



SECOND SEMESTER 2015-2016

Course Handout Part II

Date:13/01/2016

In addition to part -I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : MATH F342

Course Title : DIFFERENTIAL GEOMETRY

Instructor-in-charge : PRADIPKUMAR H. KESKAR

1. Course description :

The course studies geometric objects like curves and surfaces in the 3- dimensional space. Topics include plane and space curves, Serret-Frenet frame and curvature and torsion of curves, global properties of curves, first and second fundamental forms of surfaces, normal, principal and Gaussian curvatures of a surfaces, Gauss' Theorema Egregium and geodesics on surfaces.

2. Scope and Objective of the Course:

The objective of this course is to provide a systematic exposition of the essential concepts of modern differential geometry, and an understanding and appreciation for the intrinsic beauty of these concepts, as well as their deep relationships to computer and physical Sciences. The under current is to generalize and reinforce the classical subject in a modern way.

3. **Text Book:** Andrew Pressley : Elementary Differential Geometry, Springer-Verlag (2001)

4. Reference Books:

1. Barrett O'Neill – Elementary differential geometry, Revised 2nd edition, Elsevier (2006)
2. Gray A, Abbena E, Salamon S – Modern differential geometry of curves and surfaces with MATHEMATICA, 3rd Edition, CRC Press (2006)
2. Struik D. J. –Lectures on classical differential geometry, 2nd Edition, Dover Publications(1988) Reprint
3. Bär, Christian - Elementary Differential Geometry, 1st South Asian edition, Cambridge University Press (2011)





5. Course Plan:

Lec. No.	Learning Objectives	Topics to be Covered	Ref. to text Book: chap/Sec.
1-4	Different ways to represent curves and relations between them, examples	Parameterized curves, reparameterization, arc length, level curves vs parameterized curves	Chapter 1
5-8	To understand how fast the curve turns and twists, moving frame of coordinates	Curvature of regular plane and space curves, torsion of a space curve, Serret-Frenet equations	Chapter 2
9-11	Global properties of curves	Simple closed curves in plane, isoperimetric inequality, four vertex theorem	Chapter 3
12-16	To understand basic concepts regarding surface in 3 dimensional space, examples of surfaces	Concepts of a surface, smoothness, tangent space and normal vector, orientability, examples of surfaces, applications of inverse function theorem	Chapter 4
17-20	How to make measurements along surface?	First fundamental forms, isometries, surface area	Sections 5.1, 5.2, 5.4
21-25	How fast does a surface curve?	Second fundamental form, normal and principal curvatures, Weingarten matrix, geometric shape and classification of surface points by curvatures	Chapter 6
26-31	How one curvature (Gaussian curvature) determines the shape	Gaussian and mean curvatures, surfaces of constant Gaussian curvature and their classification and examples, Gauss map	Chapter 7
32-36	Gaussian curvature is preserved by isometries	Gauss's remarkable theorem, Coddazzi-Mainardi equations	Chapter 10
37-42	Shortest paths along surfaces	Definition and properties of geodesic, geodesic equations, behavior under isometry, geodesics on surface of revolutions, shortest paths	Chapter 8





6. Evaluation Scheme :

Component	Duration	Weightage(%)	Date & Time	Remarks
Test	90 min	35	19/3 2:00 -3:30 PM	Closed Book
Tutorial Quizzes		20	unannounced	Closed Book
Compre. Exam	3 hr	45	16/5 FN	Open/Closed Book

7. **Chamber consultation Hour:** To be announced in the class.

8. **Home Assignments:**

Problems will be assigned periodically. They must be worked out to understand the subject.

9. **Reading Assignments:**

Students are expected to consult the Reference books as advised in the class room.

10. **Notices :** Notices, if any, concerning this course will be displayed only on the Notice Board of Mathematics Group. Also refer to the nalanda web-site for the course.

11. **Make up:** Prior permission is needed for make-up, make-up will only be given if enough evidence is there for not being able to take regular test. No make-ups will be given for tutorial quizzes.

Instructor-in-charge

MATH F342

