

Module code

SPM-3414

Type of module

Undergraduate: Mathematical Sciences – Elective

Fluids and Waves



Modular credits

4

Total student
engagement

56 hours

Prerequisite

SPM-2206
(Multivariate Calculus)

Anti-requisite

None

Aims

To develop students' ability to analyse and apply mathematical principles of fluid mechanics and wave propagation to model and solve problems in fluid flow, wave phenomena, and related physical systems.

Module learning outcomes (MLO)

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

MLO 1

Analyse the principles of fluid mechanics, including conservation laws, fluid motion, and flow behaviour, using appropriate mathematical models.

MLO 2

Apply mathematical techniques to solve problems involving ideal and viscous fluid flow, potential flow, and one-dimensional wave propagation.

MLO 3

Evaluate mathematical models of fluid and wave phenomena by analysing assumptions, solution behaviour, and physical interpretations.

MLO 4

Interpret and justify mathematical solutions for fluid mechanics and wave propagation problems in engineering and physical science contexts.

Module contents

Conservation equations	Pressure tensor	Eulerian and Lagrangian descriptions of fluids
Rates of change of material integrals, fundamental fluid model	Ideal fluid motion	Vorticity and irrotational flow
Subsonic flow and the incompressible approximation	Potential flow	Pressure variation in ideal subsonic flow
Boundary layers and vortices	Stokes flow past a sphere	Exact viscous flow solutions
One-dimensional wave equations (first and second order)	Review of the vibrating string	Traffic flow problem (characteristics and shock waves)
Water waves and sound waves		

Assessment

60%

Examination

40%

Coursework

Examination
60%

Class tests
40%

■ Examination — 60%

■ Class tests — 40%

Formative assessment

Weekly tutorial
sessions, discussion
and feedback

Summative assessment

COMPONENT		WEIGHTING
Examination		60%
Coursework		40%
Individual		40%
Class tests		40%

Graduate attributes and skills

Programme learning objectives (PLO) addressed

1 PLO 1 (Core Mathematical Knowledge)

2 PLO 2 (Analytical Problem-Solving)

4 PLO 4 (Mathematical Communication)

Sustainability concept addressed

4 SDG 4 Quality Education

9 SDG 9 Industry, Innovation and Infrastructure

Digital skills/software used (not limited to)

■ Learning management and collaboration platforms (e.g. Canvas)

■ Word processing software (e.g. Microsoft Word)

■ Spreadsheet and numerical analysis software (e.g. Microsoft Excel)

■ Mathematical document preparation software (e.g. Scientific Word)

Micro-credentialling option

No

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

No

Document details

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