Swansea University
Prifysgol Abertawe

# FACULTY OF SCIENCE AND ENGINEERING

## UNDERGRADUATE STUDENT HANDBOOK

## YEAR 3 (FHEQ LEVEL 6)

## ELECTRONIC AND ELECTRICAL ENGINEERING DEGREE PROGRAMMES

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

## DISCLAIMER

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

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

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

**The 22-23 academic year begins on 19 September 2022**

Full term dates can be found here

**DATES OF 22-23 TERMS**

19 September 2022 – 16 December 2022

9 January 2023 – 31 March 2023

24 April 2023 – 09 June 2023

**SEMESTER 1**

19 September 2022 – 27 January 2023

**SEMESTER 2**

30 January 2023 – 09 June 2023

**SUMMER**

12 June 2023 – 22 September 2023

## IMPORTANT

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

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

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

**Welcome to the Faculty of Science and Engineering!**

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

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

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

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

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

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

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

| | |
|---|---|
| **Faculty of Science and Engineering** | |
| Interim Pro-Vice Chancellor/Interim Executive Dean | Professor Johann Sienz |
| Head of Operations | Mrs Ruth Bunting |
| Associate Dean – Student Learning and Experience (SLE) | Professor Paul Holland |
| **School of Aerospace, Civil, Electrical, General and Mechanical Engineering**<br>**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 Zhongfu Zhou |

## 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 third-year student studying *Electronic and Electrical Engineering* at Swansea University you are continuing a journey which we hope will end with Engineering Council registration as either an Incorporated Engineer (IEng) or Chartered Engineer (CEng).

Each of the Bachelor of Engineering (BEng) programmes covered by this handbook has been accredited by the Institution of Engineering and Technology (IET) on behalf of the Engineering Council for the purpose of fully meeting the academic requirement for registration as an Incorporated Engineer (IEng) and partially meeting the academic requirement for registration as a Chartered Engineer (CEng).

Each of the Integrated Masters (MEng) programmes covered by this handbook has been accredited by the Institution of Engineering and Technology (IET) on behalf of the Engineering Council for the purpose of fully meeting the academic requirement for registration as a Chartered Engineer (CEng).

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.

In addition, if you are taking part a Year in Industry next year, your experience can be converted into the Engineering Technician (EngTech) qualification. Please contact your IET Student Advisor for details.

If you are graduating this year, 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.

## Prizes

The following prizes are awarded at the end of the academic year:

- *Institution of Engineering and Technology Prize* – This prize is awarded annually by the IET. The prize will be awarded to the final year undergraduate student on an IET accredited course who, in the opinion of the Board of Examiners, has demonstrated outstanding merit. In the event of insufficient merit being shown the prize will not be awarded.
- *R. G. Isaacs Prize in Electronic and Electrical Engineering* – The prize will be awarded to the Part III student in Electrical and Electronic Engineering whose project is considered by the Board of Examiners to be of outstanding merit. In the event of no project of high quality the prize will not be awarded.
- *W. Renwick Prize* – is awarded annually to the Year 3 student whose project has a computing component and is considered by the Board of Examiners to be of outstanding merit. In the event of no project of high quality the prize will not be awarded.

## Faculty prizes and progression awards

The Faculty of Science and Engineering awards graduation prizes to the best Electrical and Electronic Engineering student in each graduating year.

In addition, it awards prizes to the best student in each year and progression awards to students who achieve high averages in each year's programme of studies. These prizes are awarded at a special ceremony and dinner held each year.

# Year 3 (FHEQ Level 6) 2022/23
# Electronic and Electrical Engineering

**BEng Electronic and Electrical Engineering[H602,H605]**
**BEng Electronic and Electrical Engineering with a Year Abroad[H603]**
**BEng Electronic and Electrical Engineering with a Year in Industry[H604]**
**MEng Electronic and Electrical Engineering[H606]**
**MEng Electronic and Electrical Engineering with a Year Abroad[H600]**

## Compulsory Modules

| Semester 1 Modules | Semester 2 Modules |
|---|---|
| **EG-340**<br>**Design Electronics**<br>**10 Credits**<br>**Dr T Davies**<br>**CORE** | **EG-319**<br>**IC Design**<br>**10 Credits**<br>**Prof K Kalna/Mrs M Ahmed**<br>**CORE** |
| **EG-342**<br>**Power Systems**<br>**10 Credits**<br>**Dr M Fazeli**<br>**CORE** | **EG-341**<br>**Microwave Circuits and Antennas**<br>**10 Credits**<br>**Prof A Mehta**<br>**CORE** |
| **EG-345**<br>**Power Electronics**<br>**10 Credits**<br>**Dr Z Zhou**<br>**CORE** | |
| **EGA333**<br>**Communications**<br>**10 Credits**<br>**Prof A Mehta**<br>**CORE** | |
| **EG-3080**<br>**Engineering Management (Aero, EEE, Mech)**<br>**10 Credits**<br>**Prof JC Arnold/Prof MR Jennings/Dr EH Jewell/Mr JK Mcfadzean/Dr B Morgan/Dr A Rees**<br>**CORE** | |
| **EG-353**<br>**Research Project**<br>**30 Credits**<br>**Dr MR Brown/Mr A Goodfellow/Prof PJ Holliman/Dr AC Tappenden**<br>**CORE** | |
| **Total 120 Credits** | |

