# 3113 (Differential Geometry)

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| *Year:* | 2014–2015 |
| *Code:* | MATH3113 |
| *Level:* | Advanced |
| *Value:* | Half unit (= 7.5 ECTS credits) |
| *Term:* | 1 |
| *Structure:* | 3 hour lectures per week |
| *Assessment:* | 90% examination, 10% coursework |
| *Normal Pre-requisites:* | MATH1402 |
| *Lecturer:* | Dr K Fritzsch |

*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 study special surfaces such as minimal surfaces, which are natural models for soap films. We will introduce the notion of a topology, which in some sense is the minimal structure that can be put on a set so that one can give a useful notion of continuity. We will then define abstract manifolds that are not, in general, subsets of $\mathbb{R}^n$.

*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.

**Manifolds:** Topology, topological manifolds.