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Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2008

EN 2K 107 (A)—ENGINEERING MECHANICS (A)

(Common to AI/CH/CE/CS/EE/EC/IT/IC and AR)

Time : Three Hours

Maximum : 100 Marks

I. (a) Explain the following with suitable illustration :—

(i) Free-body diagram.

(ii) Lami's theorem.

(b) Explain the laws of friction with suitable practical examples.

(c) Sketch and explain any *two* trusses used for bridges.

(d) Explain the equations to be used for equilibrium of forces that are concurrent and parallel in space.

(e) Explain the principle of virtual work.

(f) Determine the centroid of a semicircle from first principle.

(g) Explain the following :—

(i) D'Alembert's principle.

(ii) Moment of momentum.

(h) Discuss the effect of impact of elastic bodies.

(8 × 5 = 40 marks)

II. (a) (i) A spherical ball of weight 75 N is attached to a string and suspended from a ceiling. A horizontal force F of 150 N is applied to the ball, determine the angle the string makes with the vertical and the tension in the string.

(8 marks)

(ii) Find the minimum Force F required for the string to make an angle of 63.55° with vertical.

(7 marks)

Or

(b) A uniform ladder AB 6 m long rests against a smooth vertical wall at A and on a smooth horizontal floor at B which is 2 m away from the wall. It is prevented from slipping by a horizontal chain tied at C such that BC = 1.8 m. Find the reactions at A and B and also the tension in the chain if the self weight of the ladder is 1.2 kN.

(15 marks)

Turn over

III. (a) A rectangle concrete foundation ABCD of size 4 m × 5 m supports loads of 100 kN, 150 kN, 250 kN and 125 kN at A, B, C and D respectively. Determine the result and the point of application.

Or

(b) A cable carrying a uniformly distributed vertical load of 3 kN/m is placed between two supports A and B, 20 m apart. The right support B is 2 m above the left support A. The lowest point C is 1 m below A. Determine :

(i) Maximum and Minimum tension in the cable.

(ii) Slope, dip and tension in the cable at E which is 10 m from A.

(15 marks)

IV. (a) Find the moment of inertia of a section in the shape of an Isoceles triangle with base 80 mm and height 120 mm, which has a hole of 20 mm, diameter, whose center is 40 mm from the base.

Or

(b) A frictionless double incline with angles α_1 and α_2, $\alpha_1 < \alpha_2$, carries a set of sliding masses m_1 and m_2 respectively, connected with an inextensible string and passing over a frictionless pulley at the apex of the inclines determine the relationship between α_1 and α_2 in terms of m_1 and m_2 for equilibrium and hence determine α_2 if $\alpha_1 = 30°$ and $m_1 = 2\ m_2$.

(15 marks)

V. (a) The motions of two particles A and B are defined by $a_A = 3t$ and $a_B = 2t^2$ where a is in m/s^2, v is in m/s and t is in seconds. Find $x_{B/A}$ and $v_{B/A}$ at $t = 5s$. At $t = 0$, $x_A = 10$ m, $x_B = 13$ m and $v_A = 2v_B = 2$ m/s.

Or

(b) A stone is projected with a speed of 30m/s at an angle of elevation of 50°. Find its velocity and distance travelled :

(i) After two seconds.

(ii) At the highest point of its path.

(iii) At a height of 6 m.

(15 marks)

[4 × 15 = 60 marks]