

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.Applicable Mathematics - END SEMESTER EXAMINATIONS - APRIL 2025  
SEMESTER - IV

**20PAMCT4011 - Differential Geometry and Tensor Calculus**

Total Duration : 2 Hrs. 30 Mins.

Total Marks : 60

**Section B**

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

1. State and prove fundamental theorem for space curves.
2. Predict the length of the curve given as the intersection of the surfaces  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ ,  $x = a \cos h(z/a)$  from the point  $(a, 0, 0)$  to the point  $(x, y, z)$ .
3. Define Surface of revolution and Helicoids.
4. State and prove Gauss Bonnet theorem.
5. Show that the sum of two tensors which have the same number of covariant and the same number of contravariant indices is again a tensor of the same type and rank as the given tensors.
6. Prove that the set of all admissible transformations of coordinates forms a group.
7. Write the formulas for covariant differentiation and explain their significance.
8. What is the relationship between the Christoffel symbol and the metric tensor?

**Section C**

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

9. Obtain the curvature and torsion of the curve of intersection of the two quadratic surfaces:  $ax^2 + by^2 + cz^2 = 1$ ,  $a'x^2 + b'y^2 + c'z^2 = 1$ .
10. Determine the direction coefficients of a vector that makes an angle  $\pi/2$  with a given direction whose coefficients are  $(l, m)$ .
11. State and prove Ricci's theorem.
12. If a transformation of co-ordinates  $T$  possesses an inverse  $T^{-1}$  and if  $J$  and  $K$  are the Jacobians of  $T$  and  $T^{-1}$  respectively. Then prove that  $JK = 1$

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

13. Define geodesics and prove that on the general surface, a necessary and sufficient condition for the curve  $v = c$  to be a geodesic is:  $EE_2 + FE_1 - 2EF_1 = 0$  when  $v = c$ , for all values of  $u$ .

\*\*\*\*\*