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MT–504

M.A./M.Sc. MATHEMATICS (MAMT/ MSCMT)

(Differential Geometry and Tensor–I)

1st Semester Examination, 2024 (June)

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. State and prove Beltrami-Enneper theorem.

2. Find the necessary and sufficient condition that a surface $\xi = F(\xi, \eta)$ should represent a developable surface.

3. Define edge of regression. Find the equation of edge of regression of the envelope.

4. Define osculating circle. Find the centre and radius of circle of curvature.

5. Find the equation of osculating plane at a point of a space curve given by the intersection of two surfaces.

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 asymptotic lines on the surface $z = y \sin x$.

2. Define the following :

   (i) Principal sections of the surface

   (ii) Principal direction

3. Find the expression for curvature of the normal section.

4. Prove that for the curve :

   $x = r \cos \theta, y = r \sin \theta, z = 0, ds^2 = dr^2 + r^2 d\theta^2$

5. Find the developable surface which passes through the curves :

$$y^2 = 4ax,\ z = 0 \text{ and } y^2 = 4bz,\ x = 0$$

6. Prove that the tangents at the corresponding points of the associate Bertrand curves are inclined at a constant angle.

7. Find the inflexional tangent at (x_1, y_1, z_1) on the surface $y^2z = 4ax$.

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

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