C 40923   (Pages : 4)   Name...............

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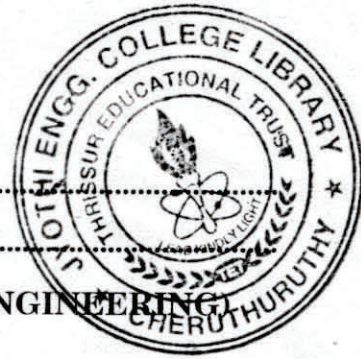
COMBINED FIRST AND SECOND SEMESTER B.TECH (ENGINEERING) DEGREE EXAMINATION, ARPIL 2013

EN/PTEN 09 105—ENGINEERING MECHANICS

(2009 Scheme—Regular/Supplementary/Improvement)

Time : Three Hours   Maximum : 70 Marks

Part A

Answer all questions.

1. What is a statistically indeterminate problem ?

2. State parallel axis theorem.

3. State the second theorem of Pappus-Guldinus.

4. Define work-energy principle.

5. State the equations of motion for rotation.

$(5 \times 2 = 10 \text{ marks})$

Part B

Answer any four questions.

6. An electric-light fixture of weight Q (40N) is supported as shown in Fig. 1. Determine the tensile forces S_1 and S_2 in the wires BA and BC if their angles of inclination are as shown.
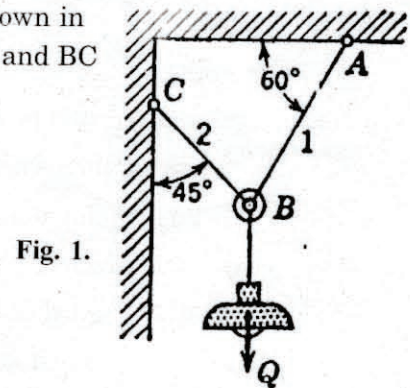

Fig. 1.

7. An inclined plane as shown in Fig. 2. is used to unload slowly a heavy safe weighing 400N from a truck 1.2 m high into the grounds. The coefficient of friction between the bottom of the safe and the plank is 0.30. State whether it is necessary to push the safe down the plane or hold it back from sliding down.
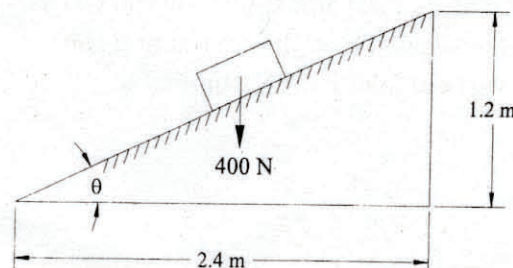

Fig. 2.

Turn over

8. Find the mass moment of inertia of the cylinder shown in Fig. 3 with respect to the z-axis.
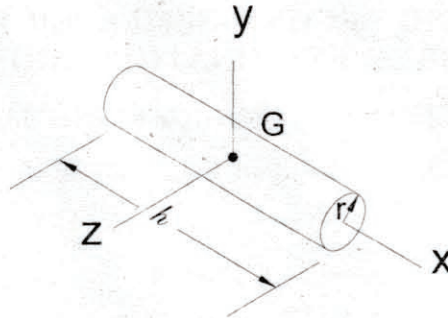

Fig. 3.

9. An aircraft, moving horizontally at 108 km/hr at an altitude of 1000 m releases a bomb towards a target on the ground which hits it. Estimate the horizontal distance of the aircraft from the target, when it released the bomb. Calculate also the velocity and direction with which the bomb hits the target. Neglect air friction.

10. A motorist is travelling on a curved portion of a highway of radius 400 m at a speed of 0 km/hr. The brakes are suddenly, applied, causing the speed to decrease at a constant rate of 1.5 m/s^2. Determine the magnitude of the automobile (a) immediately after the brakes have been applied and (b) 3 seconds later.

11. A pelton wheel is rotating at 40 rad/sec when the power is turned off. If it takes 25 seconds for the wheel to come to rest, determine (a) the constant angular deceleration and (b) the total number of revolutions the wheel makes.

$(4 \times 5 = 20 \text{ marks})$

Part C

Answer section (a) **or** *section* (b) *of each question.*

12. (a) The following forces act at a point :

     (i)   20 N inclined at 30° towards North of East.

     (ii) 25 N towards North.

     (iii) 30 N towards North West, and

     (iv) 35 N inclined at 40° towards South of West.

     Find the magnitude and direction of the resultant force.

