EXPERIMENTAL AND PROFESSIONAL SKILLS - 2024/5

Module code: ENG1091

Module Overview

Engineers need to develop a variety of experimental, transferable and programming skills as part of their education and on-going professional development. This module provides training in experimental and professional skills. The experimental skills consist of (i) laboratory skills, (ii) basic data handling skills, and (iii) report writing skills. The professional skills consist of (i) computer programming skills in MATLAB, (ii) logical reasoning, analytical and oral presentation skills, and (iii) teamworking skills. The module also provides an introduction to the expectations and responsibilities of a professional engineer.

The laboratory component of this module is designed both to support learning in other parts of the curriculum, through practical experiments, and also to further develop generic and transferable skills, including practical laboratory skills, data handling, a basic understanding of experimental uncertainty and scientific writing. Working as part of a group is an integral part of the laboratory classes. Computing skills are developed through tutorials in Microsoft software and MATLAB programming, whereas the laboratory classes reinforce data handling skills.

The professional skills are developed via guest lectures and seminars on topics including ethics; security; equity, diversity and inclusion (EDI); sustainability; writing of CVs and cover letters, and ethics in engineering. Oral communication skills are developed by delivering a presentation to a small group of peers on topics linked to the seminars. The module introduces aspects of the economic, legal, social, ethical, security and environmental contexts in which professional engineers operate.

Module provider

Mechanical Engineering Sciences

Module Leader

KEDDIE Joseph (Maths & Phys)

Number of Credits: 15

ECTS Credits: 7.5

Framework: FHEQ Level 4

Module cap (Maximum number of students): N/A

Overall student workload

Independent Learning Hours: 73

Lecture Hours: 7

Seminar Hours: 6

Tutorial Hours: 8

Laboratory Hours: 12

Guided Learning: 32

Captured Content: 12

Module Availability

Semester 2

Prerequisites / Co-requisites

N/A

Module content

Indicative content includes:

Laboratory Experiments. Six laboratory experiments will be conducted in small groups. Topics of experiments can include stress analysis in beams, mechanical properties of metals and polymers, centrifugal pumps, flow meters, DC motors, hydraulic flow, and biomechanics.

IT and Computing Skills Tutorials. Data handling and basic programming skills are developed through formative exercises. There are exercises are using Microsoft software (Excel and Word) to reinforce data handling and presentation in graphs and reports. MATLAB programming skills are taught to support data handling, manipulation and professional presentation.

Lectures: There are lectures to teach professional communication skills (report writing and oral presentation). There are also lectures delivered by guest speakers on topics to include Security; Equity, Diversity and Inclusion (EDI); and Integrity in Engineering.

Professional Skills Seminars on "The Engineer and Society". The expectations of a professional engineer will be introduced. These will introduce aspects of the economic, legal, social, ethical, security and environmental sustainability contexts in which professional engineers operate. Focused seminar topics will include ethics, security, EDI, and sustainability. The seminars will also describe the skills employers seek and include support in the preparation of a CV and cover-letter for an engineering career. Students will develop skills in logical reasoning and communication by delivering an oral presentation on a subject linked to the seminar topics to reinforce that learning. The presentation will answer a question by drawing upon evidence.

Assessment pattern

Assessment type	Unit of assessment	Weighting
School-timetabled exam/test	MATLAB Test - 40 minutes	20
Coursework	Security Quiz	Pass/Fail
Practical based assessment	Laboratory Preparation and Performance	20
Coursework	Laboratory Report 1	15
Coursework	Laboratory Report 2	15
Practical based assessment	Professional Skills Portfolio	30

Alternative Assessment

MATLAB test: an online assignment. Security Quiz: an on-line quiz Laboratory Preparation and Performance: On-line quizzes for three different experiments and a report on the performance of one laboratory experiment, accounting for the nature and minimization of experimental error. Laboratory Report 1: a written report using data that will be provided. Laboratory Report 2: a written report using data that will be provided. Professional Skills Portfolio: Depending on the failed activity, alternative assessments could comprise an on-line quiz, a bespoke written assignment, or an audio/video recording of a presentation on a seminar topic.

Assessment Strategy

Undertake basic research and preparation prior to a practical investigation.

Carry out laboratory experiments and then analyse and discuss results, including identification of sources of experimental uncertainty.

Produce written technical reports to a prescribed formal style.

Use MS Excel and MATLAB software to address problems that require data manipulation and handling or the repetitive use of mathematical functions.

Present engineering data in a formal academic manner using MS Word, MS Excel, MS PowerPoint or MATLAB software, as appropriate for a specific context.

