Swansea University
Prifysgol Abertawe

FACULTY OF SCIENCE AND ENGINEERING

UNDERGRADUATE STUDENT HANDBOOK

YEAR 3 (FHEQ LEVEL 6)

GENERAL ENGINEERING

DEGREE PROGRAMMES

SUBJECT SPECIFIC
PART TWO OF TWO
MODULE AND COURSE STRUCTURE
2023-24

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 23-24 academic year begins on 25 September 2023

Full term dates can be found here

DATES OF 23-24 TERMS

25 September 2023 – 15 December 2023

8 January 2024 – 22 March 2024

15 April 2024 – 07 June 2024

SEMESTER 1

25 September 2023 – 29 January 2024

SEMESTER 2

29 January 2024 – 07 June 2024

SUMMER

10 June 2024 – 20 September 2024

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.

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.

At Swansea University and in the Faculty of Science and 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, technical and administrative staff, administrators - I'm sure you will find many friendly helping hands ready to assist you. And make the most of living and working alongside your fellow students.

During your time with us, please learn, create, collaborate, and most of all – enjoy yourself!

Professor David Smith
Pro-Vice-Chancellor and Executive Dean
Faculty of Science and Engineering

Faculty of Science and Engineering	
Pro-Vice-Chancellor and Executive Dean	Professor David Smith
Director of Faculty Operations	Mrs Ruth Bunting
Associate Dean – Student Learning and Experience (SLE)	Professor Laura Roberts
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
BEng General Engineering Programme Director	Dr Michael Clee

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 8.30am-4pm.

The **Student Support Team** provides dedicated and professional support to all students in 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 (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 other resources:

https://myuni.swansea.ac.uk/fse/

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 23-24 handbooks to ensure that you have access to the most up-to-date versions.
We do not expect you to purchase textbooks, unless it is a specified key text for the course.

THE DIFFERENCE BETWEEN COMPULSORY AND CORE MODULES

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

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

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

Year 3 (FHEQ Level 6) 2023/24
Engineering
BEng General Engineering[H500,H901]
BEng General Engineering with a Year in Industry[H502]

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-3082 **Embedded Systems** **10 Credits** **Dr A Ali** **CORE**	**EG-3066** **Industry 4.0** **10 Credits** **Dr JS Thompson** **CORE**
EG-365 **Manufacturing Optimisation** **10 Credits** **Prof TC Claypole** **CORE**	**EG-3070** **Biomedical Instrumentation** **10 Credits** **Prof PM Holland** **CORE**
MN-3016 **Innovation Management** **15 Credits** **Prof GH Davies/Ms CJ Edwards/Dr S Roderick** **CORE**	**EG-3075** **Sustainable Integrated Eng Design & Management** **15 Credits** **Mr R Rees/Dr C Li** **CORE**
EG-353 **Research Project** **30 Credits** **Dr AC Tappenden/Dr M Fazeli/Prof PJ Holliman** **CORE**	
Total 120 Credits	

Optional Modules

Choose exactly 20 credits

EG-3080	Engineering Management (Aero, EEE, Mech)	Prof JC Arnold/Prof MR Jennings/Dr EH Jewell/..	TB1+2	10 (CORE)
EGA366	Kinematics and Programming for Robot	Dr AA Fahmy Abdo	TB1	10 (CORE)

Year 3 (FHEQ Level 6) 2023/24
Engineering
BEng General Engineering with a Year Abroad[H501]

Compulsory Modules

Semester 1 Modules	Semester 2 Modules
EG-3082 **Embedded Systems** **10 Credits** **Dr A Ali** **CORE**	**EG-3066** **Industry 4.0** **10 Credits** **Dr JS Thompson** **CORE**
EG-365 **Manufacturing Optimisation** **10 Credits** **Prof TC Claypole** **CORE**	**EG-3070** **Biomedical Instrumentation** **10 Credits** **Prof PM Holland** **CORE**
MN-3016 **Innovation Management** **15 Credits** **Prof GH Davies/Ms CJ Edwards/Dr S Roderick** **CORE**	**EG-3075** **Sustainable Integrated Eng Design & Management** **15 Credits** **Mr R Rees/Dr C Li** **CORE**
EG-353 **Research Project** **30 Credits** **Dr AC Tappenden/Dr M Fazeli/Prof PJ Holliman** **CORE**	
Total 120 Credits	

