



EASTERN UNIVERSITY, SRI LANKA
DEPARTMENT OF MATHEMATICS
SECOND EXAMINATION IN SCIENCE - 2008/2009
FIRST SEMESTER (Feb./Mar., 2010)
MT 215 - CLASSICAL MECHANICS II
(PROPER & REPEAT)

Answer all Questions

Time: One hour

Q1. With the usual notation, for a common catenary, prove that

$$(i) \quad y = \frac{1}{2} c (e^{x/c} + e^{-x/c});$$

$$(ii) \quad s = \frac{1}{2} c (e^{x/c} - e^{-x/c}),$$

where e denotes the exponential function. A uniform heavy string of length a is attached to two points P and Q such that the point Q being at a horizontal distance h , and vertical distance k , from the point P . Using the result given in (i) and (ii) find y_P, y_Q, s_P and s_Q . Hence show that

$$\pm \sqrt{a^2 - k^2} = 2c \sinh \left(\frac{h}{2c} \right).$$

Q2. State the Bernoulli-Euler law of flexure and Macaulay's notation.

Use these notions to solve the problem: A uniform beam AB of length a and weight W is clamped horizontally at the end A and it is free at the other end. The beam is at rest on a support at its middle point C and the height of the support being adjusted so that the end B is on the same level of A . Show that the

$$(i) \quad \text{pressure at } C \text{ is } \frac{6W}{5}, \text{ and}$$

$$(ii) \quad \text{the height of the support at } C \text{ above the line } AB \text{ is } \frac{11a^3W}{1920EI}, \text{ where } E \text{ and } I \text{ are the Young modulus and moment of inertia about the central line of the beam, respectively.}$$