Prepare and deliver a short formal oral presentation to peers relating to the 'Engineer and Society'

Learn from engaging in seminar activities within a small group and by listening to presentations from peers.

Prepare for a career as a professional engineer.

The summative assessment for this module consists of:

A test that requires the use of MATLAB to perform basic calculations and data handling. Learning outcomes 1, 4.

A quiz to confirm an understanding of the principles of cyber security in an engineering context. The Security Quiz is a core requirement that requires a pass mark in order to pass the module. Learning outcomes 6, 7

Quizzes to assess knowledge of background concepts and the preparation for each experiment, followed by the performance of the experiment as part of a team: Learning outcomes 1, 2, 3.

Data preparation and writing of lab reports on two different experiments: Learning outcomes 1, 2, 3 ,4.

The Professional Skills Portfolio is comprised of compulsory participation in seminars, an oral presentation at a seminar, and the writing of a professional CV to summarise the skills and competencies developed in the module. Specifically, the components of the assessment are:

Participation in interactive seminars considering aspects of the economic, legal, social, ethical, security, EDI, and environmental sustainability contexts in which professional engineers operate. Learning outcomes 6, 7

Preparation of a professional CV and example cover letter while considering what determines employabliity. Learning outcomes 6, 7.

Preparation and delivery of a seven-minute oral presentation on a topic linked to the seminars (Ethics, Security, EDI, and Sustainability) using logical reasoning to answer a selected question. Learning outcomes 3, 5, 6, 7.

Feedback: In every laboratory session, students have face-to face discussions with the experiment supervisor. Written feedback on the first lab reports and marks according to a rubric are returned within three weeks, to enable feed-forward to the writing of the second report, and is formative as well as summative. Staff and postgraduate demonstrators give formative feedback in the IT tutorials, lab classes and seminars as the students undertake a diverse range of tasks involving academic presentation skills,

computer programming, data presentation, and data handling. Informal peer formative feedback is provided in a question-and-answer period during seminar presentations. Summative feedback is provided automatically for lab preparation and security quizzes. Verbal feedback is provided by seminar leaders following student presentations, and summative feedback is provided using a rubric.

Module aims

- Introduce students to the economic, legal, social, ethical, security, EDI, and environmental sustainability contexts in which professional engineers operate.
- Provide students with knowledge of the employability skills expected by the engineering profession
- Expose students to a laboratory experience which reinforces and illustrates wider aspects of the engineering curriculum
- Provide basic training in experimental approaches, including the handling of data and identification of the likely contributions to experimental uncertainty.
- Expose students to the experience of effectively working as part of a team
- Provide an introduction to programming in MATLAB.
- Develop skills in teamworking, communication, logical reasoning, analysis, and oral presentations.
- Develop the knowledge and provide students with experience of using standard MS Office products to support academic writing, data analysis, and oral presentation.
- Introduce students to basic report writing skills, which they will be expected to refine and develop as they progress through their degree
- Equip students with the knowledge and experience of how to present information in a formal professional context.
- Impart knowledge of ethics, security, integrity, EDI, and sustainability.

Learning outcomes

		Attributes Developed
001	Prepare, perform and effectively report experimental investigations, both individually and as part of a team, analysing and interpreting experimental data while working with experimental uncertainty;	KCT
002	Demonstrate an awareness of the principles and importance of experimental measurement and related health & safety and risk issues;	KT
003	Conduct academic research demonstrating knowledge of the resources and the ability to handle them with academic integrity;	PT
004	Use MS Word MS Excel and MATLAB in support of your academic studies, especially in handling experimental data;	CT
005	Structure and deliver a short oral presentation using logic and reasoning, and then provide feedback to others after a presentation;	PT
006	Demonstrate understanding of the commercial context and the importance of professional conduct in engineering;	PT
007	Knowledge of the role of the engineer in society, including ethics, security, EDI, integrity and sustainability.	KC

Attributes Developed

C - Cognitive/analytical

K - Subject knowledge

T - Transferable skills

P - Professional/Practical skills

Methods of Teaching / Learning

The learning and teaching strategy is designed to:

Provide students with a fundamental grounding in experimental methods and scientific/technical report writing.

Reinforce engineering science concepts taught in other modules though practical experimentation and demonstration.

Provide students with a grounding in the use of Microsoft Word, Excel, and PowerPoint software and MATLAB software to produce (i) appropriately formatted academic writing, (ii) appropriately presented engineering data, and (iii) formal oral presentations, to handle and process data, and to implement computer programs.

Develop skills in planning, preparing and delivering formal oral presentations and drawing upon logical reasoning.

Introduce wider aspects of the context in which professional engineers operate.

Provide experience in teamworking and independent thinking via interactive exercises.