## Optional Modules

Choose exactly 10 credits

| | | | | |
|---|---|---|---|---|
| **EG-355** | Quantum Devices | Prof K Kalna | TB1 | 10 (CORE) |
| **EGA366** | Kinematics and Programming for Robot | Dr S Li | TB1 | 10 (CORE) |

**And**

Choose exactly 10 credits

| | | | | |
|---|---|---|---|---|
| **EG-351** | Communication Systems and Networks | Dr JW Jones | TB2 | 10 (CORE) |
| **EGA305** | Nanoelectronics | Prof KS Teng | TB2 | 10 (CORE) |

# Year 3 (FHEQ Level 6) 2022/23
# Electronic and Electrical Engineering
**MEng Electronic and Electrical Engineering with a Year in Industry[H601]**

## Compulsory Modules

| Semester 1 Modules | Semester 2 Modules |
|---|---|
| **EG-340**<br>**Design Electronics**<br>**10 Credits**<br>**Dr T Davies**<br>**CORE** | **EG-319**<br>**IC Design**<br>**10 Credits**<br>**Prof K Kalna/Mrs M Ahmed**<br>**CORE** |
| **EG-342**<br>**Power Systems**<br>**10 Credits**<br>**Dr M Fazeli**<br>**CORE** | **EG-341**<br>**Microwave Circuits and Antennas**<br>**10 Credits**<br>**Prof A Mehta**<br>**CORE** |
| **EG-345**<br>**Power Electronics**<br>**10 Credits**<br>**Dr Z Zhou**<br>**CORE** | |
| **EGA333**<br>**Communications**<br>**10 Credits**<br>**Prof A Mehta**<br>**CORE** | |
| **EG-233**<br>**Placement Preparation: Engineering Industrial Year**<br>**0 Credits**<br>**Prof GTM Bunting/Dr CME Charbonneau/Dr P Esteban/Dr SA Rolland/Dr V Samaras/Dr S Sharma** | |
| **EG-3080**<br>**Engineering Management (Aero, EEE, Mech)**<br>**10 Credits**<br>**Prof JC Arnold/Prof MR Jennings/Dr EH Jewell/Mr JK Mcfadzean/Dr B Morgan/Dr A Rees**<br>**CORE** | |
| **EG-353**<br>**Research Project**<br>**30 Credits**<br>**Dr MR Brown/Mr A Goodfellow/Prof PJ Holliman/Dr AC Tappenden**<br>**CORE** | |
| **Total 120 Credits** | |

## Optional Modules

Choose exactly 10 credits

| | | | | |
|---|---|---|---|---|
| **EG-355** | Quantum Devices | Prof K Kalna | TB1 | 10 |
| **EGA366** | Kinematics and Programming for Robot | Dr S Li | TB1 | 10 |

**And**

Choose exactly 10 credits

| | | | | |
|---|---|---|---|---|
| **EG-351** | Communication Systems and Networks | Dr JW Jones | TB2 | 10 |
| **EGA305** | Nanoelectronics | Prof KS Teng | TB2 | 10 |

# EG-233 Placement Preparation: Engineering Industrial Year

**Credits: 0 Session: 2022/23 September-June**

**Pre-requisite Modules:**

**Co-requisite Modules:**

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

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

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

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

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

**Module Content:**

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

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

**Intended Learning Outcomes:**

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

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

**Assessment:** Placements (100%)

**Assessment Description:**

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

**Moderation approach to main assessment:** Not applicable

**Assessment Feedback:**

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

**Failure Redemption:**

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

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

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

# EG-3080 Engineering Management (Aero, EEE, Mech)

**Credits: 10 Session: 2022/23 September-June**

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Lecturer(s):** Prof JC Arnold, Prof MR Jennings, Dr EH Jewell, Mr JK Mcfadzean, Dr B Morgan, Dr A Rees

**Format:** Core Lectures: 16
Discipline specific lectures: 3
Support tutorials: 3

**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

Discipline-specific lectures will cover the first 3 weeks to introduce and explain the subject-specific project. Lectures in the core components will follow over the next 7 weeks.

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

**Module Aims:** The goal of this course is to provide the skills for professional engineers to meet the challenges of their future careers, whether they be in academia, industry, or as an entrepreneur. Irrespective of future careers engineers will be involved in projects, management and business organisations and an awareness of these issues is important for all team members. It should be recognized that the topics included in the course are not limited to scientists and engineers, they are useful for people in any careers. This course is not aimed at making you a certified project manager, but to provide the skills that will allow you to be a more effective project team member and also when you start to take on the role of project manager.

