EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

EXTERNAL DEGREE EXAMINATION IN SCIENCE 2010/2011

SECOND YEAR SECOND SEMESTER (Apr./May, 2017)

EXTMT 205 - DIFFERENTIAL GEOMETRY

(Special Repeat)

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swer all questions **Time : One hour**

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1. (a) State Serret-Frenet formula.

   Let Γ be a curve with constant torsion τ and a point Q, a constant distance c from the point P on Γ, on the binormal to the curve Γ at P. Show that the angle between the binormal to the locus of Q and the binormal to the given curve Γ is

   $$\tan^{-1}\left(\frac{c\tau^2}{\kappa\sqrt{1+c^2\tau^2}}\right)$$

   where κ is the curvature of the curve Γ at P.

   (b) Define "normal plane" of a space curve.

   Find the equation for the normal to the curve $\underline{r} = (1+t)\underline{e}_1 - t^2\underline{e}_2 + (1+t^3)\underline{e}_3$ at the point $t = 1$.

2. What is meant by saying that a curve is a helix?

   (a) Prove that, a space curve to be a helix if and only if $\frac{\tau}{\kappa}$ is constant, where τ and κ are torsion and curvature of the given space curve, respectively.

   (b) Show that the curve given by $x = a\cos\theta$, $y = a\sin\theta$ and $z = a\theta\cot\beta$ is a helix, where a and β are constants.