanotechnology devices.
Hands-on experience (including an awareness of health & safety aspects) of fabrication methods for thin polymer thins on inorganic substrates will also be gained.

Accreditation Outcomes (AHEP)
A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects (SM3fl)
Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations (EA1fl)
Ability to use fundamental knowledge to investigate new and emerging technologies (EA2fl)
Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods (EA3fl)
Ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D3fl)
Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk (ET6fl)
Advanced level knowledge and understanding of a wide range of engineering materials and components (EP1fl)

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

Assessment Description:
Exam/timed assessment 80% January.
Assignment 1 (Problem sheet) 10%. October/November
Assignment 2 (Data analysis) 10%. November/December

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 40% in the exam component. If you achieve less than 40% 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: Model answers will be given for coursework 1. A feedback sheet will be available following the exam.

Failure Redemption: If rules allow - standard University provisions with marks capped. Any re-examination of this module will be by written examination only (100%).

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

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 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

Available to visiting and exchange students.

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

EGNM03 Nanoscale Simulation

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof P Rees, Dr MR Brown

Format: Lectures: 12 hours
Example classes/tutorials: 18 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

Lectures, Example classes/tutorials

Assessment: Coursework (65%), Exam (35%)

Module Aims: • Quantum mechanics – Bohr model of the atom, Schrodinger equation, energy eigenvalues and wave functions of the hydrogen atom.

• Application of quantum mechanics to nano-scale semiconductor structures – Semiconductor band structure, effective mass approximation, quantum wells, wires and dots, density of states for electrons, quantum devices.

• Molecular modelling – Basic atomic forces and bonding, small molecule models, proteins, molecular modelling packages.

• Transport of particles – Electron transport; diffusion and conduction, nano-fluidics, rate equations and Monte Carlo simulations.

Module Content:

• Quantum mechanics - Bohr model of the atom, Schrodinger equation, energy eigenvalues and wavefunctions of the hydrogen atom.
• Application of quantum mechanics to nano-scale semiconductor structures - Semiconductor band structure, effective mass approximation, quantum wells, wires and dots, density of states for electrons, quantum devices.
• Molecular modelling - Basic atomic forces and bonding, small molecule models, proteins, molecular modelling packages.
• Transport of particles - Electron transport; diffusion and conduction, nano-fluidics, rate equations and Monte Carlo simulations.
• Radiation modelling. Transport of particles. photon and electron transport. Monte Carlo simulations .
• Rate equations, diffusion and conduction.
• Image processing. Radon and Fourier transform.
• Electromagnetic modelling. impedance, induced currents and magnetic heating.

Intended Learning Outcomes: After completing this module you should:

Be able to:
• Demonstrate an understanding of computer modelling of physical systems
• Apply modelling to electromagnetic fields, semiconductor materials and devices and to model simple molecule and to have an understanding of the kinetics of particles at the nanoscale.

Have an ability to (thinking skills):
• Understand the physics which effect devices on the nanometer scale.
• Critically review research information sources.

Have an ability to (practical skills):
• Develop computer models to solve differential equations.

Have an ability to (key skills):
• Solve a wide range of mathematical problems numerically.
• Literature searches, written and oral presentational skills, numerical modelling.

Accreditation Outcomes (AHEP)
• A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
• A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
• Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects (SM3fl)
• Ability to use fundamental knowledge to investigate new and emerging technologies (EA2fl)
• A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP2fl)

Assessment:	Examination 1 (35%) Coursework 1 (20%) Coursework 2 (20%) Coursework 3 (15%) Coursework 4 (10%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Exam 35% and 65% laboratory and write-ups

Students enrolled on the MSc in Clinical Science (Medical Physics) will undertake specialism-specific modelling, with the following given as examples:
• Radiotherapy - Linear accelerator source modelling with Monte Carlo
• Radiation Safety - Radiation enclosure design with Monte Carlo
• Imaging with ionising radiation - S-factor calculations with Monte Carlo, time-activity curves
• Imaging with non-ionising radiation - Fourier analysis of MRI echo data, modelling of U/S impedance, induced currents and magnetic heating, pulse-sequence design

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 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

Moderation approach to main assessment: Universal double-blind marking

Assessment Feedback: During lab sessions

Failure Redemption: Failure redemption will be via 100% supplementary coursework.

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.
• Practical work: Development of computer models to simulate nanoscale structures.
• All lectures and Course Material will be provided 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 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

EGNM04 Nanoscale Structures and Devices

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr TGG Maffeis, Prof KS Teng

Format: Lectures/on demand activities: 20 hours;
Laboratory: 2 hours;
Directed private study: 40 hours
preparation for assessment: 40 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/Laboratory/Example classes/Discussions

Module Aims: This module explores the novel properties of semiconductors and metals when their dimension reach the nanometre scale. The module reviews various types of nanostructures (nanowires, quantum dots, graphene, carbon nanotubes) focussing on fabrication techniques, properties and practical applications. It also details the challenges faced by the Silicon industry beyond Moore's law and highlights possible replacements for CMOS technology.