Or

   (b) A horizontal beam AB of length 4 m is hinged to a vertical wall at A and supported at its midpoint C by a tie rod CD as shown in Fig. 4. Find the tension S in the tie rod and the reaction at A due to a vertical load P (50N) applied at B.
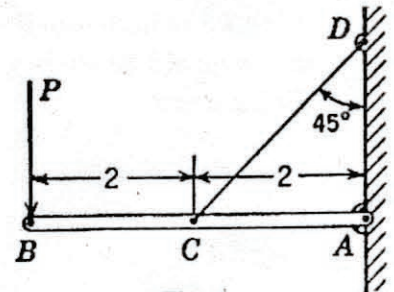

Fig. 4.

13. (a) Find the forces in members of the truss shown in Fig. 5.
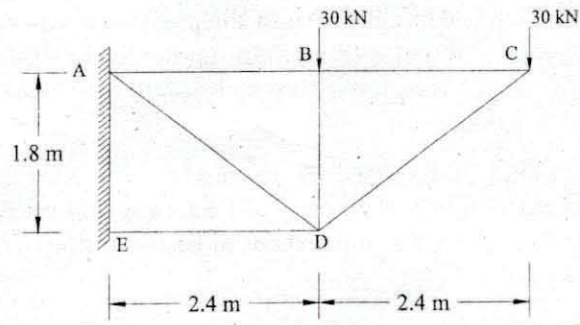

Fig. 5.

Or

(b) Find the moment of inertia about the centroidal axes for the section shown in Fig. 6
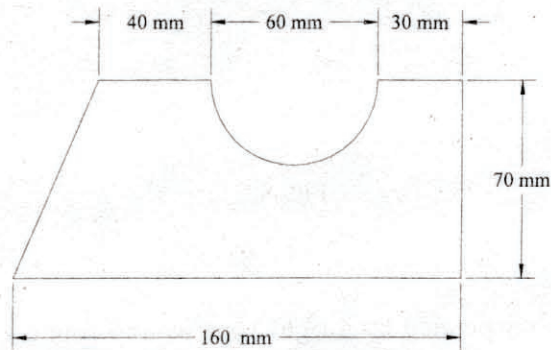

Fig. 6.

14. (a) Two blocks of weights A (150 N) and B (50 N) are connected by a string and passes over a frictionless pulley as shown in Fig. 7. Determine the acceleration of blocks A and B and the tension in the string.
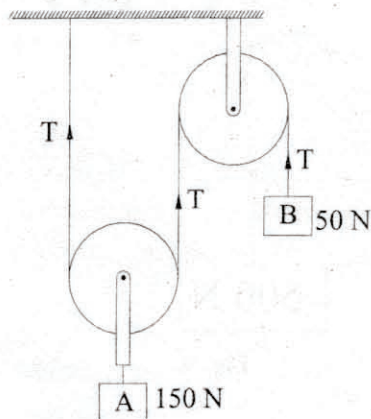

Fig. 7.

Or

(b) A soldier fires a bullet at an angle of 30° (upward from the horizontal) from his position on hill to strike a target which is 61 m lower than the position of the soldier. The initial velocity of the bullet is 91.5 m/sec. Calculate (a) the maximum height to which the bullet will raise above the horizontal. (b) the actual velocity with which it will hit the target. (c) the total time required for the flight of the bullet.

15. (a) A pulley with two loads, connected by an inextensible cord is shown in Fig. 8. If the load B moves downward with an initial velocity of 1.5 m/sce, and uniform acceleration of 0.75 m/sec², determine (i) number of revolutions executed by the pulley in 2 sec. (b) velocity and position of the load A after 2 sec.
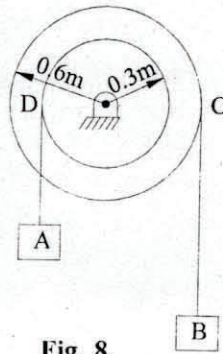

Fig. 8.

Or

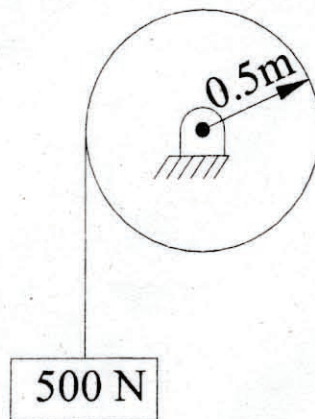(b) A block of 500 N is suspended by a tight rope wound round the pulley of weight 200N and radius 0.5 m, as shown in Fig. 9. Determine the acceleration of the weight and the tension in the rope.

Fig. 9.

(4 × 10 = 40 marks)