COURSE DETAILS
Course Code: F18AA
Full Course Title: Applied Mathematics A
SCQF Level: 8
SCAF Credits: 15
Available as Elective: No

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

COURSE AIMS
The goal of the course is to explain the basic principles of Newtonian mechanics and special relativity and to show how these theories can be used to describe a range of physical phenomena.

LEARNING OUTCOMES – SUBJECT MASTERY
By the end of the course, students should be able to:

- Understand fundamental concepts of kinematics such as velocity, acceleration and kinetic energy
- Understand Newton’s laws
- Sketch simple trajectories
- Derive and solve the equation of motion for a projectile near the earth’s surface
- Derive and solve the equation of motion of an object oscillating on a spring, including damping and periodic driving force.
- Understand the terms damping constant, characteristic frequency, transient and steady solution, resonance.
- Understand elastic and inelastic collisions
- Derive and apply conservation laws for energy and angular momentum
- Understand the principles of planetary orbits
- Understand the basic mathematical concepts in special relativity

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

Communicate mathematical reasoning orally and in writing

Use of mathematical software

SYLLABUS
F18AA Applied Mathematics A

One-dimensional dynamics: Newton's second law in one dimension: free fall in constant gravitational field, simple harmonic motion, conservation of energy

Oscillations: Revision of second order differential equations with constant coefficients: method of undetermined coefficients for inhomogeneous equations, application to equation of oscillating spring with damping and driving term, resonance

Three-dimensional kinematics and Newtonian mechanics: Motion of a particle in three dimensions, relative motion, Newton's first and second law of motion, circular motion, projectile motion

Conservation laws: Linear momentum and energy, Newton's third law and momentum conservation, collisions

Planetary motion: Motion under a central force, conservation of angular momentum and energy, Kepler's laws

Introduction to relativity: Galilean principle of relativity; constancy of the speed of light and Einstein's special theory of relativity; Lorentz transformations; time dilation and Lorentz contraction

### COURSE RELATIONSHIPS

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<th>Course Code</th>
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<th>School</th>
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<td>Pre-Requisite</td>
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### LOCATION AND ASSESSMENT METHODS

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