Module Content:

• Micro and Nano-electronics - Top-down technology examining scaling issues, lithography and beyond. Real devices: transistors and others (FinFet, latest node). Next generation devices (Single electron transistor, nanowires, quantum computing)

• Bottom-up Technology - Atomic manipulation and Quantum Corrals. Growth techniques for nanostructures (chemical and physical vapour deposition, molecular beam epitaxy) - Nanolithography and next generation devices.

• Nanoscale Structures - Nanowires, Quantum Dots, Bucky balls and Carbon Nanotubes: their physical and electronic properties, fabrication and applications.

Intended Learning Outcomes: Technical outcomes:
• Demonstrate an advanced knowledge of nanoscale objects and devices and their novel properties compared to bulk counterparts
• Critically describe the top-down and bottom-up approaches for the fabrication of nanostructures, their advantages, applications and limitations.
• Explains the physical implications of nanoscale objects for real and next-generation devices.
• Analyse and critically review information resources (journals, internet, talks, etc.).
• Understand physical, chemical and biological concepts and how they apply to nanotechnology.
• Conduct, analyse and document experiments with minimum help.
• Apply statistical analysis to experimental data.
• Research and present a chosen topic professionally.
• Evaluate specific experimental results or research papers and place them in a wider context.

Accreditation outcomes (AHEP):
A comprehensive understanding of the relevant scientific principles of the specialisation. (SM1fl)
A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects. (Sm3fl)
Ability to use fundamental knowledge to investigate new and emerging technologies. (Ea2fl)
Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of
engineering analytical methods. (EA3fl)
Advanced level knowledge and understanding of a wide range of engineering materials and components (EP1fl)
A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP2fl)

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

Assessment Description:
Exam: a mix of numerical problems and open ended questions
Lab report: written in the form of a publication.
Presentation: 10 minutes and 5 minutes of questions based on a selected publication.

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 40% in the exam component. If you achieve less than 40% 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: Feedback provided on the feedback form

Failure Redemption: If rules allow a 100% supplementary examination with marks capped.

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.

• Practical work: Growth of nanostructures; nanostructures studied by SEM.

• All lectures and course material will be provided on Canvas.

• Not available to Visiting and Exchange students due to lab activity.

• 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 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

EGNM05 Bio-nanotechnology

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr CJ Wright

Format: 20 Hours Lectures
5 Hours Tutorials
75 Hours Directed Learning
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

Module Aims: The module aims to equip the student with an understanding of the concepts behind bionanotechnology. To achieve this the student is introduced to the relevant biological processes that control life with nanoscale systems. This knowledge is established from the perspective of nanoscale engineering.

Module Content:

• Introduction to the course and orientation
• Biological Systems relevant to nanotechnology - Biological hierarchy; carbohydrates; lipids; proteins; nucleic acids (DNA, RNA); protein synthesis; recombinant DNA techniques;
• Nanoscale properties of environmental interfaces.
• Nanotechnology environmental impact
• Introduction to Colloidal systems - Nature of the colloid state
• Bio-nanocomposites
• Bio-sensors application within engineering, medicine and environment.
• Bio-nanomedicine - Nanoscale properties of the mammalian and microbial cell interface.
• Regenerative medicine at the nanoscale.
• Appropriate health and safety issues will be covered.
• Current bionanotechnology case studies.

Intended Learning Outcomes: Technical Outcomes
After completing this module you should be able to demonstrate:
• A knowledge and understanding of how and why modern research is harnessing biological systems to further nanotechnology endeavour.
• How modern engineering is gaining guidance from natural systems that construct and control at the nanoscale.
• How general principles of structure and function within biological systems are used to construct functional devices within nanotechnology.
• The techniques that are available for characterising, harnessing and modifying these nanodevices.
• Current applications and state of the art within biotechnology
• Current realistic speculation as to the future of biotechnology
• An understanding of health and safety aspects of nanotechnology and its impact on the natural and built environment
• An ability to understand and communicate between the diverse disciplines that encompass bionanotechnology.

Accreditation Outcomes (AHEP)
• A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
• A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation (SM2fl)
• Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects (SM3fl)
• Ability to use fundamental knowledge to investigate new and emerging technologies (EA2fl)
• Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods (EA3fl)
• Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation (ET5fl)
• Advanced level knowledge and understanding of a wide range of engineering materials and components (EP1fl)

Assessment:	Examination 1 (60%) Coursework 1 (10%) Coursework 2 (25%) Presentation (5%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description:
• Examination 60%
• Paper Critique 10%
• Project 25%
• Project presentation 5%

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 40% in the exam component. If you achieve less than 40% 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: The marks of the continuous assessment will be given to the students with a written description of their performance and how it could have been improved..

There will be an office surgery for students to discuss performance in module and progress on the project

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

Failure Redemption: If rules allow - standard University provisions with marks capped. Failure redemption would be by project, that will cover all aspects of the module syllabus. The project will be designed to allow the student to demonstrate their level of knowledge and understanding of the module and synthesis with their course and wider context of study.

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

• All lectures and Course Material will be provided on Canvas.

• This is a masters level module thus students are expected to demonstrate independence of study and thought, actively reading around the topic to cope with any shortfalls in their previous experience.

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

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 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.

