C176

Total Pages : 3 Roll No. .....

MAMT-04

Differential Geometry and Tensors

M.Sc./M.A. Mathematics (MSCMT/MAMT-19)

Ist Year Examination, 2022 (June)

Time : 2 Hours] **Max. Marks : 80**

Note : This paper is of Eighty (80) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A

(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Twenty (20) marks each. Learners are required to answer any Two (02) questions only.

(2×20=40)

1. Show that when the curve is analytic, there exists a definite osculating plane at a point of inflection, provided the curve is not a straight line.

2. Find the Evoluate of the circular halix

$x = a \cos \theta$, $y = a \sin \theta$, $z = a\theta \tan \alpha$.

3. Show there are two principal directions at every point on a surface which are mutually orthogonal.

4. Show that the metric of a Euclidean space, referred to spherical coordinates is given by $ds^2 = (dr)^2 + (r\, d\theta)^2 + (r \sin\theta\, d\varnothing)^2$. Determine its metric tensor and Conjugate metric tensor.

5. Show that the Christoffel symbols are not tensor quantities.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Ten (10) marks each. Learners are required to answer any Four (04) questions only. (4×10=40)

1. Find the equation of the Osculating plane of the curve given by $\bar{r} = (a \sin t + b \cos t, a \cos t + b \sin t, c \sin 2t)$.

2. The necessary and sufficient condition for the curve to be straight line is that $\kappa = 0$ at all points of the curve.

3. The torsion of the two Bertrand curve have the same sign and their product is constant.

4. Prove that $xyz = 2$ is a developable surface.

5. Show that $e^z \cos x = \cos y$ is a minimal surface.

6. The necessary and sufficient condition that the parametric curves through a point to have conjugate directions is $M = 0$.

7. Show that $g^{ij}\, g^{kl}\, dg_{ik} = -dg^{jl}$.

8. An Einstein space $V_N (N > 2)$ has constant curvature.
