MA 518: Geometry of Curves and Surfaces
3 credit hours, Spring 2019

Instructor Dr. Curtis Porter (department of mathematics). `cwporter@ncsu.edu`

Class Meetings MWF 12:50 pm – 1:40 pm in SAS 1220

Office Hours Tuesday 1 pm – 2 pm in SAS 3208 and by appointment

Prerequisites MA 242, MA 405

Text Manfredo do Carmo, *Differential Geometry of Curves and Surfaces*, $25 (paperback) via `amazon.com` – also available as an ebook through the NCSU library webpage

Course objective

To learn the main concepts of differential geometry by studying curves and surfaces embedded into three dimensional Euclidean space.

Catalog Description

> Geometry of curves and surfaces in space. Topics include: arclength, torsion, and curvature of curves; tangent spaces, shape operators, and curvatures of surfaces; differential forms, metrics, covariant derivatives, and geodesics. Applications in the physical sciences and/or projects using computer algebra.

Approximate schedule

(Chapters are from do Carmo)

Geometry of Curves (chapter 1) 3 weeks

Introduction to Surfaces (chapter 2) 2 weeks

Differential Forms and Vector Fields (supplemental notes) 2 weeks

The Gauss Map (chapter 3) 2 weeks

Covariant Differentiation and the Intrinsic Geometry of Surfaces (chapter 4) 3 weeks

Special Topics: Minimal Surfaces, Global Geometry, Variational Problems 3 weeks

Student Learning Outcomes

A student who successfully completes this course will be able to:

1. Compute geometric invariants of curves and surfaces: length, curvature, torsion, first and second fundamental forms, mean curvature, Gauss curvature.

2. Distinguish between intrinsic and extrinsic invariants of curves and surfaces.

3. Compute covariant derivatives.

4. Draw inferences about the global shape of a curve or surface given information about its curvature.

5. Explain physical phenomena in geometric terms.

Course structure

For the most part, lectures will be in the traditional format. However, some time will be spent in active-learning activities such as worksheets, discussions, and on-the-spot problems. Attendance at all class meetings is essential.

Assignments and Grades

Evaluation

Homework will be due approximately once every two weeks and is worth 20% of the course grade.

Exams: there will be two mid-term exams Each exam is worth 25% of the course grade.

Final Exam is worth 30% of the course grade.

Missed/Late Assignments

In the case of missed exam or assignment, please, let the instructor know *in writing* and *as soon as possible*. Assignments missed for valid reasons may be made up consistent with the University's policy on attendance, Regulation 02.20.03. `policies.ncsu.edu/regulation/reg-02-20-03`. Late homework will not be accepted without a valid reason.

Homework

Each homework assignment will consist of three parts:

Reading appropriate sections of the text-book is essential.

Exercises are for your practice and thought. They will not be collected, but should be considered mandatory.

Problems will be submitted and graded.

Homework sets should be typed (preferably with LaTeX). See the course website for a list of LaTeX resources.

Statement for students with disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG 02.20.01)

N.C. State University Polices, Regulations, and Rules (PRR)

Students are responsible for reviewing the PRRs which pertain to their course rights and responsibilities. These include: `http://policies.ncsu.edu/policy/pol-04-25-05` (Equal Opportunity and Non-Discrimination Policy Statement), `http://oied.ncsu.edu/oied/policies.php` (Office for Institutional Equity and Diversity),`http://policies.ncsu.edu/policy/pol-11-35-01` (Code of Student Conduct), and `http://policies.ncsu.edu/regulation/reg-02-50-03` (Grades and Grade Point Average).