EGNM07 Principles of Nanomedicine

Credits: 10 Session: 2022/23 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr S Sharma, Prof OJ Guy

Format: 20 hours of formal lecturing. 40 hours private study/reading and 40 hours preparation for assessment

Delivery Method: 100% course work

Module Aims: This module will cover the broad range of subjects which encompass the discipline nanomedicine. Building on the foundation of a knowledge of nanotechnology this module will focus on medical applications including biological markers, diagnostics, therapeutics and drug delivery vehicles.

Module Content:

• Interactions on the nanoscale: biological, physical, chemical and optical interactions.
• Nanoparticles: optical markers, magnetic markers - dots, tubes, wires etc.
• Drug delivery strategies: drug delivery systems, pharmacology of nanovectors.
• Imaging techniques: Microscopy, Flow cytometry.
• Therapeutics: thermal, optical, microwave.

Intended Learning Outcomes: Technical Outcomes
• An understanding of the physics at the nanoscale together with an appreciation of the relevant biology of the system studied.
• How to design and fabricate a nanoparticle marker.
• An understanding of nanoscale imaging techniques and their limitations.
• An appreciation of how a nanoparticle can be used as a drug delivery vehicle.
• A knowledge of medical practices, diagnosis and treatment
• Study independently; use library resources; note taking; time management

Accreditation Outcomes (AHEP)

MEng
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively (SM3m)
- Awareness of developing technologies related to own specialisation (SM4m)
- Understanding of concepts from a range of areas including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects (SM6m)
- Work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies (D3m)
- Understanding of the need for a high level of professional and ethical conduct in engineering, a knowledge of professional codes of conduct and how ethical dilemmas can arise (EL1m)
- Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk (EL6m)
- Knowledge of characteristics of particular equipment, processes, or products, with extensive knowledge and understanding of a wide range of engineering materials and components (P2m)
- Understanding of the use of technical literature and other information sources (P4m)
- Ability to work with technical uncertainty (P8m)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (P9m)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)

MSc
- Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects (SM3fl)
- Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies (D1fl)
- Awareness of the need for a high level of professional and ethical conduct in engineering (ET1fl)
- Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk (ET6fl)
- A thorough understanding of current practice and its limitations, and some appreciation of likely new developments (EP2fl)

Assessment:	Coursework 1 (25%) Coursework 2 (25%) Coursework 3 (25%) Coursework 4 (25%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: The continuous assessment will be based on a literature survey and a series of problem sheets relating to scientific journal papers and class room lectures.

Courseworks C1, C2 and C3 will be done individually. C4 will involve group presentations.

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

Assessment Feedback: Individual feedback on each piece of assessed work via Canvas or can be discussed via Zoom, Skype or in person.

Failure Redemption: If rules allow - standard University provisions with marks capped. Any re-examination of this module will be by 100% coursework submission.

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

• AVAILABLE TO Visiting and Exchange Students. The module has no pre-requisites.

EGNM09 Micro and Nano Electro-Mechanical Systems

Credits: 10 Session: 2022/23 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof L Li

Format: Lectures: 20 hours
Example Classes: 2 hours
Directed Private Study: 78 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 end of semester examination.

Module Aims: Micro and Nano Electro-Mechanical Systems (MEMS/NEMS) are technology that integrates electrical and mechanical components and they offer many novel and diverse applications ranging from display technologies to sensor systems.

Module Content: Introduction to MEMS and NEMS
Modelling the Dynamics of MEMS/NEMS
MEMS/NEMS Sensors and Actuators
Piezoelectric, electrostatic, and thermoelectric
Fabrication of MEMS/NEMS
Optical and RF MEMS

Intended Learning Outcomes: Technical Outcomes:
After completing this module you should be able to demonstrate:
• Ability to analyse the dynamic motion of micro/nano resonators based on mass-spring-damper model.
• Ability to use mathematical tools (such as Matlab) to simulate key parameters of micro/nanoelectromechanical systems.
• Ability to analyse how the physical and electronic properties change with dimension and how this affects devices, and comprehensive understanding of why the devices are realized in micro/nano scales.
•Ability to model the electronic/physical/mechanical properties of the piezoelectric crystals, electrostatic and thermoelectric devices, and to apply these devices in optical, radio frequency, and power generation systems.
• Ability to conduct multi-physics modelling encompassing disciplines such as electronics, physics, and mechanics.
• Ability to design microfabrication processes for target micro/nanoelectromechanical devices.

Accreditation Outcomes (AHEP)
- A comprehensive understanding of the relevant scientific principles of the specialisation (SM1fl)
- Ability to generate an innovative design for products, systems, components or processes to fulfil new needs (D3fl)
- Ability to use fundamental knowledge to investigate new and emerging technologies (EA2fl)

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

Assessment Description: 80% End term Examination
20% Mid term assignment

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 40% in the exam component. If you achieve less than 40% 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 receive feedback from formal examination via standard College proforma.

Failure Redemption: If rules allow - standard university provision of Supplementary examination, with marks capped at 40% and by written examination only (100%).

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

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 40% in the exam component. If you achieve less than 40% in the exam, then the module mark will be just the exam mark.