 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**M.Sc.** DEGREE EXAMINATION - **MATHEMATICS**

FIRST SEMESTER – **APRIL 2012**

# MT 1813 - DIFFERENTIAL GEOMETRY

Date : 03-05-2012 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

**Answer all the questions:**

**All questions carry equal marks:**

I a) Obtain the equation of the tangent at any point on the circular helix.

(or)

b) Derive the equation of osculating plane at a point on the circular helix. [5]

c) Derive the formula for torsion of a curve in terms of the parameter u and hence

calculate the torsion and curvature of the curve.

(or)

d) Derive the Serret-Frenet formulae and deduce them in terms of Darboux vector.[15]

II a) Find the plane that has three point of contact at origin with the curve



(or)

b) Prove that the necessary and sufficient condition that a space curve may be helix is

that the ratio of its curvature to torsion is always a constant. [5]

c) Define evolute and involute. Also find their equations.

(or)

d) State and prove the fundamental theorem of space curves. [15]

III a) Derive the equation satisfying the principal curvature at a point on the space curve.

(or)

b) Prove that the first fundamental form is positive definite. [5]

c) Prove the necessary and sufficient condition for a surface to be developable.

(or)

d) Derive any two developables associated with a space curve. [15]

IV a) State the duality between space curve and developable.

(or)

b) Derive the geometrical interpretation of second fundamental form. [5]

c) Find the first and second fundamental form of the curve

.

(or)

d) (1) How can you find whether the given equation represents a curve or a surface?

(2) State and prove Euler’s Theorem.

(3) Define oblique, normal, principal sections of a surface. [3+6+6]

V a) Derive Weingarton equation.

(or)

b) Show that sphere is the only surface in which all points are umbilics. [5]

c) Derive Gauss equation.

(or)

(d) State the fundamental theorem of Surface Theory and demonstrate it in the case

of unit sphere . [15]