### COURSE DETAILS

**Course Code:** F10PG  
**Full Course Title:** Geometry  
**SCQF Level:** 10  
**SCAF Credits:** 15  
**Available as Elective:** No

### DELIVERY LEVEL

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<th>Yes</th>
<th>Postgraduate Taught</th>
<th>No</th>
<th>Postgraduate Research</th>
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### COURSE AIMS

The aim of this module is to explore Euclidean, spherical and hyperbolic geometry. We study the characteristic properties of those geometries and investigate their isometry groups. The course also aims at studying geometric structures on surfaces.

### LEARNING OUTCOMES – SUBJECT MASTERY

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

- compute arc lengths, curvature and torsion of curves and be able to interpret results geometrically  
- compute action of vector field on a function and pairing of vector field with a 1-form  
- compute wedge products and exterior derivatives of differential forms  
- understand notion of moving frame and compute connection forms for given frame  
- understand description of surface in terms of maps into Euclidean space  
- compute normal and tangent vector fields to a parametrised surface  
- understand definition of first and second fundamental form and of principal curvatures  
- compute Gauss and mean curvature for simple parametrised surfaces  
- understand geometrical meaning of Gauss curvature  
- derive equation for geodesic on a given parametrised surface and find geodesics in simple cases  
- state major theorems and definitions; understand the proofs of the theorems; reproduce proofs of minor results; reproduce major results when provided guidance

### 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
Curves in Euclidean space: Definition and symmetry of 3-dimensional Euclidean space, parametrised curves in Euclidean space, arc length, curvature and torsion.

Vector fields and differential forms: Vector fields as derivative operations, differential 1-forms, line integrals, forms of higher degree, exterior derivative

Moving frames and structure equations: Definition of a moving frame in Euclidean space, connection forms, first and second structure equations.

Surfaces in Euclidean space: Surfaces described by maps into Euclidean space, normal vectors and tangent vectors, adapted frames, first and second fundamental forms, Gauss and mean curvature, Gauss and Codazzi equation.

Curvature and geodesics: The meaning of curvature, Theorema Egregium, definition of geodesic, introduction to Riemannian geometry.

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<td>Ordinary Differential Equations</td>
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