A–0695

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MAT-611

Mathematics (MSCMAT/MAMT)

(Geometry)

Examination, June 2025

Time : 2:00 Hrs. Max. Marks : 70

Note* :–** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

(Long Answer Type Questions) 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. Show that the intrinsic equations of the curve given by $x = ae^u \cos u$, $y = ae^u \sin u$, $z = be^u$ are :

$$k = \frac{a\sqrt{2}}{s\sqrt{\{2a^2 + b^2)}}, \quad \tau = \frac{a\sqrt{2}}{s\sqrt{\{2a^2 + b^2)}}$$

2. Find the equation of the osculating sphere and osculating circle at (1, 2, 3) on the curve :

$$x = 2t + 1, \; y = 3t^2 + 2, \; z = 4t^3 + 3$$

3. Find the equation of the curves bisecting the angles between the parametric curves.

4. (i) Define Normal Curvature, find its equation.

   (ii) Define Principal Curvature, find its equation.

5. Find $\text{div}A^i$, $\text{div}A_i$ and $\nabla^2\phi$ in cylindrical co-ordinates where A^i and A_i are vectors and ϕ is a scalar.

Section–B

(Short Answer Type Questions) 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Find the equation of oscillating plane at the point 't' on helix $r = (a \cos t, a \sin t, ct)$.

2. For the curve $x = a(3t - t^3)$, $y = 3at^2$, $z = a(3t + t^3)$, show that :

$$k = \tau = \frac{1}{3a(1+t^2)^2}$$

3. Show that the radius R of the sphere of curvature is given by $R^2 = \rho^4\sigma^2 r'''^2 - \sigma^2$.

4. (i) Define Bertrand curves.

   (ii) Define Spherical Indicatrices.

5. The metric of first fundamental form is a positive definite quadratic form in du, dv.

6. Define Monge's Form of the Surface, find its equation.

7. States and Drive Rodrigue's formula.

8. Prove that :

$$\left\{ \begin{matrix} i \\ ij \end{matrix} \right\} = \frac{\partial(\log\sqrt{g})}{\partial x^j}$$

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