MATHEMATICS B - 2024/5

Module code: ENG0012

Module Overview

This module builds on ENG0011 Mathematics A and is designed to reinforce and broaden A-Level Calculus, Vectors, Matrices and Complex Numbers. The students will continue to develop their ability to solve real- world problems in a confident manner. The concepts delivered on this module reflect the skills and knowledge required to understand the physical world around us. This is vital, as mathematics plays a critical role in the students' future employability and achievement on their respective undergraduate courses. On completion of the module students are prepared for the more advanced Mathematical concepts and problem solving scenarios in the first year of their Engineering or Physical Sciences degree.

Module provider

Sustainability, Civil & Env Engineering

Module Leader

WARNER Patricia (Sust & CEE)

Number of Credits: 15

ECTS Credits: 7.5

Framework: FHEQ Level 3

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

Overall student workload

Independent Learning Hours: 40

Lecture Hours: 22

Tutorial Hours: 22

Guided Learning: 44

Captured Content: 22

Module Availability

Semester 2

Prerequisites / Co-requisites

ENG0011 Mathematics A (pre-requisite)

Module content

Matrices, vectors, complex numbers, differentiation, parametric equations, implicit differentiation, graph

sketching, integration and various techniques, solving first order and second order ODEs, partial derivatives, eigenvalues and eigenvectors.

Assessment pattern

Assessment type	Unit of assessment	Weighting
Online Scheduled Summative Class Test	SHORT TIMED ONLINE (OPEN BOOK) TEST WITHIN 24HR WINDOW (20 MINUTES) - 1 OF 5	5
Online Scheduled Summative Class Test	SHORT TIMED ONLINE (OPEN BOOK) TEST WITHIN 24HR WINDOW (20 MINUTES) - 2 OF 5	5
Online Scheduled Summative Class Test	SHORT TIMED ONLINE (OPEN BOOK) TEST WITHIN 24HR WINDOW (20 MINUTES) - 3 OF 5	5
Online Scheduled Summative Class Test	SHORT TIMED ONLINE (OPEN BOOK) TEST WITHIN 24HR WINDOW (20 MINUTES) - 4 OF 5	5
Online Scheduled Summative Class Test	SHORT TIMED ONLINE (OPEN BOOK) TEST WITHIN 24HR WINDOW (20 MINUTES) - 5 OF 5	5
Examination	WRITTEN EXAMINATION (2 HOURS)	75

Alternative Assessment

N/A

Assessment Strategy

The assessment strategy is designed to allow students to demonstrate:

Their knowledge of mathematical concepts and rules, and to show their skills in solving a variety of problems, in different contexts, using appropriately selected techniques.

The in-semester assessments include short written online tests assessing the recent knowledge acquired while the end of module exam has greater in-depth problem-solving testing application of concepts taught.

Summative assessment

Five short online tests, one every two weeks, 20 minutes [all learning outcomes covered] 25% (5 x 5%). These will be open for a 24-hour period, in which the test lasts 20 minutes.

End of semester exam, closed book invigilated 2 hours [all learning outcomes covered] 75%.

All of the above assessments are AI resilient.

Formative assessment

Exam type questions are given to the students at each tutorial.

Feedback

For the short online tests feedback is given with the correct answers. A lot of the feedback for this is as oral discussions and peer assessment during tutorials. A great deal of emphasis is given to these short online tests.by the students They are worth minimal marks but the conversations among the students as to how and why they made their mistakes is so useful.

An online diagnostic test is given to the students during welcome week. This highlights the weaknesses and the topics where emphasis is directed for in-depth delivery. Within three weeks of the students joining the foundation year there are three assessments with marks. This is such a useful indication of initial engagement / lack of engagement from the start of the course.

For the exam type questions, these are marked and written feedback given.

While the short online tests have their own value, the end of module written exam has its place. The content delivers the 'prove that' and 'show that' types of questions which are impossible to assess with short online tests. Practice exam questions are given to the students throughout the semester. These do not contribute towards their final exam mark but enables them to have purposeful written feedback on their written work. It is a long time since they produced any full written solutions to problems, proofs etc.

Module aims

- This module aims to review and consolidate students' knowledge of A-level Calculus, Vectors and Matrices and Complex Numbers. More advanced problem solving scenarios will be introduced, and the students will begin to devlop some higher level thinking skills.
- Review and consolidate students¿ knowledge in the more difficult aspects of the A Level mathematical content.
- Emphasise the development of higher-level thinking skills which can be applied in a variety of problem-solving activities.
- Formulate problems in precise terms, identifying the issues forming complex reasoning.
- Use mathematics to describe the physical world.
- Build up students' confidence to tackle any problem, looking at it from different points of view
- Encourage students to communicate mathematically and to share their understanding of the complex situations and problems they are faced with.
- Encourage students to work independently on building up of their own mathematical knowledge and understanding, focusing on becoming successful on their undergrad course and later becoming better engineers.
- Challenge the students' thinking and to understand there is no right method or incorrect method in achieving a solution. All methods are correct as long as they logically arrive at the required solution. The aim is to find the best solution amongst various alternatives.
- Develop skills in logical thinking and analysis and a disciplined approach to working with precision and accuracy