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

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

Section A. Programme Specific Component
There are three programme specific components:
All include lectures and then a subject-specific case study assignment covering the planning, scheduling and financial modelling of manufacturing processes in the relevant sector.
• Aerospace Engineering
• Mechanical Engineering
• Electrical and Electronic Engineering

Section B. Core Component
Financial aspects of Engineering Management
Introduction to financial planning, modelling and accounting, including consideration of fixed and variable costs, return on investments.
Entrepreneurship: Team building & Finance / Business Start-ups / The Business Planning process.

Project Management
Definition of a project and the stages within a project; project characteristics, project Stakeholders, what makes a successful project manager; triple constraint; standards and knowledge; management knowledge and skills
Project Life Cycle
Initiation, planning, execution and closure; Project charter; Objectives and Scope; Project planning; Scope; Requirements; Work breakdown structure; network diagram; resource planning and activity scheduling; Risk management.

Legal and ethical aspects of Engineering Management
Legal frameworks, liabilities, employee / employer aspects, the management of intellectual property. International standards and certifications.

**Intended Learning Outcomes:** Technical Outcomes
Upon completion of the module the student should be aware of and able to use:
- Some of the "tools" that assist in the efficient use of financial & human resources in manufacturing;
- Methods of writing a successful project plan
- Methods to assess the success of a project or business
- Approaches to ensure all projects and business activity is operating within a legal, ethical and responsible framework.

Accreditation Outcomes (AHEP)
D3p Work with information that may be incomplete or uncertain and quantify the effect of this on the design
ET5p Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues,
ET6p Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques.
EP5m Knowledge of relevant legal and contractual issues
EP6m Understanding of appropriate codes of practice and industry standards
EP7m Awareness of quality issues and their application to continuous improvement
EP11m 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

| | |
|---|---|
| **Assessment:** | Coursework 1 (2%)<br>Coursework 2 (3%)<br>Assignment 1 (30%)<br>Examination 1 (65%) |
| **Resit Assessment:** | Examination (Resit instrument) (100%) |

**Assessment Description:** The core component is assessed via a two-hour in-person examination in May/June.

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

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

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

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

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

**Failure Redemption:** A resit examination (2 hours) making up 100% of the resit mark.

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

Penalty for late submission of work: ZERO TOLERANCE.

The module is available to exchange students.

Notes and worked examples can be found on Canvas.

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

# EG-319 IC Design

**Credits: 10 Session: 2022/23 January-June**

**Pre-requisite Modules:** EG-143; EG-240; EG-242; EG-355

**Co-requisite Modules:**

**Lecturer(s):** Prof K Kalna, Mrs M Ahmed

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

**Delivery Method:** All Programmes will employ a blended approach to delivery using the Canvas Digital Learning Platform for live and self-directed online activity, with live and self-directed on-campus activities each week.

Assessment: Examination

**Module Aims:** To provide an overview of the BiCMOS and CMOS technologies and the concepts of designing analog and digital integrated circuits in the context of CMOS technology.

**Module Content:** • Introduction to Bipolar, MOS, BiCMOS and BCD technologies.
• Analogue CMOS Sub-circuits: MOS Switch, Active Resistor, Current Sources, Bandgap References.
• CMOS Operational Amplifiers: Design of CMOS Op Amps.
• Top-down digital circuit design: from VLSI architecture design to CMOS fabrication

This module develops a knowledge and understanding of:
• CMOS, BiCMOS and power IC technologies;
• MOSFET and BJT switch, active resistor;
• Fundamental building blocks of Analogue ICs (Common - Source/Drain/Gate amplifiers and current mirrors);
• Differential Amplifiers, CMOS Operational Amplifiers and Bandgap reference circuits.
• Digital IC design system and component aspects, design verification, VHDL and Verilog Code, signal integrity, clocking.

And develops an ability to:
• Apply large-signal circuit analysis and interpret the results.
• Analyse CMOS and bipolar analogue circuits by performing small-signal analysis.
• Understand top-down digital design approach focusing on CMOS technology.
• Understand the practical implications of different IC analysis methods.
• Design more complex circuits by combining fundamental IC building blocks.

**Intended Learning Outcomes:** After completing this module you should be able to:
• Describe CMOS technology;
• Analyse the operation of Analogue/Digital CMOS circuits;
• Apply some aspects of the Computer-Aided Analysis Programs in the design process of CMOS circuits.

AHEP3 Learning Outcomes:
SM4m Awareness of developing technologies related to own specialisation. Assessed by LAB coursework and Examination.
SM5m A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations.
EA1m Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes. Assessed by LAB coursework and Examination.
D1m Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics.
ET2p Knowledge and understanding of the commercial, economic and social context of engineering processes
EP1p Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc)
EP7m Awareness of quality issues and their application to continuous improvement

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

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

**Assessment Description:** The examination is worth 70% of the module. It consists of four questions. Question one is compulsory, and is related to digital IC design, then the students will answer two from three of the remaining questions, related to analogue IC design. Each question answered will be worth 33.3% of the examination. The examination topics will be those presented directly in the lectures.
Closed-book in-person in May/June

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

**Assessment Feedback:** For the examination the students will receive a generic form that tells the student what common mistakes were. It also lists the mean mark and the number of 1st class, 2:1 class, 2:2 class, 3rd class and fails achieved by the group. Individually the students can make appointments with the lecturer to reveive specific individual feedback on the assignment or examination if this is wanted/needed.

