COURSE DETAILS

Course Code: F19AB
Full Course Title: Applied Mathematics B
SCQF Level: 9
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL

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<th>Postgraduate Taught:</th>
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<th>Postgraduate Research:</th>
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Additional Information:

COURSE AIMS

The objective of the module is to introduce some fundamental ideas and techniques in Applied Mathematics.

LEARNING OUTCOMES – SUBJECT MASTERY

By the end of the course, students should be able to:

- find the Fourier sine and cosine series of simple functions on $[-L, L]$
- find the half-range Fourier sine and cosine series of functions on $[0, L]$
- understand the concept of a PDE
- understand the meaning and application of the heat, Laplace's and wave equations
- understand and be able to use the separation of variables approach
- solve the heat equation in 1D with various boundary conditions using separation of variables and Fourier analysis
- solve Laplace's equation in 2D with various boundary conditions using separation of variables and Fourier analysis
- solve the wave equation with various initial conditions using separation of variables and Fourier analysis
- derive the Euler–Lagrange equations for the extremizer of a functional
- solve the Euler–Lagrange equations for simple examples
- perform both of the previous two exercises for functionals involving higher derivatives and/or more than one dependent and/or independent variables
- use Lagrange multipliers to solve problems with constraint
- define action and state Hamilton's Principle
- derive Lagrange's equations of motion and use them to solve for the dynamics of simple examples, eg. Kepler and simple pendulum problems
- derive Hamilton's equations
- understand Poisson brackets
- exploit symmetries to solve simple mechanics problems
- understand the relation between symmetries and conservation laws

LEARNING OUTCOMES – PERSONAL ABILITIES

- Demonstrate the ability to learn independently
- Demonstrate knowledge of an area of mathematics.
- Manage time, work to deadlines and prioritise workloads
SYLLABUS

Fourier Analysis: Full and half range Fourier series.

An introduction to PDEs: Simple PDEs; Separation of Variables; Solution of the heat equation, Laplace’s equation and the wave equation making use of Fourier series.

Calculus of variations: variational derivative; Euler–Lagrange equations; examples including the Brachistochrone, isoperimetrical, and soap bubble problems; extensions to higher derivatives, several dependent and independent variables; constraints and Lagrange multipliers.

Lagrangian mechanics: action; Hamilton’s Principle; Lagrange’s equations; examples including the Kepler and simple pendulum problems; Poisson brackets; Noether’s theorem.

COURSE RELATIONSHIPS

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<th>Course Code</th>
<th>Level</th>
<th>Title</th>
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<td>Multivariable Calculus and Real Analysis A</td>
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<td>Pre-Requisite</td>
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LOCATION AND ASSESSMENT METHODS

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