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| **Module Code** | EEU22E12 |
| **Module Name** | COMPUTATIONAL SCIENCE AND ENGINEERING 1 |
| **ECTS Weighting[1]** | 5 ECTS |
| **Semester taught** | Semester 2 |
| **Module Coordinator/s** | Anil Kokaram |

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| **Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline** | On successful completion of this module, students will be able to:<br><br>1.    Explain the need for numerical solutions to engineering problems.<br>2.    Describe how numerical methods incur errors.<br>3.    Use Matlab to implement solutions to Engineering problems including curve fitting.<br>4.    Perform basic statistical analysis.<br>5.    Use the Taylor Series as a basis for error estimation.<br>6.    Find numerical solutions to differential equations.<br>7.    Perform basic linear and non-linear optimization.<br>8.    Perform numerical integration and differentiation<br>9.    Apply the finite element method to basic engineering problems<br>10.   Assess the computational load of a numerical algorithm and describe the link between computational load and energy consumption<br><br>**Graduate Attributes: levels of attainment**<br>To act responsibly - Enhanced<br>To think independently - Attained<br>To develop continuously - Enhanced<br>To communicate effectively - Choose an item. |
| **Module Content** | Please provide a brief overview of the module of no more than 350 words written so that someone outside of your discipline will understand it.<br><br>This is a module on the application of mathematical methods to gain approximate solutions to real world engineering problems. This module demonstrates why there is frequently a need for numerical solutions to real-world problems, and introduces the high level programming environments of Excel, Matlab (and optionally Python) to code basic solutions to Engineering problems. The module also introduces best practice Engineering coding methodology used in companies like Google and YouTube. The Mathematics which underpin this module have been largely covered in previous Mathematics modules. This module therefore provides a link between pure |

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[1] TEP Glossary

| | Mathematics and Engineering applications encountered in industry and in research. |
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| **Teaching and Learning Methods** | Lectures: The teaching strategy broadly follows a single text book [1] for the core material, to assist in student revision. Tutorials: there are weekly assignments using either Excel or Matlab or Python to implement each numerical method guided by teaching assistants who are recruited from the postgraduate student body in the School of Engineering. |

**Assessment Details[2]**
**Please include the following:**
- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

| Assessment Component | Assessment Description | LO Addressed | % of total | Week due |
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| Examination | Written 2hr examination | | 75% | 1st June 2025 |
| Assignments | Assignments are submitted on a weekly basis | | 25% | Due Weeks 1 to 12 |
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**Reassessment Requirements**

**Contact Hours and Indicative Student Workload[2]**

| **Contact hours: 44** |
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| **Independent Study (preparation for course and review of materials):** | |
| **Independent Study (preparation for assessment, incl. completion of assessment):** | |
| **Recommended Reading List** | 1. Numerical Methods for Engineers by Steven Chapra & Raymond Canale, McGraw Hill, 7th Edition.<br>2. Numerical Recipes in C, The Art of Scientific Computing, by Press, Teukolsky, Vetterling and Flannery, Cambridge University Press, 3rd Edition |
| **Module Pre-requisite** | Mathematics (JF), Physics, Basic knowledge of Linear Algebra (JF Level) |
| **Module Co-requisite** | |
| **Module Website** | On Blackboard |
| **Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.** | No |
| **Module Approval Date** | |
| **Approved by** | |
| **Academic Start Year** | September 2024 |
| **Academic Year of Date** | 2024/25 |