UNIVERSITY OF MADRAS

M.Sc. DEGREE PROGRAMME IN MATHEMATICS

SYLLABUS WITH EFFECT FROM 2023-2024

<table>
<tr><td>Title of the Course</td><td colspan="7">DIFFERENTIAL GEOMETRY</td></tr>
<tr><td>Paper Number</td><td colspan="7">CORE XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">528C4A</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td>1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Linear Algebra concepts and Calculus</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">This course introduces space curves and their intrinsic properties of a surface and geodesics. Further the non-intrinsic properties of surface and the differential geometry of surfaces are explored</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT – I Curves in the Plane and in Space: Curves – Parametrisation – Arc – length – level curves – Curvature – Plane and Space Curves .
Chapters 1 and 2.</td></tr>
<tr><td colspan="6">UNIT – II Surfaces in Space: Surface patches – Smooth surfaces – Tangents – Normals – Orientability – Examples of surfaces – Lengths of curves on surfaces – The first fundamental form – Isometries - Surface area.
Chapter 4 : 4.1 to 4.4, 4.7
Chapter 5 : 5.1 to 5.2, 5.4</td></tr>
<tr><td colspan="6">UNIT – III Curvature of Surfaces :
The second fundamental form – Curvature of curves on a surface – Normal – Principal – Gaussian and mean curvatures – Gauss map.
Chapter 6 : Sections 6.1 to 6.3
Chapter 7 : 7.1, 7.5, 7.6</td></tr>
<tr><td colspan="6">UNIT – IV Geodesics : Geodesics – Geodesic equations – Geodesic as shortest paths – Geodesic coordinates.
Chapter 8 : 8.1 to 8.2, 8.4 to 8.5</td></tr>
<tr><td colspan="6">UNIT – V Theorema Egregium of Gauss : Theorema Egregium - Isometries of surfaces – Codazzi - Mainardi equations - Compact surfaces of constant Gaussian curvature.
Chapter 10.</td></tr>
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Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Andrew Pressley,*Elementary Differential Geometry*,Springer, 2000.
RefereEce Books	1. Struik, D.T. *Lectures on Classical Differential Geometry*, Addison – Wesley, Mass. 1950. 2. Kobayashi. S. and Nomizu. K. *Foundations of Differential Geometry*, Interscience Publishers, 1963. 3. Wilhelm Klingenberg: *A course in Differential Geometry*, Graduate Texts in Mathematics, Springer-Verlag 1978. 4. J.A. Thorpe *Elementary topics in Differential Geometry*,Under-graduate Texts in Mathematics, Springer - Verlag 1979.
Website and e-Learning Source	http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org, www.physicsforum.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Explain space curves, Curves between surfaces, metrics on a surface, fundamental form of a surface and Geodesics.

CLO2:Evaluate these concepts with related examples.

CLO3: Compose problems on geodesics.

CLO4: Recognize applicability of developable.

CLO5:Construct and analyze the problems on curvature and minimal surfaces

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1