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

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

**Additional Notes:** • AVAILABLE TO Visiting and Exchange students. Replaces module EG-354.
• Penalty for late submission of work: ZERO TOLERANCE.

# EG-340 Design Electronics

**Credits: 10 Session: 2022/23 September-January**

**Pre-requisite Modules:** EG-240

**Co-requisite Modules:**

**Lecturer(s):** Dr T Davies

**Format:** Lectures 20 hours
Example classes 5 hours
Directed private study 75 hours

**Delivery Method:** It is hoped that for the academic session 2022/2023 this module will be a combination of in-person lectures with some on-line lectures featuring demonstrations.

The current plan is for two in-person lectures per week. with one on-line lecture for lecture/demonstrations of some of the topics described in class.

All lectures will be recorded and made available on Canvas.

**Module Aims:** The huge range of electronic devices available today are based on a limited number of circuit elements. For example, cellular mobile telephones use basic circuits such as oscillators, frequency synthesisers, frequency selective circuits, in addition to sophisticated digital components.
In this module, some of the key circuits are identified and discussed, including analogue multipliers, frequency selective networks, frequency synthesisers, and ADC/DAC techniques.

**Module Content:**

• Types of oscillators: relaxation, phase shift, tuned circuit and quartz crystal.
• Applications of RC networks, including the twin-T and Wein bridge.
• The Gilbert Cell as a circuit element.
• The Gyrator as a circuit element.
• Applications of frequency synthesis. PLL type synthesisers. Direct digital synthesis.
• Types of ADC and DAC, including successive approximation, dual slope and flash.
• Circuit techniques for digital modulation.

**Intended Learning Outcomes:** Technical Outcomes
After completing this module, you should be able to:
• Choose the appropriate oscillator for a given application and quantify its operation;
• Describe the operation of frequency synthesisers;
• Discuss the advantages of different ADC and DAC techniques and quantify their operation;
• Identify the signal processing elements in communications circuits such as multipliers and frequency selective networks

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 (SM1p)
- 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 (SM2p)
- Knowledge of characteristics of particular materials, equipment, processes, or products (EP2p)
- Ability to apply relevant practical and laboratory skills (EP3p)

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

**Assessment Description:** This module is assessed by means of a single two-hour examination. The format of the exam is a choice of three questions from four.

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

**Assessment Feedback:** edback on examination results will be in a standard format on the College Intranet.

Information provided will include average mark, maximum and minimum marks for the examination as a whole and for individual questions. A brief explanation of each question will also be provided, indicating the way in which the Examiner expected the question to be answered.

**Failure Redemption:**
If you are eligible for a resit examination this will take the form of a 100% supplementary examination.

**Additional Notes:** Delivery of both teaching and assessment will be blended including in-person lectures and lecture/demonstrations via ZOOM.

• AVAILABLE TO Visiting and Exchange students.

# EG-341 Microwave Circuits and Antennas

**Credits: 10 Session: 2022/23 January-June**

**Pre-requisite Modules:** EGA207

**Co-requisite Modules:**

**Lecturer(s):** Prof A Mehta

**Format:** Lectures 20 hours
Example classes 5 hours
Directed private study 75 hours

**Delivery Method:** 100% lecture based

**Module Aims:** The module develops the analysis and synthesis of distributed circuits and the principles of microwave antennas.

**Module Content:**

• Analysis of cascaded networks; the use of ABCD parameters and scattering parameters.
• Theory of the Smith Chart and its practical application to transmission line problems.
• Microwave circuit design, synthesis of microwave distributed filters, matching circuits and transformers.
• Circuit realisation in microstrip.
• Antenna theory - phased array and microwave antennas.

**Intended Learning Outcomes:** Technical Outcomes
After completing this module you should be able to:
• Apply a Smith Chart to solve problems associated with distributed circuits.
• Analyse a cascaded network of distributed components with ABCD- and S-parameters.
• Synthesise microwave distributed filters.
• Analyse the radiation patterns from microwave aperture and array antennas.

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 (SM1p)
- 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 (SM2p)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1p)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2p)
- 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 (D4p)
- Ability to work with technical uncertainty (EP8p)

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

**Assessment Description:** This module is assessed by means of a single 2-hour examination. The format of the exam is a choice of 3 questions from 4.

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

**Assessment Feedback:** Feedback will be in a standard format on the College of Engineering Intranet. Information provided includes average mark, maximum and minimum marks, for the examination as a whole and for individual questions.