Optional Modules

Choose exactly 20 credits

EG-3078	Data Science for Engineers	Miss CM Barnes	TB2	10 (CORE)
EG-3080	Engineering Management (Aero, EEE, Mech)	Prof JC Arnold/Prof MR Jennings/Dr EH Jewell/..	TB1+2	10 (CORE)
EGA366	Kinematics and Programming for Robot	Dr AA Fahmy Abdo	TB1	10 (CORE)

EG-3066 Industry 4.0

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr JS Thompson

Format: 22 hrs lectures
10 hrs data lab/Case Study Workshops
70 hrs directed private study

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

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

Lectures/Case Study/Example Classes/Labs

Module Aims: This module introduces fundamental concepts and enabling digital technologies of Industry 4.0. Through practical case studies and exposure to latest research, students will be able to understand how digital technologies such as Big Data, Machine Learning, Augmented Reality, Robotics, Simulation and Additive Manufacturing can be utilised in an industrial context to improve product design, manufacturing processes and supply chain management. The course will equip the participant with the relevant skills to become capable of deploying and evaluating digital technologies in industrial production systems to achieve more flexible, customised and efficient operations in different industrial sectors.

Module Content: Industry 4.0 - an Overview
• Industry 4.0 - historical context
• Industry 4.0 - a global phenomenon
• Drivers of Industry 4.0 i.e. Internet of Things (etc.)
• End-to-end engineering; Vertical and Horizontal Integration
• Sustainability and Mass Customisation
• Industry 4.0 Architecture (RAMI and IIRA)
• Cyber Physical Systems
• Practical Case Studies (i.e. SWOT analysis)

Industry 4.0 - Digital Technologies and Systems
• Industrial Big Data and Machine Learning
• Robotics
• Additive Manufacture
• Augmented Reality
• Simulation and the Digital Twin
• Computational (Data Analytics) Labs

Deployment and Evaluation of Smart Manufacturing (Industry 4.0)
• Industry 4.0 Maturity Index
• Industry 4.0 Readiness Levels
• The implication of Industry 4.0 and Cyber Security

Intended Learning Outcomes:
Technical Outcomes
Upon completion of this module the student will:
• Be expected to have developed their knowledge of Industry 4.0.
• Understand how Smart Manufacturing and new approaches to Information and Communications Technology (ICT) are changing production systems.
• Understand and use Big Data technologies in manufacturing operations and appreciate the uncertainty involved in such methods.
• Gain an awareness of the driver technologies of Industry 4.0.
• Critically evaluate and measure the effectiveness of Smart Manufacturing Systems as part of Industry 4.0.
• Reflect on the human factor and possible issues in the successful implementation of Industry 4.0

Accreditation Outcomes (AHEP)
- Ability to work with technical uncertainty (P8)
- Knowledge of characteristics of particular materials, equipment, processes or products (P2)

Assessment:	Assignment 1 (30%) Assignment 2 (20%) Assignment 3 (50%)
Resit Assessment:	Examination (Resit instrument) (100%)

Assessment Description: Assignment 1 – An individual report based on analysis and conclusions of the Big Data Computer Labs.
Assignment 2 – A group submission comprising of a Blog and SWOT analysis around an aspect of Industry 4.0 implementation.
Leave unchanged.
Assignment 3 – An individual Technical Summary of how Industry 4.0 can be implemented for a specific manufacturing process case study; combined with a reflective exercise on the use of AI-assistive tools for technical writing.

Moderation approach to main assessment: Universal Double Blind Marking of the whole cohort

Assessment Feedback: The Assignment components will be submitted and marked through Canvas. Marks with associated feedback will be provided within 3 weeks of the submission date.

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

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

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

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

EG-3070 Biomedical Instrumentation

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Prof PM Holland

Format: Laboratory work 30 hours Online preparation 10 hours Writing reports 20 hours Directed study 24 hours Contact Hours will be labs on-campus.

Delivery Method: Delivery will be a blend of directed online study and in-person laboratories.

