"*Do not write anything on question-paper except Roll Number, otherwise it shall be deemed as an act of indulging in unfair means and action shall be taken as per rules.*"

Roll No. 22MAT20010

M.Sc. (Sem. - III)

2067 **Diff.Geom.**

M.Sc. Mathematics (IIIrd Semester)

EXAMINATION-2023

Maths - 302

DIFFERENTIAL GEOMETRY

Time Allowed : **Three** Hours

Maximum Marks : 70

Part-A

1. Ten short answer type questions (Definitions, illustrations, functions, short explanations, etc; up to 25 words) for two marks each. $10\times2=20$ marks; two questions from each Unit, no choice in this Part.

Part-B

2. Five short answer (up to 250 words) type questions for

four marks each. $5 \times 4 = 20$ marks; one question from each Unit with internal choice.

Part-C

3. Five questions of long/explanatory answer (up to 500 words) type, one drawn from each Unit; student need to answer any three; ten marks each; $3 \times 10 = 30$ marks.

Part-A

1. Write the equation of fundamental plane in 3-D space.
2. What do you mean by unit tangent vector?
3. What is osculating sphere?
4. What do you mean by torsion?
5. Define involute of space curve.
6. What are developable surfaces.
7. Write fundamental forms of the surfaces.
8. Write differential equation of line of curvature.
9. Define curvature of asymptotic lines.
10. Define torsion of asymptotic lines.

Part-B

Unit-I

1. (a) Find equation of normal at any point of a circular helix.

Or

(b) Find equation of osculating plane for a curve in space.

Unit-II

2. (a) Find radius of curvature for the curve

$x = t^4 - 1, y = t^3 - 1, z = t^2 - 1.$

Or

(b) Discuss the properties of Bertrand curve.

Unit-III

3. (a) Find envelope at the surface of ellipsoid of constant volume.

Or

(b) Discuss the properties of skew surfaces.

Unit-IV

4. (a) Find asymptotic lines on the surface of a cone $x^2 + y^2 = z$

Or

(b) Find lines of curvature of the surface :

$x = 4t^3 + 3 \quad y = 3t^2 + 2 \quad z = 2t + 1.$

Unit-V

5. (a) Find asymptotic lines of the curve $x^2z + y^2z = 2xy$.

Or

(b) Find curvature of asympototic lines on the surface $z = f(x, y)$ in terms of partial derivatives.

Part-C

1. Find out tangent vector and normal plane at any point of the curve $x = \cos\theta,\ y = a\sin\theta,\ z = c\theta$.

2. Discuss the application of Serrel-Frenet Formulae.

3. Find envolute and evolute of the surface of parabola $y^2 = 4ax, z = a$.

4. Find the curve surface which passes through the lines of curvature of the surface of cone $y^2 + z^2 = x^2$.

5. State and prove Beltrami Enneper Theorem.

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