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

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

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

• AVAILABLE TO Visiting and Exchange students.
• PENALTY: zero tolerance for late submission

# EG-342 Power Systems

**Credits: 10 Session: 2022/23 September-January**

**Pre-requisite Modules:** EG-241; EGA107

**Co-requisite Modules:**

**Lecturer(s):** Dr M Fazeli

**Format:** Lecture: 24-26 Hours
Example class: 6 Hours
Private study: at least 70 hours

**Delivery Method:** Classroom sessions.
100% Examination.

**Module Aims:** This module aims to introduce the component of a Power Network and analyse their operation in both balanced and unbalanced conditions

**Module Content:**

• Introduction: 3-phase systems, Electromagnetism
• 3-phase transformers, Scott transformers, Open-delta transformers, and phase shifting transformers
• Transmission lines
• Synchronous generators
• Per Unit Calculations
• Symmetrical component and fault calculations

**Intended Learning Outcomes:** Technical Outcomes
On successful completion of this module students will be expected, at threshold level, to be able to:
• Model and analyse different components of a power system including transmission lines, synchronous generators and transformers in different operating modes, which demonstrate the comprehensive understanding of power systems operation (assessed by exam).
• Utilise Per Unit calculation to analyse power systems for both 1-phase and 3-phase systems, which demonstrate understanding of mathematical methods necessary to analyse power systems (assessed by exam).
• Construct the operating chart of a synchronous generator and utilise it to calculate active and reactive powers, power factor, etc. for different operating points, which demonstrate a through understanding of current practice and its limitations (assessed by exam).
• Apply symmetrical components to analyse an unbalanced power system and calculate the fault current, which demonstrate the ability to apply appropriate engineering analysis for solving complex problems (assessed by exam).

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 (SM2p)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1p)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2p)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4p)

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

**Assessment Description:** Examination in TB1 exam period.

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

**Assessment Feedback:** Feedback will be in a standard format on the College of Engineering Intranet. Information provided includes average mark, maximum and minimum marks for the examination as a whole and for individual questions.

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

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

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

AVAILABLE TO visiting and exchange students provided they know the pre-requisites modules.
Zero Tolerance for late submission.

# EG-345 Power Electronics

**Credits: 10 Session: 2022/23 September-January**

**Pre-requisite Modules:** EG-241

**Co-requisite Modules:**

**Lecturer(s):** Dr Z Zhou

**Format:** On demand online teaching: 16 hours
On demand online examples and coursework support support: 6 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

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

Assessment: closed book in-person examination (80%) and continuous assessment (20%)

The examination is worth 80% of the module. Answer 4 questions. Each question answered will be worth 25%. The examination topics will be those presented directly in the lectures.

The continuous assessment is worth 20% of the module. This is based on an assignment related to the simulation and analysis of power electronics converter circuits.

**Module Aims:**

The module introduces circuit topologies and switching techniques for power electronics systems.

**Module Content:**

• AC/DC converters
• Single and three phase DC-AC converters
• Boost and Buck DC/DC converters
• AC-AC converters
• PWM switching strategies for real-time control of power electronics converters
• Semiconductor power device power losses and thermal analysis

**Intended Learning Outcomes:** Technical Outcomes

After completing this module students should be able to:
• Understand, analyse and design power converters for power electronics applications.
• Choose, apply and analyse switching techniques for real-time control of power electronics converter systems.
• Evaluate semiconductor power device power losses and thermal analysis.

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 (SM1p)
- 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 (SM2p)
- Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline (SM3p)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1p)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2p)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3p)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4p)

| | |
|---|---|
| **Assessment:** | Examination (80%)<br>Assignment 1 (20%) |
| **Resit Assessment:** | Examination (Resit instrument) (100%) |

**Assessment Description:** Examination (80%) and continuous assessment (20%)

The examination is worth 80% of the module, answer 4 questions. Each question answered will be worth 25%. The examination topics will be those presented directly in the lectures.

The continuous assessment is worth 20% of the module. This is based on an assignment related to the simulation and analysis of power electronics circuits.

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

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

**Assessment Feedback:** For the examination, the students will receive an examination feedback summary sheet giving details of the common mistakes that were identified from the assessed exam scripts. It also lists the maximum, minimum and means marks for each question and the number of students attempting it. Feedback specific to each question is additionally provided to aid the students.

For the continuous assessment, the students will receive feedback giving details of the common mistakes that were identified from the submitted coursework. Individually students can make an appointment with the lecturer to receive individual feedback on the assignment if this is required.

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

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

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

• AVAILABLE TO visiting and exchange students.
• Penalty for late submission of work: ZERO TOLERANCE.

# EG-351 Communication Systems and Networks

**Credits: 10 Session: 2022/23 January-June**

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Lecturer(s):** Dr JW Jones

**Format:** Lectures 20 hours
Directed private study 80 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

Coursework 25% as 5 Canvas tests, each carrying 5 marks.
Standard 75% Exam to answer 3 out of 4 questions.