Module Aims: The module covers aspects of Biomedical Instrumentation. It is designed to give medical engineers the knowledge and experience to design, fabricate and use a range of medical devices based on sensors and electronic circuits and systems to interact with the body. The use of medical devices are common in clinical practice and common areas of use include the recording of body or medical device temperature which will form the focus of the module.

Module Content: With the aid of the commercial simulation package, Sim-electronics, the practical laboratory work in this module develops topics such as:

- Sensors for biomedical applications.
- Practical op-amp circuits.
- Real circuit components.
- Filters.
- Arduino technology.

Practical work includes:

- The preparation, performance and reporting on a structured series of experiments supporting the taught modules at this level.
- Practice in using IT packages to assist with report writing and presentations.
- The use of Simelectronics for circuit design and analysis.
- The construction of a hands free switch for people with a disability.

Intended Learning Outcomes: There are several blocks common to all biomedical instrumentations systems with some additional ones depending upon the particular application. The common blocks are measurand; sensor; signal conditioning; signal processing and a data presentation element. Students will be able to conceptualise and understand the theory underpinning the whole instrumentation system whilst understanding the purpose and function of each block and the interfacing between them. (Evaluated in formative online tests and technical lab reports, EA4)

Students will be set an authentic example(s) of NHS projects where they will investigate and define the problem. They will identify typical constraints including environmental and sustainability limitations; ethical, health, safety, security, risk and medical device directives. They will design solutions using simulation software before physical build, test, and evaluation in the electronics lab.
(Evaluated in technical laboratory report 1 and 2, D2, D3, G4, P3, P6)

The students will write technical laboratory reports and reflective statements to develop metacognition and other lifelong learning skills. (Evaluated in technical laboratory report 1 and 2, G1, G2)

Accreditation Outcomes (AHEP)
- Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems. (EA4b)
- 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)
- Work with information that may be incomplete or uncertain and quantify the effect of this on the design (D3)
- Ability to apply relevant practical and laboratory skills (P3)
- Understanding of appropriate codes of practice and industry standards (P6)
- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities (G1)
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD (G2)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)

Assessment:	Coursework 1 (0%) Coursework 2 (10%) Coursework 3 (10%) Coursework 4 (20%) Report (30%) Report 2 (30%)
Resit Assessment:	Coursework reassessment instrument (100%)

Assessment Description: Descriptions
Students will be assessed on the following components:

i) Coursework 1 is the laboratory introduction which is in the first two weeks of the module. It is a pass/fail assessment and must be passed.

ii) Report 1: is a technical laboratory report worth 30% individual assessment.

iii) Coursework 2: is a student reflection on the use of feedback from the first lab report.

iii) Coursework 3: is a student reflection on the benefits of professionalism in biomedical instrumentation labs.

iv) Report 2: is a technical laboratory report worth 30%

v) Coursework 4: is a Canvas quiz to check understanding of the learning outcomes of each lab and is worth 20%

If students do not meet the requirements of the Pass/Fail component, they will receive a Qualified Failure (QF) outcome. This means that the student will be required to redeem the failure, even if their module mark is above 40%.

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students will receive feedback via individual comments on assessed work. Rubrics are used for marking and students can check their mark against the rubric.

Failure Redemption: If a student is awarded a re-sit at least one piece of coursework will be set. If eligible, the failure redemption is only available to students who have at least 80% attendance at laboratory classes during the teaching semester.

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

• NOT AVAILABLE TO Visiting and Exchange Students due to pre-requisite requirements.

• LABORATORY CLASSES ARE COMPULSORY. Students must have at least 80% attendance at laboratory classes in order to be allowed to be assessed for the module.

• PRE-LABORATORY PREPARATION IS COMPULSORY. Students must complete the necessary laboratory preparation by successfully engaging with electronically delivered theory lectures, software simulations in simscape and Canvas assessments before coming to practical laboratories.

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

EG-3075 Sustainable Integrated Eng Design & Management

Credits: 15 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Mr R Rees, Dr C Li

Format: Practical and groupwork

Delivery Method: Lectures.
Formal design review meeting including feedback on first assignment.
Computer lab sessions for software support.

