

Pure Mathematics 423

Differential Geometry

(see Course Descriptions under the year applicable: <http://www.ucalgary.ca/pubs/calendar/>)

Syllabus

Topics

Review of vector algebra and elementary vector analysis

Local curve theory, Frenet-Serret formulas and applications

Local surface theory, Geodesics, Gaussian curvature

Global theory of surfaces, Gauss-Bonnet Theorem

Course Outcomes

Overview: The course introduces the fundamentals of differential geometry primarily by focussing on the theory of curves and surfaces in three space. The theory of curves studies global properties of curves such as the four vertex theorem. The theory of surfaces introduces the fundamental quadratic forms of a surface, intrinsic and extrinsic geometry of surfaces, and the Gauss-Bonnet theorem.

Calculational skills:

1. The student will be able to compute quantities of geometric interest such as curvature, as well as develop a facility to compute in various specialized systems, such as semigeodesic coordinates or ones representing asymptotic lines or principal curvatures.
2. The student will also be introduced to the method of the moving frame and overdetermined systems of differential equations as they arise in surface theory.

Theoretical skills:

3. Students will start being able to develop arguments in the geometric description of curves and surfaces in order to establish basic properties of geodesics, parallel transport, evolutes, minimal surfaces and consequences of the Poincaré index theory.

The mathematical sophistication is at the level of the books 'Differential geometry' by Stoker, 'Elementary differential geometry' by O'Neill or do Carmo's 'Differential Geometry of Curves and Surfaces'.

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Suggested Text reference removed 2009:01:01
Prerequisite change: 2009:07:01