C 6287 (Pages : 4) Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, MAY 2010

PTEN/EN 09 105—ENGINEERING MECHANICS

(Common to all Branches)

[2009 admissions]

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. State parallelogram law of forces.
2. Define angle of repose.
3. State perpendicular axis theorem.
4. Define impulse-momentum principle.
5. State the equations of motion for translation.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

6. A ball Q of weight 12 N rests in a right-angled trough, as shown in Fig. 1. Determine the forces exerted on the sides of the trough at D and B if all surfaces are perfectly smooth.

Fig. 1

7. A block of weight 150 N is resting on a rough inclined plane as shown in Fig. 2. The block is tied up by a horizontal string, which has a tension of 50 N. Find (i) The frictional force on the block ; (ii) The normal reaction of the inclined plane ; (iii) The coefficient of friction between the surfaces of contact.

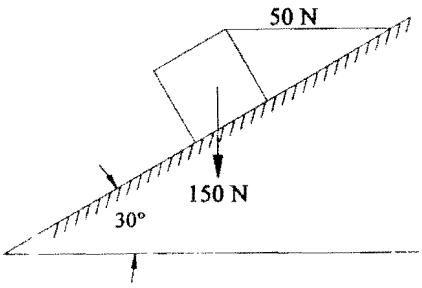

Fig. 2

8. Derive the mass moment of inertia of a sphere.

Turn over

9. A block weighing 100 N, rests on a horizontal plane, as shown in Fig. 3. Find the magnitude of the force P, required to move the block at an acceleration of 2 m/sec^2 towards right. Take the coefficient of friction between the block and the plane as 0.25.

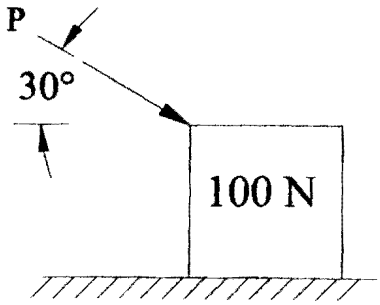

Fig. 3

10. A bullet of mass 30 gram moving horizontally with a velocity of 450 m/sec strikes a wooden block of weight 45 N, resting on a rough horizontal floor. The bullet is embedded into the block and then both block and bullet move as a single unit. Calculate the distance moved ? Take $\mu = 0.45$.

11. The 15 kg uniform cylinder having 150 mm radius shown in Fig. 4 is rolled up the 20° incline with an initial speed of 15 m/sec. Determine the maximum distance that the cylinder will roll up the incline. Assume that no slipping occurs.

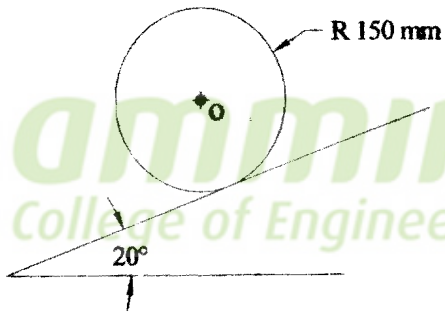

Fig. 4

(4 × 5 = 20 marks)

Part C

Answer section (a) or section (b).

Each question carries 10 marks.

12. (a) ABCD is weightless rod under the action of four forces P, Q, S and T as shown in Fig. 5. If P = 10 N, Q = 4 N, S = 8 N and T = 12 N, calculate the resultant in magnitude and direction and also locate its point of application with respect to the end A of the rod.

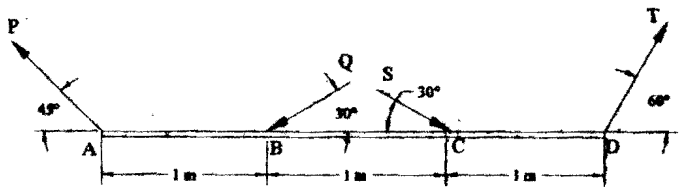

Fig. 5

Or

(b) A fine 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 40 N at the free end E as shown in Fig. 6. If in the position of equilibrium, BC is horizontal and AB and CD makes 150° and 120° with BC, find (i) Tension in the portion AB, BC and CD of the string ; and (ii) Magnitudes of W_1 and W_2.

