F19AB Applied Mathematics B

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

DELIVERY LEVEL
Undergraduate: Yes  Postgraduate Taught: Yes  Postgraduate Research: No

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 La-grange 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>School</th>
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LOCATION AND ASSESSMENT METHODS

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