2E2005

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B.Tech. II Semester (Main/ Back) Examination, June/July - 2016

205 Engineering Mechanics

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one question** from **each unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) Describe force and State its application. Give a detailed classification of system of force. **(6)**

b) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown in the Fig. (i) If in the equilibrium position, BC is horizontal and AB and CD make 150° and 120° with BC, find : (i) Tensions in the portions AB, BC and CD of the string and (ii) Magnitudes of weights W_1 and W_2. **(6+4)**

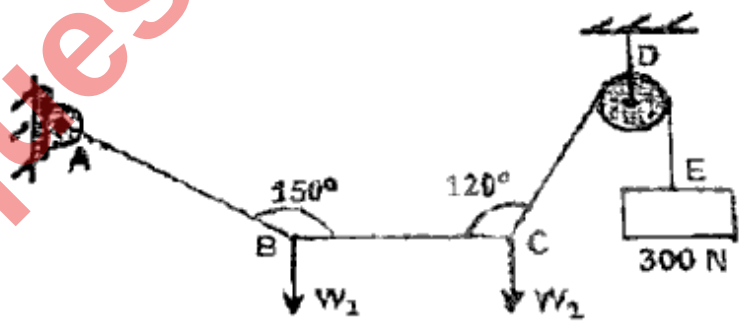

Fig. (i)

OR

1. a) State and Prove Lami's Theorem. **(8)**

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b) Two beams AC and CD are hinged at C and are supported by rollers at A and D and a hinge support is provided at B as shown in Fig. (ii). Using principle of virtual work, determine the reactions at the hinge C and at support B, when a load of 600 N is acting at point E. **(8)**

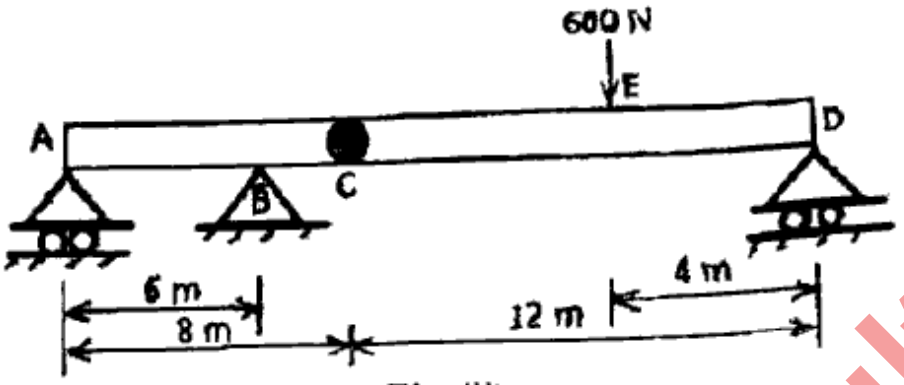

Fig. (ii)

Unit - II

2. a) State the law of machine. Derive an expression for the efficiency of a machine. **(6)**

b) Find the moment of inertia about the horizontal and vertical axis (X-X and Y-Y) passing through the centroid of the section shown in Fig. (iii). **(6+4)**

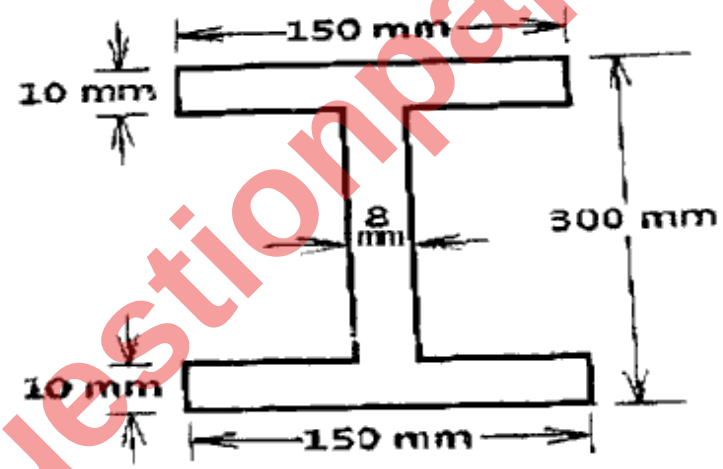

Fig. (iii)

OR

2. a) A machine lifts a load of 250 N by an effort of 160 N, at another instant the same machine lifts the load of 375 N by an effort of 175 N. If the velocity ratio of the machine is 20, determine :

i) Law of machine,

ii) Efficiency of the machine at 375 N &

iii) Efforts lost in friction at 250 N load. **(2+2+2)**

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b) A uniform lamina as shown in fig. (iv) consists of a rectangle, a semicircle and a triangle. Determine the centroid of the lamina. All dimensions are in mm. **(10)**

