M.Sc. DEGREE EXAMINATION,APRIL 2020
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. Define an arc length.
2. Define an involute.
3. Define metric.
4. Calculate the fundamental coefficient's E,F,G and H for the paraboloid $\vec{r} = (u, v, u^2, -v^2)$
5. Define Geodesic .
6. Define a helix.
7. Define a symmetric tensor.
8. Define tensor.
9. State the transformation for a covariant tensor of rank two.
10. Define the christoffel 3 index symbolof the first kind.
11. Define an osculating plane .
12. Define an osculating circle

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

Answer any **FIVE** questions

13. Calculate the curvature and torsion of the cubic curve given by $\vec{r} = (u, u^2, u^3)$.
14. On the paraboloid $x^2 - y^2 = z$.Find the orthogonal trajectories of the section by the planes z = constant.
15. Show that the curves u+v = constant are geodesic on a surface with $metric(1 + u^2)du^2 - 2uvdudv + (1 + v^2)dv^2$
16. Prove that the sum of two tensor which have the same no of covariant or contra variant indices is again a tensor of the same type and rank as the given tensor.
17. Show that if $g_{ij} = 0$ for all i=j Then {i,ij}=1
18. Find the involute of the circular helix $\vec{r} = (acosu, asinu, bu)$

19. compute the first fundamental magnitude for the surface
$\vec{r} = (ucosv, usinv, f(u))$

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

Answer any **THREE** questions

20. State and prove Fundamental existence theorem for space curves.
21. Prove that if O is the angle at the point (u,v) between the two directions given by $Pdu^2 + 2Qdudv + Rdv^2 = 0$then $tan\theta = \frac{2H\sqrt{Q^2-PR}}{ER-2F\theta+GP}$.
22. State and prove Gauss Bonnett Theorem.
23. Prove that $\frac{\partial}{\partial x^i} log\sqrt{g} = \left\{ \begin{array}{c} \alpha \\ i\alpha \end{array} \right\}$.
24. State and prove Ricci's theorem.

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