SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN (AUTONOMOUS)
(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC) Chromepet, Chennai — 600 044.
M.Sc. END SEMESTER EXAMINATION APRIL/NOV - 2021
SEMESTER - IV
17PAMCT4A11 - Differential Geometry and Tensor Calculus

Total Duration :	**3 Hrs**	**Total Marks**	**: 75**
MCQ	: 30 Mins	MCQ	: 15
Descriptive	: 2 Hrs.30 Mins	Descriptive	: 60

Section B

Answer any **SIX** questions $(6 \times 5 = 30$ Marks)

1. Prove that the only compact surfaces whose Gaussian curvature is positive and mean curvature constant are spheres
2. Derive the formula for torsion of a curve in terms of the parameter u.
3. Prove that the necessary and sufficient condition that a space curve may be helix is that the ratio of its curvature to torsion is always a constant.
4. If there is a surface of minimum area passing through a closed space curve, prove that it is necessarily a minimal surface.
5. Show that the necessary and sufficient condition for a curve to be a straight line is that $K = 0$ for all points.
6. Define geodesic. State the necessary and sufficient condition that the curve $u = c$ be a geodesic
7. Show that every tensor can be expressed as the sum of two tensors, one of which is symmetric and the other skew symmetric.
8. If a_{ij} is a skew symmetric tensor and A^i is a contravariant vector, prove that $a_{ij}A^iA^j = 0$.

Section C

Part A

Answer any **TWO** questions $(2 \times 10 = 20$ Marks)

9. Find the intrinsic equation of the curve $x = ae^u \cos u$, $y = ae^u \sin u$,$z = be^u$.
10. State and prove fundamental existence theorem for space curves.
11. Prove that the Jacobian of the product transformation is equal to the product of the Jacobians of transformations entering the product.
12. Find a surface of revolution which is isometric with a region of the right helicoid.

Part B

Compulsory question $(1 \times 10 = 10$ Marks)

13. Prove that a necessary and sufficient condition for a surface to be a developable is that its Gaussian curvature is zero.