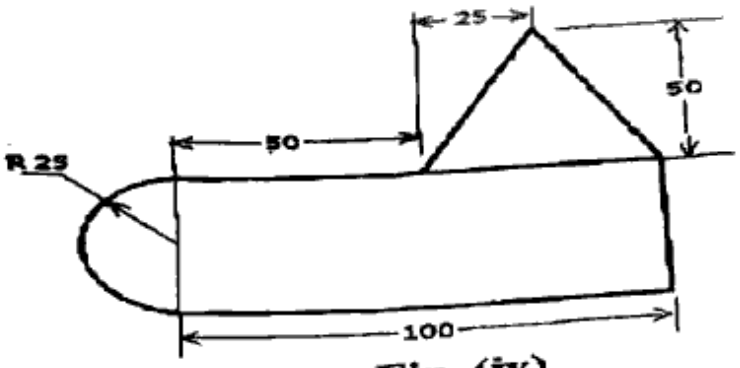

Fig. (iv)

Unit - III

3. a) Define angle of repose. Show that the angle of repose is equal to angle of static friction. **(6)**

b) A uniform ladder 3 m long weighs 200 N. It is placed against a wall making an angle of 60^0 with the floor. The co-efficient of friction between the wall and the ladder is 0.25 and that between the ladder and the floor is 0.35. The ladder in addition to its own weight has to support a man of 1000 N at its top. Calculate :

i) The horizontal force P to be applied to the ladder at the floor level to prevent slipping.

ii) If the force P is not applied, what should be the minimum inclination of ladder with the horizontal, so that there is no slipping of it? **(5+5)**

OR

3. a) Derive an expression for the ratio of belt tensions on the tight side and slack side for a flat belt passing over a fixed pulley in terms of co - efficient of friction and angle of contact of belt over pulley. **(8)**

b) A ladder of weight 390 N and 6 m long is placed against a vertical wall at an angle of 30^0 with wall. The co-efficient of friction between the ladder and the wall is 0.25 and that between ladder and floor is 0.38. Find how high a man of weight 1170 N can ascend, before the ladder begins to slip. **(8)**

Unit - IV

4. a) A stone is thrown vertically upwards with a velocity 20 m/s from the top of the tower of 25m height. Make calculations for the following parameters :

i) The maximum height to which the stone will rise in its flight. **(2+2+2**

ii) Velocity of the stone during its downward travel at a point in the sam level as the point of projection.

iii) Time required for the stone to reach the ground.

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3. b) What is Projectile motion? Derive the expression for the horizontal range, maximum height and time of flight. (4+3+3)

OR

4. a) Two guns are pointed at each other, one upwards at an angle of 30^0 and the other at the same angle of depression. The muzzles of the guns are 40 m apart. If the guns are shot with velocities of 350 m/s upwards and 300 m/s downwards respectively, determine when and where the shots will meet. (8)

b) A particle moves along horizontal direction and its position at any instant is prescribed by the relation $X = 3t^3 - 5t^2$, where X is in m and t is in seconds, determine : (2+2+2+2)

i) Displacement during t = 2 sec. to 5 sec.

ii) Average velocity during t = 2 sec. to 5 sec. and instantaneous velocity at t = 2sec.

iii) Average acceleration during t = 2 sec. to 5 sec. and instantaneous acceleration at t = 5 sec.

iv) Distance travelled in first 5 sec.

Unit - V

5. a) Explain the principle of work and energy and derive an expression for the same. (8)

b) A pile hammer of 250 kg mass is made to fall freely on a pile from a height of 6 m. If the hammer comes to rest in 0.012 sec, determine (i) the change in momentum, (ii) impulse and (iii) average force. (3+2+3)

OR

5. a) State impulse momentum relation. A shell of mass 60 kg is fired horizontally with a velocity of 250 m/s by a gun of 3000 kg mass. Make calculations for :

i) The velocity with which the gun recoils, (2+2+2+2)

ii) The uniform force required to stop the gun in 0.5 m distance, and

iii) The time required to stop the gun. It may be presumed that momentum of the system comprising the gun and the shell is conserved.

b) From what height, must a heavy elastic ball be dropped on a floor, so that after rebounding thrice it will reach a height of 9 meters? Take $e = (0.5)^{1/3}$. (8)

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