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Total Pages : 3 Roll No. ....

MT-504

Differential Geometry and Tensor-I

MA/MSC Mathematics (MAMT/MSCMT)

1st Semester Examination, 2022 (Dec.)

Time : 2 Hours] **[Max. Marks : 35**

Note : This paper is of Thirty Five (35) 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 Nine and Half (9½) marks each. Learners are required to answer any Two (02) questions only. (2×9½=19)

1. Show that the tangent at any point of the curve whose equations are $x = 3u$, $y = 3u^2$, $z = 2u^3$, makes a constant angle with the line $y = z - x = o$

2. State and prove Serret-Frenet formulae.

3. Find the plane that has three point contact at the origin with the curve $x = u^4 - 1$, $y = u^3 - 1$, $z = u^2 - 1$.

4. Find the radii of curvature and torsion of the helix $x = a \cos u$, $y = a \sin u$, $z = au \tan \alpha$.

5. State & Prove Meunier's theorem.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Four (04) marks each. Learners are required to answer any Four (04) questions only. (4×4=16)

1. Find the length of one complete turn of the circular helix $\vec{r} = a \cos u i + a \sin u j + cuk$; $-\infty < u < \infty$.

2. Define osculating plane, normal plane & rectifying plane of a space curve.

3. Prove that the necessary & sufficient condition for the curve to be a plane curve is $[r^I, r^{II}, r^{III}] = 0$

4. Prove that for all helices, curvature bears a constant ratio with torsion.

5. Define involute & evolutes.

6. What are the first & second fundamental forms?

7. Discuss orthogonal trajectories with suitable examples.

8. Find the equation of edge of regression of the envelope.