EASTERN UNIVERSITY, SRI LANKA

EXTERNAL DEGREE EXAMINATION IN SCIENCE

SECOND YEAR FIRST SEMESTER - 2002/2003

(Oct./Dec.' 2006)

EXTMT 215 - CLASSICAL MECHANICS II

Answer all questions **Time : One hour**

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1. A flexible string is in equilibrium under the action of the external force $\underline{F}$ per unit length. With the usual notation, show that

$$\frac{d\underline{T}}{ds} + \underline{F} = 0.$$

Show also that it is equivalent to

$$\frac{dT}{ds} + F_t = 0, \quad \frac{T}{\rho} + F_n = 0, \quad F_n = 0.$$

A rough rigid wire is in the form of catenary with parameter c. It is fixed in a vertical plane, with its directrix is horizontal and its vertex upwards. A uniform heavy chain of length c is in limiting equilibrium, with one end at the vertex of the wire. Prove that the coefficient of friction between the wire and chain is $\left(\frac{\ln 4}{\pi}\right)$.

2. If S and M are shearing force and bending moment respectively at a point of uniformly loaded beam, then prove that

$$\frac{dS}{dx} = \omega, \qquad \frac{dM}{dx} = -S,$$

where ω is the weight per unit length of the beam.

State the Bernoulli-Euler law of flexure.

A uniform elastic beam AB of length $3a$ and weight W is clamped horizontally at its ends, which are at the same horizontal level. Two concentrated loads, W and $2W$ are placed at the point of trisection of the beam with smaller load near to A. Show that the reaction at A and B are $\frac{95W}{54}$ and $\frac{121W}{54}$ respectively. Find also the bending moment at each points.