

EASTERN UNIVERSITY, SRI LANKA
SECOND EXAMINATION IN SCIENCE 2001/2002
(April/May'2002)
FIRST SEMESTER
MT 215 - CLASSICAL MECHANICS II

Answer all questions

Time : One hour

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

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

Show also that this is equivalent to

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

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

$$\frac{dS}{dx} = \omega, \quad \text{and} \quad \frac{dM}{dx} = -S,$$

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

A uniform elastic beam AB of length $4l$ and weight W having flexural rigidity EI is clamped horizontally at A and is freely supported on a knife edge at the same horizontal level as A at a point C , where $BC = l$. The beam carries a load $\frac{15W}{16}$ concentrated at B . Prove that the reaction at C is $2W$ and that the magnitude of the bending moment at A is $\frac{Wl}{4}$. Find the depth of B below A .