Learning outcomes

		Attributes Developed
001	Solve a variety of problems requiring the use of calculus	CKPT
002	Construct and manipulate a variety of Mathematical expressions	CKPT
003	Recognise when to apply an appropriate rule or method	CKPT
004	Apply a problem solving strategy, which may require the application of multiple Mathematical concepts	CKPT

		Attributes Developed
005	Solve Simple Engineering and Physical Science problems using known procedures in different contexts	CKPT
006	Interpret the geometrical or physical meaning of the solution to a problem	CKPT

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:

Familiarise students with mathematical concepts and techniques, supported by extensive use of examples and applications; students are engaged in the solution of problems and application of techniques in tutorials/problems classes.

The learning and teaching methods include:

Lectures to revise prior learning and bring students from varying backgrounds to a common level of knowledge, and to introduce new concepts and techniques and provide illustrative examples and applications.

Guided learning to cover certain topics, to develop students' independent learning skills.

Problem sheets of examples for technique selection and skills development.

Tutorials/problems classes for the development of skills in selecting and applying appropriate techniques, using problems sheets; assistance is given both at individual level, and for the group on common areas of difficulty

Independent learning.

Captured content - Panopto is available for missed lectures or consolidation of concepts taught.

Students are encouraged to ask and answer questions at the lectures. Their previous knowledge is challenged in lectures and more so in tutorials

Tutorials are used to consolidate the sometimes difficult concepts taught

Topics delivered in this module are developed further in other modules i.e. computing laboratory sessions

The lectures and tutorials enhance and develop student skills to a greater depth.

The ENG0012 module develops the students real foundation and bridging step between the students' current knowledge and skills to a fully integrated understanding of the mathematics content in year 1.

Support is given on a one-to-one basis for students who have not studied mathematics for several years or they have missed sessions through genuine illness

Online books for suggested reading are available

Students are encouraged to develop critical thinking skills in order to acquire the ability to analyse facts objectively leading to an

informed judgement.

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: ENG0012

Other information

Foundation Year programmes are committed to developing students with strengths in Employability, Digital Capabilities, Global and Cultural Capabilities, Sustainability, Resourcefulness and Resilience. This module is designed to develop knowledge and skills in the following:

Employability – Students undertake focused learning relating to the real-world, enabling them to develop the analytical skills and competencies relevant to their chosen study and subsequent career pathway.

The skills students acquire in the development of their mathematical knowledge are vital to their future job roles. They will use their critical thinking skills and analytical ability to solve problems encountered in a systematic and logical way. With the understanding of their mathematics, they will be able to design and optimise complex systems. They will be designing structures, optimising processes, predicting outcomes, and making informed decisions.

Digital capability - Students digital capability is promoted through the use of SurreyLearn for the independent study modules, online assessments, use of graphing packages, use of research platforms etc.

There are so many resources available to students digitally. The graphing packages give real meaning to functions and their behaviour. Panopto is an excellent resource for consolidation of the concepts and learning objectives taught. The calculator is such a useful piece of equipment as it can be so easily set up to find roots using iterative methods to the greatest degree of accuracy. Students use spreadsheets. The use of the tablets they write on helps with orderly storage and retrieval of solutions when revising. All the module content is on SurreyLearn with so much information about the course content, learning objectives, assessment dates, tutorial sheets and solutions. The formula booklet used in the face-to-face exam is available online as well.

Resourcefulness and resilience: The module is designed in such a way as to encourage and support the progressive development of independent thinking and resourcefulness through scaffolded activities and assessments. The online short test has been designed to foster active participation and reflective engagement. Assessment is balanced and varied with online tests, paper based final exam and formative bi-weekly exam questions taken in tutorials. In the assessments and tutorial worksheets, students are exposed to challenging authentic scenarios which invariably lead to setbacks and frustration. They are encouraged to reflect and fault find and to question their strategy if the outcome of a problem-solving process is not as expected. Students learn how to seek verification of their output through independent research or peer collaboration and how to respond constructively to formal and informal feedback.¿

Programmes this module appears in

Programme	Semester	Classification	Qualifying conditions
Aerospace Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module

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Astronautics and Space Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Biomedical Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Chemical and Petroleum Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Chemical Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Civil Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Computer and Internet Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Computer Science with Foundation Year BSc (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Electrical and Electronic Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Electronic Engineering with Computer Systems With Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Electronic Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Financial Mathematics with Foundation Year BSc (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Mathematics and Physics with Foundation Year BSc (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Mathematics with Data Science with Foundation Year BSc (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Mathematics with Foundation Year BSc (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Mechanical Engineering with Foundation Year BEng (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Physics with Astronomy with Foundation Year BSc (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Physics with Foundation Year BSc (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Physics with Nuclear Astrophysics with Foundation Year BSc (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module
Physics with Quantum Computing with Foundation Year BSc (Hons)	2	Compulsory	A weighted aggregate mark of 50% is required to pass the module