EASTERN UNIVERSITY, SRI LANKA

DEPARTMENT OF MATHEMATICS

SECOND EXAMINATION IN SCIENCE - 2009/2010

FIRST SEMESTER (June/July, 2011)

MT 215 - CLASSICAL MECHANICS II

(Proper & Repeat)

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swer all questions

Time : One hour

. With the usual notations, obtain the following equations for a common catenary:

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

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

(c) $y^2 = s^2 + c^2$;

(d) $y = c\cosh(x/c)$.

An endless string of length $2\beta a$ $(\beta > \pi)$ is placed around the smooth cylinder of radius a fixed with its axes horizontal. The string is hanging in the form of the catenary below the cylinder. If the length of the string in contact with the cylinder is $2(\pi - \alpha)a$. Prove that

$$\sin^2\alpha\sec\alpha = (\alpha + \beta - \pi)\cosh^{-1}(\sec\alpha).$$

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

$$M_1a + 2M_2(a+b) + M_3b = -\frac{w}{4}\left(a^3 + b^3\right) + 6EI\left(\frac{y_a}{a} + \frac{y_b}{b}\right)$$

for the moment of a slightly elastic beam.

A heavy uniform elastic rod rests on five supports which are in a horizontal line. Two of the supports are at the ends of the rod. One is at the middle point and two bisects the distance between the middle point and the ends. Show that the bending moment at the center and each of the support next to its are $\frac{Wl}{56}$ and $\frac{3Wl}{112}$, where W is the weight of the rod and $4l$ is the length of the rod. Show that the reaction on the points of the supports are in the ratio $11 : 26 : 32$.