Reg. No. : | | | | | | | | | | | |

Question Paper Code : Q 2256

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Second Semester

Civil Engineering

GE 1151 — ENGINEERING MECHANICS

(Common to All branches)

(Common to B.E. (Part–Time) First Semester – Civil Engineering and Mechanical Engineering – Regulation 2008)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions

PART A — (10 × 2 = 20 marks)

1. Find the unit vector of the force $\vec{F} = 4\vec{i} - 5\vec{j} + 8\vec{k}$.

2. The resultant of two equal forces including 60° between them has a magnitude of $9\sqrt{3}N$. What is the magnitude of the component forces?

3. What is meant by equilibrium of a body?

4. State polygon law of equilibrium.

5. Determine the centre of gravity of a quarter circular area of radius r by using Pappus – Guldinus theorem.

6. Find the mass moment of Inertia of a steel pipe of length 5 m having external diameter 80 cm and internal diameter 60 mm about its axis. Take the mass density of steell as 7900 N/m³.

7. What do you mean by relative velocity?

8. A cricket ball of mass 200 gm hit by a batsman travels with a velocity of 25 m/s and is caught by a fielder in 0.2 sec. Find the impulsive force extend on the ball and the impulse.

9. Define "Coefficient of 'Static friction'".

10. Prove that the angle of repose is equal to the angle of static friction.

PART B — (5 × 16 = 80 marks)

11. (a) Find the magnitude and direction θ of the force $\vec{A}$ so that the resultant of the system of force shown in fig. Q11(a). is horizontal and has a magnitude of 14.4 kN.

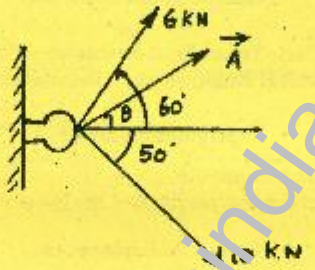

Fig. Q11(a).

(b) Find the magnitude and the points of meeting of the line of action of the resultant with the side KL for the system of forces shown in fig. Q11(b).

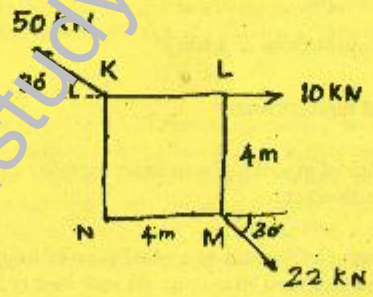

Fig. Q11(b).

12. (a) A uniform rod of length 2 m is supported on a knife edge at its centre. A container is suspended from the rod at 0.5 m from one end and a block of weight 4 kN is suspended at 1.6 m from the same end. Find the weight of the container so that the rod remains horizontal.

Or

(b) A beam is loaded as shown in fig. Q12(b). Find the equivalent single force for the system of forces and the equivalent force – couple at P and at S. Use vector approach.

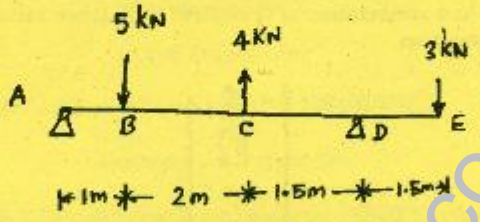

Fig. Q12(b).

13. (a) A frustum of a solid cone of height 200 mm has a base diameter of 300 mm and top diameter of 150 mm. It has an axial hole of diameter 60 mm. Determine the position of the centre of gravity of the solid.

Or

(b) Find the product of inertia of the section shown in fig. Q13(b). With respect to the x and y axes. All dimensions are in mm. Also find the principal axes and the principal moments of inertia of the section.

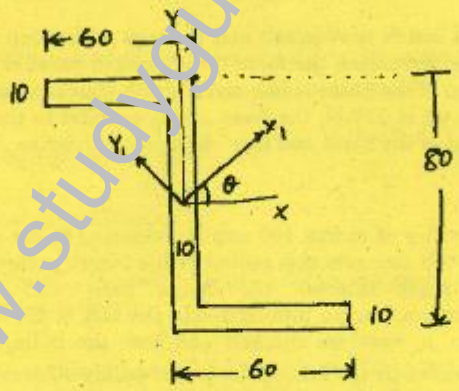

Fig. 13(b).

14. (a) A stone is projected from a point P on a 30° inclive at an angle of 65° with the plane with velocity of 10 m/s. The stone hits the inclined at Q below P. Find the time of flight, difference in height between Pand Q and also the range along the incline.

Or

(b) A car P is running towards east at a uniform speed of 40 km/h. When the car P just crosses the intersection shown in fig. Q14(b), another car Q starts from rest in the north 50 m from the intersection and travels towards south with a uniform acceleration of 1.5 m/s². Find the position, velocity and acceleration of Q relative to P, three seconds after P crosses the intersection.

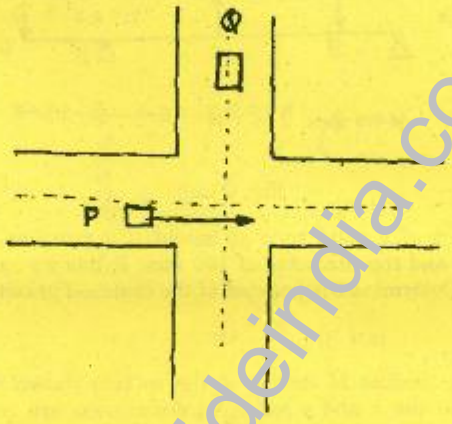

Fig. Q14(b).

15. (a) A force of 300 N is required just to move a block up a plane inclined at 20° to the horizontal, the force being applied parallel to the plane. If the inclination of the plane is increased to 25°, the force required just to move the block up is 3[illegible] N, the force acting parallel to the plane. Determine the weight of the block and the Coefficient of friction.

Or

(b) A small pulley of radius 100 mm is connected to the shaft on an electric motor. A belt connects this pulley with a bigger pulley of radius 300 arm. Contact angle between the bigger pully and the belt is 230°. The maximum tension punishable in the belt is 2000 N. The Coefficient of friction μ_s between the belt and both the pulleys is 0.25. Find the torque exerted by the belt on the bigger pulley. Also check that μ_s utilised in the lax of bigger pulley at the time of slipping in the smaller pulley is less than 0.25.
