



**SECOND SEMESTER 2021-2022**

Course Handout Part II

Date: 15-01-2022

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** : S. K. Vishwakarma

**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.

**Textbooks:**

1. D. Somasundaram, Differential Geometry A First Course, Narosa Publishing House, First Edition, 2012.

**Reference books**

1. Pressley, A – Elementary Differential Geometry, 2<sup>nd</sup> Edition (Corrected Print), Springer (2012)
2. Gray A, Abbena E, Salamon S – Modern differential geometry of curves and surfaces with MATHEMATICA, 3<sup>rd</sup> Edition, CRC Press (2006)
3. Oprea, J – Differential Geometry and Its Applications, Mathematical Association of America(2007)

**Course Plan:**

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-3	Examining the curves in space and surface along with tangent, normal, curvature, asymptotes.	Space curve, Parametrization, Arc Length, Tangent & Osculating Plane, Normal, Binormal	1.1-1.6
4-5		Curvature, Torsion, Behavior of curve at a point	1.7-1.9
6-8		Contact between curve and surfaces, Osculating circle and sphere, Spherical curvature, Involutives and Evolutes	1.10-1.13
9-10	Parameterization of curves and the properties of surfaces.	Representation of surface, Curves, Tangent plane and surface normal	2.1-2.6
11-12		General Surfaces of Revolution, Helicoid, First Fundamental Form	2.7-2.9
13-15		Direction Coefficients, Families of Curves, Orthogonal Trajectories, Isometric Correspondence	2.10-2.14
16-17	Canonical geodesic equations and its normal properties	Geodesics and their differential equation, Canonical geodesic equations	3.1-3.3

18-20		Geodesics and its normal properties, Existence Theorem	3.4-3.7
21-22		Geodesics Parallel. Geodesics Polar Coordinates and curvatures	3.8-3.10
23-25		Gauss-Bonnet Theorem, Gaussian Curvatures, Surface of constant curvature	3.11-3.13
26-28	Maximum and minimum curvatures along a given direction.	Second Fundamental Form, Classification of points, Principal curvatures	4.1-4.4
29-30		Lines of curvature, Dupin indicatrix, Developable surfaces	4.5-4.7
31-32		Developable with space curves, Minimal surfaces	4.8-4.10
33-34		Ruled Surfaces, Three Fundamental Form	4.11-4.12
35-36	Fundamental Equation of surface, Gauss equations	Tensor equation, Gauss Equations	5.1-5.3
37-38		Weingarten equations, Mainardi-Coddazzi equation	5.4-5.5
39-40		Parallel surfaces, Fundamental existence theorem	5.6-5.7

#### Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Quiz-1	TBA	10	TBA	Closed book
Mid-sem	TBA	30	14/03 9.00am to 10.30am	Closed book
Quiz-2	TBA	10	TBA	Closed book
Quiz-3	TBA	10	TBA	Closed book
Comprehensive Exam	TBA	40	21/05 FN	Open book (Part A, 20%) Closed book (Part B, 20%)

- Chamber consultation hour: To be announced in the class.
- Notices: The notices concerning this course will be displayed on the CMS Notice Board only.
- Make-up Policy: Make-up will be given only for very genuine cases and prior permission has to be obtained from the I/C.
- Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE

