19BSM802 - Differential Geometry										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		TotalMarks
					MS	ES	IA	LW	LE/Viva	
3	1	--	4	4	25	50	25	--	--	100

OBJECTIVES

1. To Understand the concept of curvature of a space curve and signed curvature of a plane curve.
2. To be able to understand the fundamental theorem for plane curves.
3. 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.
4. To be able to compute the curvature and torsion of space curves.
7. To be able to understand the fundamental theorem for space curves.
8. To get introduced to the concept of a parameterized surface with the help of examples.
9. To Understand the idea of orientable/non-orientable surfaces

UNIT I	**9**
Theory of Space Curves: 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 II	**10**
Theory of Surfaces: 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 III	**10**
Tensors: 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, Tensors of different type, Algebra of tensors and contraction	
UNIT IV	**10**
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.	
Unit-V	**13**

Useful NPTEL Lectures Link:
(1) https://nptel.ac.in/downloads/111104095/

OUTCOMES

1. The student will be able to compute quantities of geometric interest such as curvature, as well as develop a facility to compute in various specialized systems, such as semi geodesic coordinates or ones

representing asymptotic lines or principal curvatures. 2. The student will also be introduced to the method of the moving frame and over determined systems of differential equations as they arise in surface theory.	
APPROXIMATE TOTAL	**52 Hours**

TEXTS AND REFERENCES

1. T.J. Willmore, An Introduction to Differential Geometry, Dover Publications, 2012.
2. B. O'Neill, Elementary Differential Geometry, 2nd Ed., Academic Press, 2006.
3. C.E. Weatherburn, Differential Geometry of Three Dimensions, Cambridge University Press 2003.
4. D.J. Struik, Lectures on Classical Differential Geometry, Dover Publications, 1988.
5. S. Lang, Fundamentals of Differential Geometry, Springer, 1999.
6. E.Kreyszig, Differential Geometry, Dover Publications, New York, 1991.
7. B. Spain, Tensor Calculus: A Concise Course, Dover Publications, 2003