M.Sc DEGREE EXAMINATION,APRIL 2019
II Year IV Semester
Differential Geometry and Tensor Calculus

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. State Serret- Frenet formula
2. Define involute and evolute of a space curve.
3. Define a helicoid? what is the pitch of the helicoid?
4. Define anchor ring.
5. Define geodesic parallels.
6. Define Gaussian curvature.
7. Define covariant tensor of rank one.
8. Define symmetric and skew symmetric tensors
9. Define a metric tensor.
10. Define Christoffel 3- index symbols of the first kind
11. Define osculating plane.
12. Define geodesic for a curve.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. Calculate the curvature and torsion of the cubic curve $\bar{r} = (u, u^2, u^3)$
14. Show that the metric is invariant under a parameter transformation.
15. A particle is constrained to move on a smooth surface under no force except the normal reaction. Prove that its path is geodesic.
16. Prove that any linear combination of tensors of the same type and rank is again a tensor of the same type and rank
17. Prove that $\dfrac{\partial}{\partial x^i} \log \sqrt{g} = \left\{ \begin{matrix} \alpha \\ i\alpha \end{matrix} \right\}$
18. Prove that the characteristic property of helices is that the ratio of the curvature to the torsion is constant at all points.
19. Define the osculating sphere at a point on the curve and derive the formula for its centre and radius.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. Obtain the curvature and torsion of the curve of intersection of the two quadric surfaces $ax^2 + by^2 + cz^2 = 1$, $a'x^2 + b'y^2 + c'z^2 = 1$
21. Find the surface of revolution which is isometric with a region of right helicoids.
22. State and prove Gauss – Bonnet theorem
23. Prove that the law G of transformation of mixed tensors is transitive.
24. Derive Riemann- Christoffel tensors of first and second kind.

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