Lectures: 20 hours
Directed private study: 80 hours

**Module Aims:** The principles of the Internet are explained including protocols, services and functions of its 6 out of 7 OSI layers from the application layer down to the link layer. Emphasis is on understanding the TCP/IP protocol stack. Such knowledge of the Internet is then extended to cover the principles of wireless and mobile networks, multimedia networking, security in computer networks, and telecommunication networks management.

**Module Content:** The principles of the Internet are explained including the protocols, services and functions of its 6 out of 7 OSI layers from the application layer down to the link layer. Emphasis is on understanding of the TCP/IP protocol stack. Such knowledge of the Internet is then extended to cover principles and problems of wireless and mobile networks, multimedia networking, security in computer networks, and telecommunication networks management.

**Intended Learning Outcomes:** Technical Outcomes
After completing this module you should be able to:
• Understand how the Internet works and what are its components.
• Understand what protocols are employed in the Internet, and their operations, functions and services provided.
• Understand the important issues in the current developments of the Internet.
• Understand the technical literature about the Internet.

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 (SM2p)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1p)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2p)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems (EA4p)
- Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics (D1p)
- Plan and manage the design process, including cost drivers, and evaluate outcomes (D5p)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (ET2p)
- 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 (EP11m)

**Assessment:** Coursework 1 (25%)
Examination (75%)

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

**Assessment Description:** The coursework 25% is assessed via 5 individual tests on Canvas.

The standard Exam 75% has the choice of 3 out of 4 questions.

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

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

**Assessment Feedback:** Continuous feedback during lectures and by email.

**Failure Redemption:** Year 3 BEng : BEng students are only permitted to redeem a failure as per University regulations for final year students. If you are eligible for a resit this will be via a resit examination worth 100%.

Year 3 MEng : MEng students are only permitted to redeem a failure as per University regulations for YR3 - YR4 progressing students. If you are eligible for a resit this will be via a resit examination worth 100%.

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

• AVAILABLE TO Visiting and Exchange students.

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

• Notes, worked examples and past exam papers for this module can be found on Canvas.

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

# EG-353 Research Project

**Credits: 30 Session: 2022/23 September-June**

**Pre-requisite Modules:**

**Co-requisite Modules:**

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

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

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

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

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

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

**Module Aims:**

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

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

**Module Content:**

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

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

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

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

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

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

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

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

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

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

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

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

Full assessment criteria will be on Canvas.

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

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

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

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

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

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

Only available to students following an Engineering Degree Programme.

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

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

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

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

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

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

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

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

# EG-355 Quantum Devices

**Credits: 10 Session: 2022/23 September-January**

**Pre-requisite Modules:** EG-142; EG-242

**Co-requisite Modules:**

**Lecturer(s):** Prof K Kalna

**Format:** On-Line Lectures & Example classes 22 hours
Remote Access to Silvaco Software at PCs in the EEE Lab 360 hours
On Demand OnLine Support during the Work with Silvaco Software
On Campus Labs with Silvaco Software at PCs 4-6 hours
Directed private study 74 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:** This module will be taught on the campus and will employ the Canvas Digital Learning Platform for live and self-directed online activity. The blended approach to delivery using the Canvas Digital Learning Platform for online lectures will be used ONLY in the case of a government decision. The laboratory work will be on the campus unless the government orders a complete closure of the campus.
This module will consist of lectures, which concentrate on a theory, and example classes, which concentrate on applying the theory to solve examples.
Assessment: Report from Device Modelling 20%, Exam - 80%.
Assessment by an individual report from the device modelling will consist of a small group of 2 students which will work together in the EEE Lab on the modelling of the semiconductor device.

**Module Aims:** To introduce state-of-the-art semiconductor devices like fin field effect transistors (FinFETs), metal-oxide-semiconductor field effect transistors (MOSFETs), high-electron mobility transistors (HEMTs), quantum well light emitting diodes (LEDs) & lasers, and resonant tunnelling diodes (RTDs). To evaluate the performance and design of state-of-the-art nanoscale semiconductor devices based on quantum-mechanical confinement.

**Module Content:** • A short advanced theory of the p-n junction as a basic building block of every semiconductor device.
• Metal-semiconductor interface as an essential structure to control semiconductor devices: Schottky/Ohmic contact & Bardeen theory of contacts.
• Introduction to Quantum, Schrödinger's equation, the concept of the wave vector, k-space, confinement and tunnelling.
• Application to the quantum well, optical confinement, laser devices, high electron mobility transistor (HEMT), metal oxide semiconductor (MOS) structure, metal oxide semiconductor field-effect transistor (MOSFET), a ballistic model for nano-MOSFET, deep nanoscale fin field effect transistor (FinFET), resonant tunnelling diode, and quantum cascade laser.
• High-electron mobility transistor for RF applications.
• Advanced device design (need to include quantum effects).

