

**Subject Code: 02MA0554**
**Subject Name: Differential Geometry**
**M.Sc. Year – II (Sem.: 4)**

**Objective:** To provide the learners with the concept and the understanding in space curves, Curvature, Torsion, Intrinsic and Non-Intrinsic properties of a surfaces.

**Credits Earned:** 5 Credits

**Course Outcomes:** After completion of this course, student will be able to

- Have a deep understanding of first and second fundamental forms of surface.
- Find the osculating surface and the osculating curve at any point of a given curve
- Understand the Gaussian curvature, the mean curvature, the curvature lines, the asymptotic lines, the geodesics of a surface.
- Calculate the curvature and torsion of a curve.
- Use efficiently the mathematical tool of tensor calculus in the study of surfaces.

**Pre-requisite of course:** Multivariable calculus

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	2	-	5	50	30	20	25	25	150

**Contents:**

Unit	Topics	Contact Hours
1	Planar curves, Space curves, Parameterization, Curvature and Torsion, Signed Curvature, Frenet-Serret equations, Fundamental theorem of curve theory, Isoperimetric inequality.	<b>14</b>
2	Surfaces, Smooth surfaces, Tangents, Normals, First fundamental form, Isometries of surfaces, Conformal mappings of surfaces, Surface area.	<b>15</b>
3	Second fundamental form, Gauss map, Normal and principal curvature, Geodesic curvature and normal curvature of a curve, Meumer's theorem, Euler's theorem, Gaussian and mean curvature.	<b>16</b>

4	Tangent vector field and covariant derivatives, Gauss equations, Christoffel symbols, Geodesics, Geodesic equations, Characterization of geodesics on surfaces like sphere, cylinder, plane and surface of revolution, Codazzi-Mainardi equations, Theorema Egregium, Local Gauss Bonnet theorem(statement only) and it's applications	<b>15</b>
		<b>60</b>

**Recommended Books:**

1. Elementary Differential Geometry (Second edition) by Andrew Pressley, Springer publication, 2010
2. Introduction to Differential Geometry by Abraham Goetz, Addison Wesley publication, 1970
3. Differential Geometry in three dimensions by Weatherburn C.E., Cambridge university press, 1964

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

**Instructional Method:**

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**Supplementary Resources:**

- <http://www.nptel.ac.in/course.php?disciplineId=111>
- <http://www.worldscientific.com/worldscibooks/10.1142/6598>