

Module code

SPP-2401

Type of module

Undergraduate: Applied Physics – Elective

Introduction to Computational Physics



Modular credits

4

Total student
engagement

56 hours

Prerequisite

None

Anti-requisite

None

Aims

To provide students with a fundamental understanding of computer modelling physical systems, focusing on practical aspects. Students will construct simple models, test them through virtual experiments, and develop skills in designing and implementing computational models.

Module learning outcomes (MLO)

On successful completion of this module, a student will be expected to be able to:

MLO 1

Design and construct computational models of physical systems, translating theoretical descriptions into virtual representations.

MLO 2

Apply fundamental numerical methods in developing and solving models of physics problems.

MLO 3

Produce, test, and refine computer codes to minimise errors, identify defects, and evaluate code quality.

MLO 4

Evaluate and justify the choice of computational methods used, and assess the reliability of simulation outcomes.

MLO 5

Apply computational tools (e.g. Python, MATLAB, SciLab, SciCos, and MathCAD) to model, simulate, and analyse physical systems.

Module contents

Introduction to computational physics and computer modelling	Translating physical models into mathematical models	Translating mathematical models into computational models
Algorithm development and flowchart design	Introduction to programming and computational tools (e.g., Python, MATLAB)	Data visualisation and presentation of computational results
Error analysis, debugging, and validation of computational models	Numerical methods: numerical differentiation and integration	Computational methods for solving first- and second-order differential equations
Modelling of vibration and oscillatory systems	Monte Carlo and random methods	Virtual experiments and computational investigations

Assessment

0%

Examination

100%

Coursework



■ Mini Projects — 40% ■ Assignments — 40% ■ Class tests — 20%

Formative assessment

Weekly discussion and feedback

Summative assessment

COMPONENT	WEIGHTING
Examination	0%
Coursework	100%
Individual	100%
Mini Projects	40%
Assignments	40%
Class tests	20%

Graduate attributes and skills

Programme learning objectives (PLO) addressed

1	PLO 1 (Core Disciplinary Knowledge)	2	PLO 2 (Critical Thinking and Comparative Analysis)
4	PLO 4 (Numerical and Analytical Competence)	5	PLO 5 (Interdisciplinary Applications, Materials and Sustainability)

Sustainability concept addressed

4	SDG 4 Quality Education
9	SDG 9 Industry, Innovation and Infrastructure

Digital skills/software used (not limited to)

- Computational software (e.g. Python Programming, MATLAB, SciCos, SciLab, MathCAD)
- Communication tools (e.g. Emails)
- E-Learning platform (e.g. CANVAS)

Micro-credentialling option

No

Stackable towards GenBESTARI Undergraduate Degree Programme or other relevant Lifelong Learning Programmes

No

Document details

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