**Intended Learning Outcomes:** Technical Outcomes
After completing this module you should be able to:
• Understand basic principles of the operation of semiconductor devices;
• Analyse the suitability of semiconductor materials for device fabrication;
• Explain the importance of bulk and interface properties in device operation;
• Evaluate the state of the art industrial and research techniques to characterise materials and devices;
• Design simple quantum structures to produce laser diodes, high speed and digital transistors;
• Discuss the need for miniaturisation and evaluate its effect on device characteristics;
• Analyse the current concepts associated with future devices based on nanotechnology.

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 (SM1p)
- 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 (SM2p)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1p)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2p)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3p)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (EP1p)
-Understanding of the need for a high level of professional and ethical conduct inengineering and a knowledge of professional codes of conduct (ET1p)

**Assessment:** Examination 1 (80%)
Class Test 1 - Coursework (20%)
**Resit Assessment:** Examination (Resit instrument) (100%)

**Assessment Description:**
Assessment: An individual report from device simulations using Silvaco TCAD software. A small group of 2 students will work together on the modelling of a semiconductor device with a deadline set in the module schedule on Canvas (20%). Each group member will have to identify in the report his/her contribution to the common work.

Exam - in-person January 80%

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

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

**Assessment Feedback:** Feedback will be available on a Canvas for the assessment project, during a specific lecture session, and in a standard format on the College of Engineering intranet. Information provided includes extensive comments on your assessment report, then average, maximum and minimum marks for the examination as a whole and for individual questions. The exam script will also contain comments on the particular mark which can be read after asking to see the exam answer sheet. There is also very important additional feedback given during the exercise classes.

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

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

**Additional Notes:** Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus.
• AVAILABLE TO visiting and exchange students.
• Penalty for late submission of work: ZERO TOLERANCE.
• Assessment: An individual report from Device Modelling using Silvaco Atlas TCAD commercial tool. A small group of 2 students will work together on the modelling of a semiconductor device with a deadline at the end of October (20%). Each group member will have to identify in the individual report his/her contribution to the common work.
• Exam - January
This module is assessed by a combination of examination and continual assessment. In order for the continual assessment marks to count, you must achieve at least 30% in the exam component. If you achieve less than 30% in the exam, then the module mark will be just the exam mark.
• All the assessment submissions will be made via the submission tool provided by Canvas and/or Microsoft Teams.

# EGA305 Nanoelectronics

**Credits: 10 Session: 2022/23 January-June**

**Pre-requisite Modules:** EG-242

**Co-requisite Modules:**

**Lecturer(s):** Prof KS Teng

**Format:** Lectures 20 hours
Directed private study 80 hours

**Delivery Method:** Lecture and end of semester examination.

**Module Aims:** Nanoelectronics will soon succeed today's microelectronics technology and revolutionise the electronics industry. This cutting edge technology has major applications in both information and healthcare technologies, hence improving our quality of life. This module introduces the fundamental principle of nanoelectronics and its applications.

**Module Content:**

• Introduction on nanotechnology.
• Limitation in scaling down existing CMOS technology.
• Physical and electronic properties of low-dimensional nanoscale electronic materials.
• Characterisation on the nanoscale.
• Top-down and bottom-up nanofabrication techniques.
• Nanoelectronic devices, such as carbon nanotube devices and single-electron transistors.
• Molecular electronics.

**Intended Learning Outcomes:** Technical Outcomes

• Knowledge and understanding of scientific principles and methodology underpinning the properties of nanoscale electronic materials and devices (SM1p)
• Knowledge and understanding of the commercial, economic and social context of technology scaling (ET2p)
• Understanding of characterisation and fabrication techniques for nanoscale electronic materials and devices, and the ability to apply them to analyse the operation and performance of nanotechnology-based materials and devices (EA1p)

All are assessed in the Examination.

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 (SM1p)
- Awareness of developing technologies related to own specialism (SM4m)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1p)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2p)
- Knowledge and understanding of the commercial, economic and social context of engineering processes (ET2p)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (EP1p)
- Knowledge of characteristics of particular materials, equipment, processes, or products (EP2p)

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

**Assessment Description:** 100% Examination

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

**Assessment Feedback:** Students receive feedback from formal examination through College's Community Page.

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

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

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

• Notes and example sheets for the module are available on Canvas.

# EGA333 Communications

**Credits: 10 Session: 2022/23 September-January**

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Lecturer(s):** Prof A Mehta

**Format:** 2 Lecture per week
Contact Hours will be delivered through a blend of live activities online and on-campus, and may include, for example, lectures, seminars, practical sessions and Academic Mentoring sessions.

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

Assessment: Examination

**Module Aims:** Enabling students to secure strong understanding of the current communication technologies, both from the theoretical and experimental point of views.

**Module Content:**
• Fundamentals of analogue and digital signals.
• Concept of modulation in amplitude, phase and frequency.
• Modulation and demodulation of analogue signals: AM, DSB, SSB and FM.
• Baseband digital signals: sampling quantization, spectra, aliasing.
• Modulation and demodulation of digital signals: ASK, FSK, QPSK, QAM.
• Analysis of the above rf signals in both time and frequency domains.
• Access technologies: CDMA, OFDM.
• Introduction to Modern Systems: GSM, CDMA, WIFI, WIMAX, 3G, 4G, MIMOs, UWB, GPS, RFIDs.

