EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE 2002/2003

(June./July.'2003)

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

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

Show also that this is equivalent to

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

A heavy uniform string rests on the upper surface of a rough vertical circle of radius a, and partly hangs vertically. Prove that, if one end of the string is at the highest point of the circle, then the greatest length that can hang freely is

$$\frac{2\mu a + a(\mu^2 - 1)e^{\mu\pi/2}}{\mu^2 + 1},$$

where μ is the coefficient of friction between the circle and string.

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2. With the usual notations, prove the Claypeyron's equation

$$M_1 a + 2M_2(a + b) + M_3 b = -\frac{\omega}{4}\left(a^3 + b^3\right) + 6EI\left(\frac{y_a}{a} + \frac{y_b}{b}\right)$$

for the moment of a slightly elastic beam.

A uniform slightly elastic beam AD of length $4a$ and weight W rests on four supports which are in the same horizontal level. The supports are placed at the end points of the beam and at the points B and C such that $AB = 2a$, $BC = a$ and $CD = a$. Show that the magnitude of the bending moments at B and C are $\frac{17Wa}{184}$ and $\frac{3Wa}{368}$ respectively. Find the ratio of the reactions at the four supports.

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