EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE (2003/2004)

Nov./Dec.'2004

FIRST SEMESTER

Proper & Repeat

MT 215 - CLASSICAL MECHANICS II

Answer all questions

Time : one hour

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

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

Show also that it is equivalent to

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

The heavy string which occupies quarter portion of the upper part of a perpendicular rough circle, is on point of slipping, when the radius which passes through the lower end of the string, makes an angle α with the upper ward vertical. Prove that

$$\tan(\alpha - 2\lambda) = e^{\frac{-1}{2}\mu\pi} \qquad \text{where } \mu = \tan \lambda.$$

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

$$\frac{dS}{dx} = \omega, \quad \text{and} \quad \frac{d^2 M}{dx^2} = -\omega,$$

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

State the Bernoulli-Euler law of flexture.

A slightly flexible rod of length $2a$ has one of the ends clamped horizontally. A support is placed under the middle point of the rod so that the free end is $\frac{11Wa^3}{240B}$ where B is the flexural rigidity of the rod and W is the weight of the rod. Show also that the pressure on the support is $\frac{6W}{5}$.