(b) Show that in terms of E, F, G, L, M, N the Weingarten equation are : **10**

$H^2N_1 = (FM - GL)r_1 + (FL - EM)r_2$

$H^2N_2 = (FN - GM)r_1 + (FM - EN)r_2$

6. (a) Define principal curvature and show that equation for principal curvature through a point of surface $z = f(x, y)$ is

$H^2K_n^2 + H[(1+p^2)t + (1+q^2)r - 2spq]K_n + (rt - s^2) = 0.$ **10**

(b) Derive the formula for normal curvature in terms of fundamental magnitudes. **10**

Unit IV

7. (a) Show that a necessary and sufficient condition for a curve v = constant to be geodesic on the surface is : **10**

$$EE_2 + FE_1 + 2EF_1 = 0$$

(b) Show that the curve $u + v$ = constant. are geodesics on a surface with metric $(1 + u^2)du^2 - 2uv\ dudv + (1 + v^2)dv^2$. **10**

DD-313

M. Sc. EXAMINATION, May 2017

(Fourth Semester)

(Main & Re-appear)

MAT-606-B

MATHEMATICS

Differential Geometry

Time : 3 *Hours*] [*Maximum Marks :* 100

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : The question paper consists of four Units. Each Unit contains two questions and students have to attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Find the equation of tangent line at a given point P(r) on the curve C and show that the tangent at any point of the curve whose equations referred to rectangular axis are $x = 3t$, $y = 3t^2$, $z = 2t^3$ makes a constant angle with the line. **10**

(b) State and prove Serret-Frenet Formulas. **10**

2. (a) Prove that in order that the principal normals of a curve be binormal of another, the relation $a(k^2 + \tau^2) = bk$ must hold, where a and b are constant. **10**

(b) Find the radius and center of sphere of curvature. **10**

Unit II

3. (a) Define surface and parametric curves and also find the equation of tangent plane and normal plane to the surface $xyz = 4$ at the points (1, 2, 2). **20**

(b) Show that the sum of the squares of the intercepts on the co-ordinate axes made by tangent plane to the surface : **10**

$x^{2/3} + y^{2/3} + z^{2/3} = a^{2/3}$ is constant.

4. (a) Explain the following terms : **10**

(i) Characteristics of surface $F(x, y, z, a) = 0$ for parameter a.

(ii) Envelope of family of surface $F(x, y, z, a) = 0$

(iii) Edge of regression.

(b) Find the envelope of family of planes $3a^2x - 3ay + z = a^3$ and show that its edge of regression is the curve of intersection of the surface $y^2 = zx$, $xy = z$. **10**

Unit III

5. (a) Define first fundamental form and calculate first and second fundamental magnitude for the general surface of revolution. **10**

8. (a) Prove that at every point of a geodesic the principal normal is normal to the surface. **10**

(b) Prove that if a geodesic is either a plane curve or a line of curvature or it is both. **10**

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