



EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

SECOND EXAMINATION IN SCIENCE - 2013/2014

SECOND SEMESTER (Sep./Oct., 2016)

PM 205 - DIFFERENTIAL GEOMETRY

(Proper & Repeat)

all questions

Time : One hour

-) Find the directions of the tangent, normal and binormal vectors and also find the osculating, normal and the rectifying planes at any point of the circular helix given by

$$\underline{r} = (a \cos u, a \sin u, bu).$$

-) If \underline{r}_1 is the position vector of a point P_1 on the involute \tilde{C} of a curve C , then show that

$$\underline{r}_1 = \underline{r} + (\lambda - s)\underline{t}$$

where \underline{r} is the position vector of P on C , \underline{t} is the unit tangent at P on C , λ is an arbitrary constant and s is the arc-length parameter.

Find the involute of the cubic curve

$$\underline{r} = (3u, 3u^2, 2u^3).$$

- a) Define the *curvature* and *torsion* at any point of a space curve.
b) State and prove the *Serret-Frenet* formulas at a point P on a space curve γ .
c) Using the *Serret-Frenet* formulas, find the curvature and torsion at an arbitrary point on the circular helix given by

$$\underline{r} = (a \cos \theta, a \sin \theta, a\theta \cot \alpha)$$

where a and α are constants and θ is a parameter.