MATH20222

General Information

- Title: Introduction to Geometry
- Unit code: MATH20222
- Credit rating: 10
- Level: 2
- Pre-requisite units:
- Co-requisite units:
- School responsible: Mathematics
- Member of staff responsible: Hovhannes Khudaverdyan

Unit specification

Aims

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

Brief description

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.

Intended 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.

Future topics requiring this course unit

The ideas in this course unit will be developed further in third and fourth level course units in geometry and topology.

Syllabus

1. Recollection of lines and planes in R^3. Equations in various forms, normal vector to a plane, distance from a point to a plane.

2. Differential forms in R^2 and R^3. Geometrical meaning of differential forms. Examples: area of parallelogram, volume of parallelipiped.

3. Curves in R^2 and R^3. Velocity and acceleration vectors. Frenet curvature and centripetal acceleration.

4. Surfaces in 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. Riemannian manifolds. Gauss's *Theorema Egregium* (statement and applications).
7. Euler characteristic and Gauss-Bonnet Theorem (statement and idea of proof.)

Textbooks
Andrew Pressley, *Elementary Differential Geometry*, Springer;
Barrett O' Neill, *Elementary Differential Geometry*, Academic Press.

Learning and teaching processes
Two lectures and one examples class each week.
At least three hours private study each week.

Assessment
Coursework: Weighting within unit 20%
2 hours end of semester examination: Weighting within unit 80%

Arrangements