Reg. No. : E N G G T R E E . C O M

Question Paper Code : 70146

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Civil Engineering

ME 3351 — ENGINEERING MECHANICS

(Common to B.E. Automobile Engineering/B.E. Industrial Engineering/ B.E. Industrial Engineering and Management/B.E. Materials Science and Engineering/B.E. Mechanical Engineering/B.E. Mechanical Engineering (Sandwich)/B.E. Mechanical and Automation Engineering/B.E. Mechatronics Engineering/B.E. Production Engineering/B.E. Robotics and Automation/B.E. Safety and Fire Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Resultant force.
2. What is meant by coplanar concurrent forces?
3. Write the principle of transmissibility.
4. State Varignon's theorem.
5. Write the theorem of pappus-Guldinus.
6. Recall Parallel axis theorem.
7. Define coefficient of friction.
8. Write any two laws of friction.
9. What is meant by coefficient of restitution?
10. State Impulse and Momentum principle.

PART B — (5 × 13 = 65 marks)

11. (a) Three coplanar forces are acting at a point as shown in fig Q 11(a). Determine the magnitude and the direction of the resultant force.

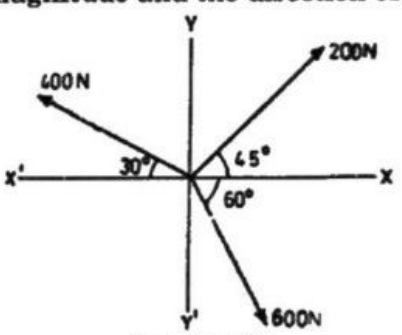

fig Q 11(a)

Or

(b) A block weighing 5kN is suspended from the ceiling by a chain. It is dragged aside by a horizontal chord until the chain makes 60° with the ceiling as shown in Fig.Q.11(b). Find the tension in the chain and in the chord.

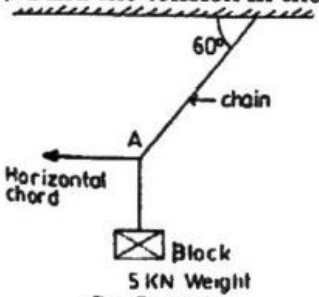

fig Q 11(b)

12. (a) Four forces of magnitude and direction acting on a square ABCD of side 2m are shown in fig Q 12(a). Calculate the resultant in magnitude and direction and also locate its point of application with respect to the sides AB and AD.

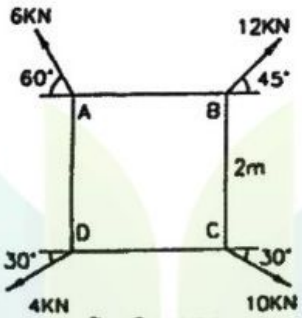

fig Q 12(a)

Or

(b) Determine the support reactions of the beam shown in fig Q 12(b) below

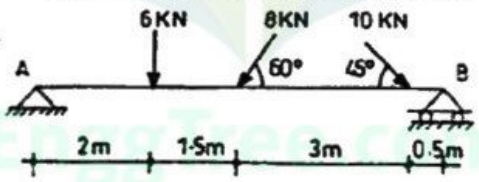

fig Q 12(b)

13. (a) Locate the center of gravity of a bullet, 1 cm diameter with a cone on the front and a hemisphere cut from the back as shown in fig Q 13(a) below. Assume the material to be homogeneous.

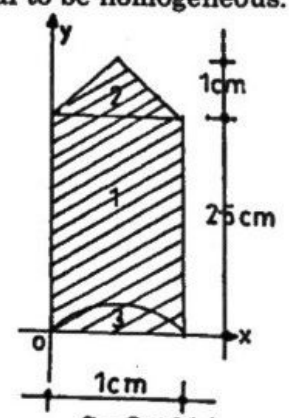

fig Q 13(a)

Or

(b) Calculate the moment of inertia of L section shown in fig Q 13(b) below about the horizontal axis passing through the C.G.

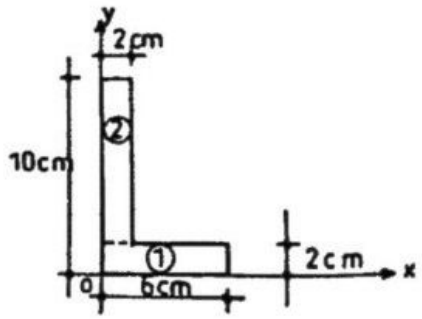

fig Q 13(b)

14. (a) What should be the value of the angle θ so that motion of the 390N block as shown in Fig.Q.14(a) impends down the plane? The coefficient of friction for all surfaces is 1/3.

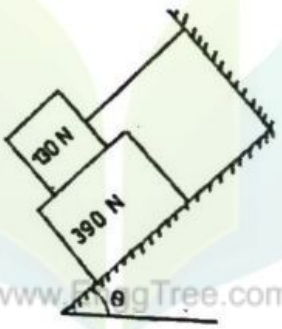

fig Q 14(a)

Or

(b) A 7m long ladder rest against a vertical wall, with which it makes an angle of 45° and on a floor. If a man whose weight is one half that of ladder climbs it, at what distance along the ladder will he be, when the ladder us about to slip? Take coefficient of friction between the ladder and the wall is 1/3 and that between the ladder and the floor is 1/2.

15. (a) Two weights 80 N and 20 N are connected by a thread and more along a rough horizontal plane under the action of a force 40 N, applied to the first weight of 80 N as shown in Fig Q 15 (a). The coefficient of friction between the sliding surface of the weights and the plane is 0.3. Determine the acceleration of the weight and the tension in the thread using work energy equation.

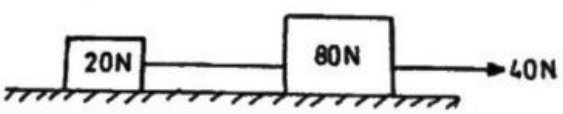

Fig Q 15 (a)

Or

(b) Two blocks of weight 150 N and 50 N are connected by a string, passing over a frictonless pulley as shown in Fig.Q 15 (b). Determine the velocity of 150 N block after 4 seconds. Use Impulse Momentum method.

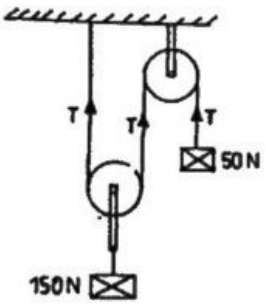

Fig Q 15 (b)

PART C — (1 × 15 = 15 marks)

16. (a) For the section shown in Fig.Q.16 (a) below, determine the moment of inertia about 1-1 and 2-2 axis.

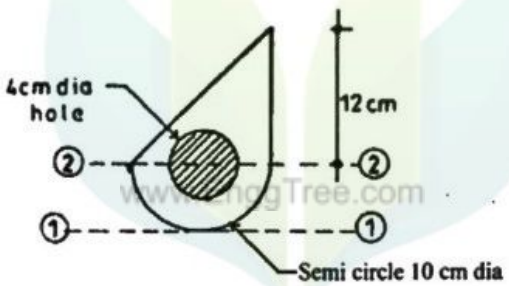

Fig.Q.16 (a)

Or

(b) A ball of mass 500 g, moving a velocity of 1 m/sec impinges on a ball of mass 1 kg, moving with a velocity of 0.75 m/sec. At the time of impact, the velocities of the balls are parallel and inclined at 60° to the line joining their centers. Determine the velocities and directions of the balls after impact. Take e = 0.6.