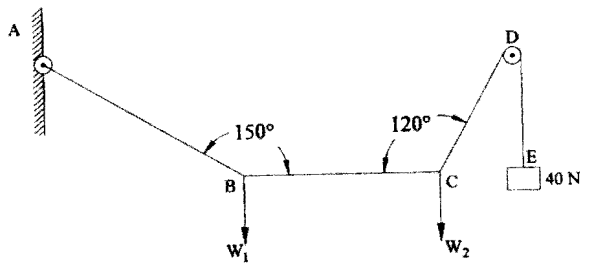

Fig. 6

13. (a) A cantilever truss supported on rollers at E and hinged at A is loaded as shown in Fig. 7. Determine the reactions at A and E.

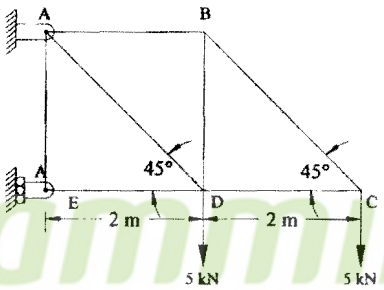

Fig. 7

(b) Find the moment of inertia about the centroidal axes for the section shown in Fig. 8.

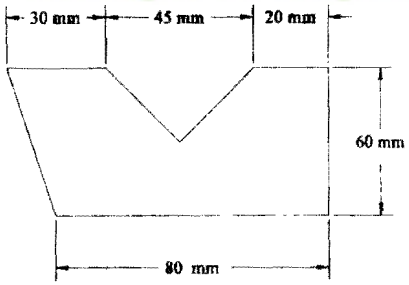

Fig. 8

14. (a) Two blocks A and B of weight 80 N and 60 N are connected by a string and passes over a frictionless pulley as shown in Fig. 9. Determine the acceleration of blocks A and B and the tension in the string.

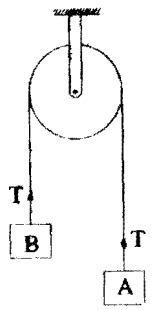

Fig. 9

Or

Turn over

(b) A projectile is fired from the edge of a 150 m high cliff with an initial velocity of 180 m/sec at an angle of elevation of 30° with the horizontal. Neglecting air resistance, find (i) the greatest elevation above the ground reached by the projectile ; and (ii) the horizontal distance from the gun to the point, where the projectile strikes the ground.

15. (a) Load A is connected to a double by one of the two inextensible cables as shown Fig. 10. The motion of the pulley is controlled by cable B, which has a constant acceleration of 1m/sec^2 and an initial velocity of 1.5 m/sec, both directed to the right. Determine (i) number of revolutions executed by the pulley in 5 seconds ; (ii) the velocity and change in position of the load A, after 5 seconds.

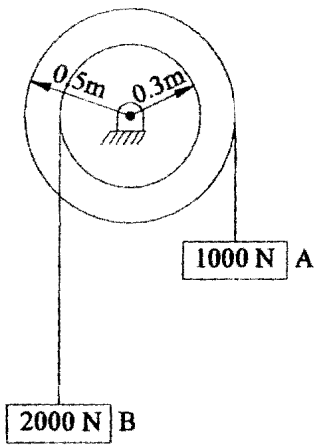

Fig. 10

Or

(b) A composite pulley of weight 500 N and radius of gyration of 0.4 m is attached with two blocks A and B of weights 1000 N and 2000 N respectively, as shown in Fig. 11. Determine the angular acceleration of the pulley and the tension in the strings by using D' Alembert's principle.

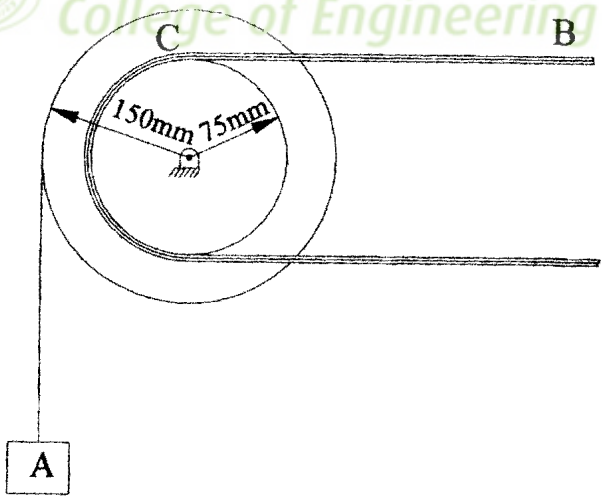

Fig. 11

(4 × 10 = 40 marks)