Impart knowledge in ethics, security, EDI, sustainability, and professional CV presentation.

The learning and teaching methods include:

Introductory briefing lectures on lab work, report writing, and oral presentations to provide both written and oral guidance on coursework.

Guest lectures to introduce topics related to the Engineer and Society and the expectations of a professional engineer (e.g. Security, Integrity in Engineering, and Equity, Diversity and Inclusion (EDI))

On-line, self-paced and interactive materials to build knowledge of background concepts and to prepare for laboratory experiments.

Laboratory sessions in small groups; including a guided introduction to experiment and apparatus, group work on the practical aspects of the experiment itself to obtain results, and a discussion of the conclusions.

IT tutorials offered in a computer laboratory using Microsoft Excel and Word and MATLAB

Seminars in small groups to provide interactive activities that reinforce professional skills and expectations, including topics such as ethics, security, EDI, sustainability, and CV writing

Indicated Lecture Hours (which may also include seminars, tutorials, workshops and other contact time) are approximate and may include in-class tests where one or more of these are an assessment on the module. In-class tests are scheduled/organised separately to taught content and will be published on to student personal timetables, where they apply to taken modules, as soon as they are finalised by central administration. This will usually be after the initial publication of the teaching timetable for the relevant semester.

Reading list

https://readinglists.surrey.ac.uk
Upon accessing the reading list, please search for the module using the module code: ENG1091

Other information

The School of Mechanical Engineering Sciences is committed to developing graduates with strengths in Employability, Digital Capabilities, Global and Cultural Capabilities, Sustainability, and Resourcefulness and Resilience. This module

is designed to allow students to develop knowledge, skills, and capabilities in the following areas:

Digital capabilities: Students will be introduced to and expected to use appropriate technology to complete authentic assignments, including PowerPoint (or a presentation tool of choice) to deliver presentations, MS Word for report writing, and MS Excel for data presentation such as graph plotting and data handling. Students will learn data handling and programming skills, specifically using mathematical formulae and functions in Excel, creating academically appropriate graphs using MS Excel; an introduction to MATLAB including: variables, assignments, operators, built-in functions and plotting, MAATLAB scripts, m-files, indentation, commenting, for- and while- loops and if-conditions + Boolean variables, arrays and matrices, user-defined functions. They will also be able to use specialist software (MATLAB) to solve engineering problems. Students will be introduced to risks and prevention of breach of Cyber Security in an industrial setting.

Employability: Students will be supported to develop their knowledge of the Engineering Council, Professional Engineering Institutions and expected competencies in ethics, EDI, sustainability and security. Transferable skills including communication, teamworking, report writing, and oral presentation skills will be improved through module activities. Students will also refine their CV, consider job requirements and practice writing a cover letter. These are all skills that will help them become employment ready.

Sustainability: The students will take part in a seminar on sustainability in relation to engineering. The students will work together in a group to discuss the United Nations Sustainable Development Goals in the context of engineering, plus consider routes to achieving Net Zero. Students will listen to oral presentations by their peers, which will include the topic of sustainability: one of the key competencies required by the Engineering Council.

Global and Cultural capabilities: Students will work in the laboratory and seminars in randomly assigned groups. This will require students to engage effectively with people from different backgrounds in ways that respect the interests of cultural groups. An invited industrial speakers will deliver a lecture on EDI and describe how their specific company is responding to equality, diversity and inclusion requirements within an engineering context.

Resourcefulness and resilience: Through participation in the group laboratory sessions and seminars, students will actively engage in group working which will emphasise the importance of team cohesion, respect, empathy and build trust with other learners. Group activities will provide opportunities to positively respond to team setbacks, e.g.when an experiment does not go to plan. During laboratory classes, students can discuss together as a team how to solve problems and how to improve the methods in the future. This activity will reinforce the message that engineering tasks often “fail” in the first instance, which is just part of the journey to improve a design or to solve a problem.

Students will provide peer feedback for presentations, therefore building their confidence-, through taking ownership of identifying strengths. Students will have to engage with a range of information sources in relation to the responsibilities of a professional engineer, some which may challenge their own values and this will encourage them to be open to adapt their own viewpoint.

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
Aerospace Engineering BEng (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Aerospace Engineering MEng	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biomedical Engineering BEng (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Biomedical Engineering MEng	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Mechanical Engineering BEng (Hons)	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module
Mechanical Engineering MEng	2	Compulsory	A weighted aggregate mark of 40% is required to pass the module

Please note that the information detailed within this record is accurate at the time of publishing and may be subject to change. This record contains information for the most up to date version of the programme / module for the 2024/5 academic year.