Module Aims: This module demonstrates the outcomes of three years of learning and applies multiple skills to an integrated engineering design project using a systems approach to design. The project will show that students can manage and deliver a design task, as a team, through all stages of the design process. Students should progress from specification to concept design, undertake analysis (using conceptual and computer tools as appropriate) and produce a design report and assembly drawings.

Module Content: Group design project with potential industrial applications.

Projects will be of a multi-disciplinary nature and will involve both conceptual and adaptive design. Students will be required to produce 'in-depth' design submissions including the evaluation of critical detail design aspects, and an assessment of manufacturing and cost implications.

While retaining group activity, each student will be required to take responsibility for particular aspects of the design, which must include an element of engineering analysis which will form an important part of the assessment process. This analysis will be either a finite element stress analysis or detailed hand calculations. The work is presented in the form of a group design report, individual contributions and engineering drawings.

Intended Learning Outcomes: Accreditation Outcomes (AHEP)
- Exercise initiative and personal responsibility, which may be as a team member or leader (G4)
- Understanding of appropriate codes of practice and industry standards (P6)
- Work with information that may be incomplete or uncertain and quantify the effect of this on the design (D3b)
- Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action(EA3b)
- Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics (D1)
- Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal (D4)
- Plan and manage the design process, including cost drivers, and evaluate outcomes (D5)
- Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues (EL5)

Assessment: Group Work - Project (40%)
Group Work - Project (60%)

Resit Assessment: Coursework reassessment instrument (100%)

Assessment Description: Two design reports (Intermediate, 40% weighting and final, 60% weighting) are submitted. Guidelines for preparing the reports are available on Canvas and are discussed in the class. A compulsory viva is held after submission of both reports.

The first viva will be primarily for the purpose of feedback on the early design. The second viva will include assessment and feedback.

Where all group members have contributed equally to the project, marks will be split 50% group effort and 50% individual sections.

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Feedback on the initial design will be given in the first viva.
Lecture sessions will be used to give further feedback.
Computer lab sessions in the second half of the semester will be used to give informal feedback to groups.
Final feedback will be given in the second viva exam.

Failure Redemption: 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 supplementary coursework.Two projects will be set during the supplementary period with a 60:40 weighting.
Additional Notes: Delivery of both teaching and assessment will be blended including live and self-directed activities online and on-campus. PENALTY FOR LATE SUBMISSION:ZERO TOLERANCE

EG-3078 Data Science for Engineers

Credits: 10 Session: 2023/24 January-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Miss CM Barnes

Format: Lecture
PC Lab

Delivery Method: Lecture and PC Lab

Module Aims: Advancing technology including the availability of cheap and widely available sensors has led to large datasets being generated. Careful analysis of this data can lead to insight and efficiencies, for example, distributed sensors on an aging bridge can detect small structural defects instantly. Handling real-world data requires an excellent understanding of statistical techniques, as well as how to clean and process data, and as this is a rapidly growing field, engineers need to have data science skills. This module will introduce practical data science that is relevant to engineering practice, including an overview of Machine Learning.

Module Content: 1. Data types and classifications
2. Cleaning and Processing of Data
3. Data science workflow
4. Data Visualisation
5. Machine Learning

Intended Learning Outcomes: SM2b 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 solutions of engineering problems

Assessment: Coursework 1 (40%)
Examination 1 (60%)

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

Assessment Description: Coursework 1: Analysis and Interpretation of datasets
Examination on course content

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Students will receive informal feedback throughout the semester during practical classes. Blended learning content will be developed to allow students to work through course material, with the opportunity for check-in quizzes to self-test knowledge

Failure Redemption: 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 supplementary exam in August.

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

PENALTY FOR LATE SUBMISSION:ZERO TOLERANCE

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

Credits: 10 Session: 2023/24 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

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%)
	Coursework 2 (3%)
	Assignment 1 (30%)
	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 to pass the module students must achieve a minimum of 30% in the examination component, and a minimum of 40% overall for the module. If students do not meet the exam and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 40%.

Moderation approach to main assessment: Moderation of the entire cohort 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.

