EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2004/2005

FIRST SEMESTER (Jan./ Feb., 2006)

MT 215 - CLASSICAL MECHANICS II

Answer all questions **Time : One hour**

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1. with the usual notations, obtain the following equations for a common catenary

   (a) $s = c\tan\psi$;

   (b) $y = c\sec\psi$;

   (c) $T = \omega y$.

   A uniform chain ABC of length ℓ and weight $\omega\ell$, hangs in equilibrium in a vertical plane, with the portion AB of the chain in contact with the line of greatest slope of a rough plane inclined at an angle α to the horizontal. The end A of the chain is above B, and the portion BC is kept hanging in a catenary below B by the action of horizontal force P acting at C. If the angle of friction between the chain and plane is $\lambda\,(\lambda > \alpha)$, and the equilibrium is limiting. Prove that the length of AB is

   $$\ell\cos\lambda\sec\alpha\sec(\lambda-\alpha)$$

   and the magnitude of P is

   $$\omega\ell\tan(\lambda-\alpha).$$

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

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

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

State the Bernoulli-Euler law of flexure.

A uniform beam of length $2a$ and weight W is supported at its end on the same horizontal level and at its mid point D. The flexural rigidity is B. A pressure on their supports are equal. Prove that the end supports are at the height $\frac{7Wa^3}{144B}$ above the level of the center support.