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MATH20222

Introduction to Geometry

Unit code:	MATH20222
Credit Rating:	10
Unit level:	Level 2
Teaching period(s):	Semester 2
Offered by	School of Mathematics
Available as a free choice unit?:	N

Requisites

None

Aims

To give an introduction to the basic ideas of geometry and topology.

Overview

This course unit introduces the basic ideas of the geometry of curves and surfaces in Euclidean space, differential forms and elementary topological concepts such as the Euler characteristic. These ideas permeate all modern mathematics and its applications.

Assessment methods

- Other - 20%
- Written exam - 80%

Assessment Further Information

- Coursework; Weighting within unit 20%
- 2 hours end of semester examination; Weighting within unit 80%

Learning outcomes

On successful completion of this module students will have acquired an active knowledge and understanding of the basic concepts of the geometry of curves and surfaces in three-dimensional Euclidean space and will be acquainted with the ways of generalising these concepts to higher dimensions.

Syllabus

1. Scalar product, orthonormal basis, orientation and vector product in \mathbb{R}^3 .
2. Differential forms in \mathbb{R}^2 and \mathbb{R}^3 . Geometrical meaning of differential forms. Examples: area of parallelogram, volume of parallelepiped.
3. Curves in \mathbb{R}^2 and \mathbb{R}^3 . Velocity and acceleration vectors. Frenet curvature and centripetal acceleration.
4. Surfaces in \mathbb{R}^3 . Example: quadric surfaces. Saddle and hyperboloid as ruled surfaces. First quadratic form. Moving frame on a surface. Second quadratic form. Gaussian and mean curvatures.
5. The concept of parallel transport.
6. External and internal points of view on surfaces. [Gauss's Theorema Egregium (statement and applications).]
7. Euler characteristic and Gauss-Bonnet Theorem (statement and idea of proof.)

Recommended reading

• Andrew Pressley, Elementary Differential Geometry, Springer;

• Barrett O' Neill, Elementary Differential Geometry, Academic Press.

Feedback methods

Tutorials will provide an opportunity for students' work to be discussed and to provide feedback on their understanding.

Study hours

- Lectures - 22 hours
- Tutorials - 11 hours
- Independent study hours - 67 hours

Teaching staff

Hovhannes Khudaverdyan - Unit coordinator