20BSM408T					DIFFERENTIAL GEOMETRY					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs. / Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To understand the concept of curvature of a space curve and signed curvature of a plane curve.
- To be able to understand the fundamental theorem for plane curves.
- To get introduced to the notion of Serret-Frenet frame for space curves and the involutes and evolutes of space curves with the help of examples.
- To be able to compute the curvature and torsion of space curves.

UNIT 1 THEORY OF SPACE CURVES **10 Hrs.**

Space curves, Parametrized Curves and Arc Length, Planer curves, Curvature, torsion and Serret-Frenet formulae. Osculating plane, normal plane, rectifying plane and osculating circles and spheres. Fundamental Theorem of the Local Theory of Curves. Evolutes and involutes of curves, Helix and Bertrand curves

UNIT 2 THEORY OF SURFACES **10 Hrs.**

Regular Surfaces and Inverse Image of Regular Values, Parametric curves on surfaces, Change of Parameters and Differential Functions on Surfaces, The Tangent Plane, Differential of a map, first Fundamental form, angle between two curves on a surface, area under parametric curves, second Fundamental form, Developable surfaces, Minimal surfaces

UNIT 3 TENSORS **10 Hrs.**

Summation convention and indicial notation, Coordinate transformation and Jacobian, Contra-variant and Covariant vectors, Tensors of different type, Algebra of tensors and contraction tensors, Summation convention and indicial notation, Coordinate transformation and Jacobian, Contra-variant and Covariant vectors, Algebra of tensors and contraction

UNIT 4 METRIC TENSOR **10 Hrs.**

Metric tensor and 3-index Christoffel symbols, Parallel propagation of vectors, Covariant and intrinsic derivatives, Curvature tensor and its properties, Curl, Divergence and Laplacian operators in tensor form, Physical components.

40 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Identify different types of surface curve.
CO2 – Understand problems related to theory of surface.
CO3 – Apply knowledge of surfaces in real world problem.
CO4 – Analyze the graph colorings in real life domain.
CO5 – Comparison between Tensors and Metric Tensor.
CO6 – Design the computational aspects of mathematical problems.

TEXT / REFERENCE BOOKS

1. M. Spivak, Calculus on Manifolds: A Modern Approach to Classical Theorems of Advanced Calculus, CRC press, 2018.
2. A.N. Pressley, Elementary Differential Geometry, Springer Science & Business Media, 2010.
3. B. O'Neill, Elementary Differential Geometry, 2nd Ed., Academic Press, 2006.
4. S. Lang, Fundamentals of Differential Geometry, Springer, 1999.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A: 6 questions of 4 marks each	24 Marks
Part B: 6 questions of 8 marks each	48 Marks
Part C: 2 questions of 14 marks each	28 Marks