MATH0020 Differential Geometry

Year:	2021–2022
Code:	MATH0020
Level:	6 (UG)
Normal student group(s):	UG: Year 3 Mathematics degrees
Value:	15 credits (= 7.5 ECTS credits)
Term:	2
Assessment:	90% examination, 10% coursework
Normal Pre-requisites:	MATH0011
Lecturer:	Dr M Hadzic

Course Description and Objectives

This course concerns the geometry of smooth curves and surfaces in $\mathbb{R}^3$. We will begin by looking at local properties, i.e., properties such as curvature, which are defined using a small neighbourhood of a point. We will go on to prove global results in which we study the curve or surface as whole. For example, the Gauss-Bonnet Theorem relates the geometry and topology of a surface. We will also study special surfaces such as minimal surfaces, which are natural models for soap films.

Recommended Texts

Manfredo Do Carmo, *Differential Geometry of Curves and Surfaces* (Prentice Hall).

Detailed Syllabus

Curves: Review of curvature and torsion of curves and Frenet-Serret formulae, isoperimetric inequality, total curvature and the global geometry of curves.

Surfaces in $\mathbb{R}^3$: First fundamental form, length and area, normal and geodesic curvature, geodesics, second fundamental form, the Gauss map, curvature (principal, Gaussian, mean, geodesic and normal), Theorema Egregium, Gauss-Bonnet Formula, Euler characteristic, minimal surfaces, applications.