EG-3082 Embedded Systems

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-151; EG-152; EG-252

Co-requisite Modules:

Lecturer(s): Dr A Ali

Format: Lectures 20 hours
Laboratory work 30 hours
Directed private study 50 hours

Delivery Method: The module is delivered with 40% lectures and 60% laboratory work. All lectures will be recorded and made available on Canvas. The assessment consists of a combination of practical laboratory tasks (50%) and an on-campus invigilated examination (50%). Students will work in groups in the laboratory examination part, but each student will write and submit individual laboratory reports which will be marked individually.

Module Aims: The Embedded System course is designed to provide students with a comprehensive understanding of Raspberry Pi, and its programming capabilities using the Python programming language. Through a combination of theoretical concepts and hands-on laboratory experiments, students will gain the knowledge and skills necessary to develop and implement their own Raspberry Pi projects using Python.

Module Content: •Introduction to Embedded Systems
Introduction to Raspberry Pi and its applications
Setting up Raspberry Pi and installing Python, Visual Studio Code and Thonny

•Interfacing with GPIO
Understanding General Purpose Input/Output (GPIO)
Controlling LEDs with switches
Reading Analog Voltages Using a Potentiometer
Controlling Dimmable LEDs with Potentiometers
LED blinking, button-controlled LEDs, sensor readings

•Interfacing various graphical user interfaces (GUIs) and Sensors and Controlling Actuators
Working with PWM (Pulse Width Modulation)
Temperature and Humidity Sensor
LCD Display
Collecting and analyzing sensor data
Interfacing OLED Display using I2C protocol
Drawing various shapes on the OLED Display
Servo Motor, distance sensors

Intended Learning Outcomes: At the end of the module, the students will be able to
• Design and implement a microcontroller-based embedded system
• Develop application-specific embedded systems and their interfacing with external devices

Assessment: Laboratory 1 (15%)
Laboratory report (15%)
Examination (50%)
Laboratory 2 (20%)

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

Assessment Description: The combination of all assessments weighs 100%. The laboratory progress is assessed by a laboratory experiment in the mid of the semester (15%) and a laboratory report in the mid of the semester (15%).
At the end of the semester, the students will be assessed by a laboratory experiment (20%) and on-campus invigilated examination 50%

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in the examination component, and a minimum of 40% overall for the module. If students do not meet the exam and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 40%.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: Feedback for each coursework piece will be provided within 3 weeks according to University regulations.
Formal examination feedback will be provided in a standard format on the FSE Canvas HUB. Information provided will be the average mark, maximum and minimum marks, for the module as a whole.

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 live and self-directed activities online and on campus.
• NOT AVAILABLE TO Visiting and Exchange Students due to number restrictions.
• Laboratory classes or their online equivalent are compulsory. Students must have sufficient attendance at laboratory classes or their online equivalent in order to be allowed to be assessed for the module.
• The Faculty of Science and Engineering has a ZERO TOLERANCE penalty policy for late submission of all coursework and continuous assessment.

EG-353 Research Project

Credits: 30 Session: 2023/24 September-June

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr AC Tappenden, Dr M Fazeli, Prof PJ Holliman

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Assessment:	Project Planning Statement (5%) Project Management (0%) Progress Report (5%) Project Management (5%) Ethics Assessment (0%) Final Paper (50%) Oral Presentation (30%) 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 (50%)
- Oral Presentation/Viva (30%)
- 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 of the whole cohort

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: A resubmitting of the final paper and/or the viva presentation takes on the 100% resit option for EG-353

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-365 Manufacturing Optimisation

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules: EG-182; EG-284

Co-requisite Modules:

Lecturer(s): Prof TC Claypole

Format: Lectures 20 hours
Directed private study 80 hours

Delivery Method: On campus lectures

Module Aims: The module provides an introduction to the philosophy and tools used within the Lean Six Sigma methodology. The module will provide an overview of the Toyota Production System (TPS) and the quality systems applicable within manufacturing.

