

Stella Maris College (Autonomous), Chennai - 600 086
(For candidates admitted during 2019 academic year and thereafter)
M.Sc. Degree Examination, April 2021
Differential Geometry

Code: 19MT/PC/DG44
Class: II M.Sc.

Time: 90 mins.
Max. marks: 50

SECTION – A
ANSWER ALL QUESTIONS ($2 \times 2 = 4$)

1. Find the Cartesian equation of the parametrized curve $\vec{\gamma}(t) = (e^t, t^2)$.
2. State the Frenet-Serret equations.

SECTION – B
ANSWER ANY TWO QUESTIONS ($2 \times 6 = 12$)

3. Compute the curvature and torsion for the curve $\gamma(t) = \left(\frac{4}{5} \cos t, 1 - \sin t, -\frac{3}{5} \cos t \right)$.
4. State and prove Euler's theorem.
5. Prove that the unit sphere in \mathbb{R}^3 is a surface.

SECTION – C
ANSWER ANY TWO QUESTIONS ($2 \times 17 = 34$)

6. a) Let $\bar{\gamma}$ be a unit – speed curve in \mathbb{R}^3 with constant curvature and zero torsion. Then prove that $\bar{\gamma}$ is part of a circle.
b) Compute the first and second fundamental form of the elliptic paraboloid $\sigma(u, v) = (u - v, u + v, u^2 + v^2)$.
7. State and prove the fundamental theorem on uniqueness and existence of space curves.
8. State and prove Gauss's remarkable theorem.