**Intended Learning Outcomes:** Technical Outcomes
After completing this module you should be able to:
• Relate wavelength and frequency, and explain the usage of different parts of the radio spectrum.
• Compare the analysis in time and frequency of various amplitude modulations.
• Understand the parameters that control the bandwidth of FM signals.
• Understand sampling theory associated with baseband digital signals: quantisation error, aliasing etc.
• Determine the spectra of digital baseband and rf signals and the effects of encoding.
• Use of SNR and Bandwidth knowledge and calculations to design efficient practical communication links for satellite and wifi networks.

Also have an understanding of:
• Transmission and reception of digital signals.
• Cellular voice system and data (internet) systems.
• The application of communication technology for various modern applications, e.g. RFIDs and MIMOs.

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 (SM1p)
- 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 (SM2p)
- Understanding of engineering principles and the ability to apply them to analyse key engineering processes (EA1p)
- 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 (D4p)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (EP1p)
- Ability to apply relevant practical and laboratory skills (EP3p)

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

**Assessment Description:** The module is assessed by a 2 hour examination - answer 3 out of 4 questions.

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

**Assessment Feedback:** Feedback will be in a standard format on the College of Engineering intranet. Information provided includes average marks, maximum and minimum marks for the exam as a whole and for individual questions.

Students are also encouraged to meet the academic for any specific feedback, if required.

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

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

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

- AVAILABLE TO visiting and exchange students
- Notes, worked examples and past papers for this module can be found on Canvas.

# EGA366 Kinematics and Programming for Robot

**Credits: 10 Session: 2022/23 September-January**

**Pre-requisite Modules:**

**Co-requisite Modules:**

**Lecturer(s):** Dr S Li

**Format:**
10h lectures
16h computer labs (8h tutorial, 8h supervised)
1h concept testing in Robot Lab (4 students per group)
16h self-guided programming in computer lab
57h self-directed study

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

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

Lectures; Tutorials; Supervised project in computer lab/robot lab; Self-guided projects in computer lab/robot lab .

**Module Aims:** This module first examines the historical development of robotics, both technical and sociological. And then introduces various application of robot technologies focusing on manufacturing, both existing and potential are examined. The core of the module lies in the studies of robot kinematics including trajectory planning and programming. As part of this, industrial standard robot models are analysed and practically experienced through simulation toolkit and commercial software.

**Module Content:** 1. History and development of robotics;
2. Overview of robot industry and applications;
3. Robot actuators, sensors and end effectors.
4. Repeatability and accuracy of robot manipulation;
5. The kinematic model, including Rotation Matrix, Homogeneous Transformation matrix and Euler Angles;
6. Calculation of forwarding and Inverse kinematics;
7. Differential kinematics including Linear and angular velocities and accelerations of manipulator links as well as Jacobian matrix;
8. Trajectory planning including both polynomial and LSPB methods;
9. Robot controllers (open/closed loop);
10. Robot programming and simulation, then the module mark will be just the exam mark.

**Intended Learning Outcomes:**
Technical Outcomes
At the end of the module the student will be expected to be able to:
- Discuss the historical development of robotics from technical, philosophical and sociological viewpoints.
- Identify, classify and construct kinematic models for a wide range of robots.
- Calculate forward and inverse kinematics and plan motion trajectories.
- Skillfully use simulation tool kits and commercial software to construct robot models and to plan its motion.

Accreditation Outcomes (AHEP)
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques (EA2)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action (EA3b)

**Assessment:**
Coursework 1 (30%)
Examination (50%)
Coursework 2 (20%)

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

**Assessment Description:**
2 hours written examination covering (1) - (5): 50%
Coursework based on 2 projects covering (3) and (6): 50%

(1) Robotic history and development: the history from ancient automated machine to modern industrial and service robot; identification of the application fields and associated industry.

(2) Robotic actuators, sensors and end effectors: electromagnetic, pneumatic, and memory alloy types of actuators; both passive and active types of sensors typically equipped on a robot; the design of the robot end-effector; the advantage and disadvantage of each type.

(3) Robot kinematics: homogeneous transformation; Denavit-Hartenburg (DH) model which enable standard robot modelling.

(4) Differential kinematics: the mapping between velocities in joint space and in Cartesian space, i.e., Jacobian matrix.

(5) Trajectory planning: polynomial approach, e.g., quintic polynomial trajectory, and linear segment with parabolic bend (LSPB) approach

(6) Robot programming and simulation: introduce 3D simulation of the robot's motion based on the DH models, as well as motion planning and task simulation based on the commercial software. Teach the means to transfer codes from a simulator to a physical robot.

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

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

**Assessment Feedback:**
General feedback for written exam;
Individual feedback for projects based coursework.

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

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

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

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