Module Content: Design of Manufacturing Systems
Toyota Production System (TPS)
Lean Six Sigma tools
Strategic stages in planning of manufacturing systems
Systems for high volume and low variety
Systems for low variety and high volume, including cellular systems
Quality Management (Philosophies of Denning, Crosby, Juran)
Quality Systems
Good Automated Manufacturing Processing (GAMP)
Process Optimisation
Design of experiments, Solving orthogonal array problems

Intended Learning Outcomes:
Technical Outcomes
Upon completion of the module the student should be able to demonstrate a knowledge and understanding of:
- Business drivers and how they influence manufacturing system design
- Applying analytical tools to guide the design of a manufacturing system
- Strategies for managing manufacturing systems
- Value Stream Mapping
- Experimental strategies that may be used to guide process improvement and optimisation
- The importance of quality and standards

Accreditation Outcomes (AHEP)
- Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems (SM2b)
- Awareness of quality issues and their application to continuous improvement (P7)
- Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) (P1)

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

Assessment Description:
Two hour examination, three questions.

Moderation approach to main assessment: Moderation of the entire cohort as Check or Audit

Assessment Feedback: There will be an overview of generic issues that will be published on the engineering intranet, including a breakdown of cohort performance.

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.

EGA366 Kinematics and Programming for Robot

Credits: 10 Session: 2023/24 September-January

Pre-requisite Modules:

Co-requisite Modules:

Lecturer(s): Dr AA Fahmy Abdo

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

Assessment Description: 2 hours written examination covering (1) - (6): 50%
Coursework based on 1-project covering (7) - (10): 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.
(7) Mobile Robotics structure and different drive wheels structure, Differential Drive, Car-Like, and Swedish Wheeled Mobile robots.
(8) Kinematics and motion of different drive wheels structure, Differential Drive, Car-Like, and Swedish Wheeled Mobile robots.
(9) Open loop and Closed Control of different drive wheels structure, Differential Drive, Car-Like, and Swedish Wheeled Mobile robots.
(10) Path planning and navigation of different drive wheels structure, Differential Drive, Car-Like, and Swedish Wheeled Mobile robots.

This module is assessed by a combination of examination and continual assessment. In order to pass the module students must achieve a minimum of 30% in the examination component, and a minimum of 40% overall for the module. If students do not meet the exam and module requirements they will receive a QF outcome and will be required to take a supplementary assessment in this module, even if their module mark is above 40%.

Moderation approach to main assessment: Moderation of the entire cohort 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.

MN-3016 Innovation Management

Credits: 15 Session: 2023/24 September-January

Pre-requisite Modules: None

Co-requisite Modules: None

Lecturer(s): Prof GH Davies, Ms CJ Edwards, Dr S Roderick

Format: 10 x 2 hour lectures
10 x 1 hour seminars

Delivery Method: Lectures / Seminars on campus.

Module Aims: Innovation is the lifeblood of the global economy. This module provides an overview of the innovation process in organisations.

Module Content: Lectures:
1. Innovation – What it is and why it Matters
2. Innovation as a Core Business Process
3. Building the Innovative Organization
4. Developing an Innovation Strategy
5. Sources of Innovation
6. Innovation Networks
7. Creating New Products and Services
8. Exploiting Open Innovation and Collaboration
9. Exploiting Entrepreneurship and New Ventures
10. Capturing the Benefits of Innovation

Each lecture has an accompanying seminar on the same topic, except for:
Week 5 – coursework preparation seminar
Week 10 - revision session.

Intended Learning Outcomes: On completion of the module, students will:

- identify approaches to innovation
- evaluate the different approaches to innovation and new product/service introduction
- be able to critically apply theories of innovation inside and outside organisations
- illustrate and discuss the application of theory to practice of new product/service design and launch.

Assessment: Coursework 1 (100%)

Assessment Description: Formative Assessment (0%) – Individual identification of innovation opportunity. Submitted through Turnitin with feedback provided on suitability of concept and application of initial frameworks/theory

Individual Assignment (100%) – Development of a Technical and Commercial Feasibility report for an innovation opportunity. 3,000 word report using structured template

Moderation approach to main assessment: Moderation by sampling of the cohort

Assessment Feedback: Coursework: Written feedback via Canvas plus drop-in session for students who would like individual feedback on their performance.

Failure Redemption: N/A Failure may be tolerated down to 0% in the final year.

Additional Notes: This module is available to incoming exchange/visiting students, if there are any linked pre-requisites students will need to provide a copy of their transcript to assess suitability. Please email somplacements@swansea.ac.uk for more information.