Reg. No.:	A		

# Question Paper Code: 51336

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

#### Third Semester

## Mechanical Engineering

#### ME 3351 — ENGINEERING MECHANICS

(Common to Automobile Engineering/Civil Engineering/Industrial Engineering/Industrial Engineering and Management/Materials science and Engineering/Mechanical Engineering (Sandwich)/ Mechanical and Automation Engineering/Mechatronics Engineering/Production Engineering/Robotics and Automation/Safety and Fire Engineering)

## (Regulations 2021)

(Also Common to PTME 3351 — Engineering Mechanics for B.E. (Part-Time) Second Semester — Civil Engineering/Mechanical Engineering — Regulations 2023)

Time: Three hours

Maximum: 100 marks

Answer ALL questions.

PART A —  $(10 \times 2 = 20 \text{ marks})$ 

- 1. Define equilibrium of particles in plane.
- 2. The greatest and least resultants of two forces are 7 kN and 1 kN respectively. Determine the angle between the two forces when their resultant is 5 kN.
- 3. State Varignons theorem.
- 4. Differentiate between space diagram and a free body diagram.
- 5. What is Pappus-Guldinus theorems?
- 6. What is meant by radius of gyration?
- 7. Define coefficient of friction.

- 8. Extend the condition at which the angle of repose and limiting angle of friction become equal.
- 9. What is meant by projectile and trajectory?
- 10. Give the equations of motion in a straight line.

PART B — 
$$(5 \times 13 = 65 \text{ marks})$$

11. (a) A system of four forces acting on a body is shown in figure 11(a).

Determine the resultant force and its direction.

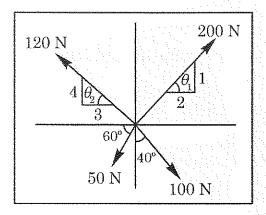


Fig. 11 (a)

Or

(b) Two cables are tied together at C and are loaded as shown in figure 11(b).

Determine the tension in (i) Cable AC and (ii) Cable BC.

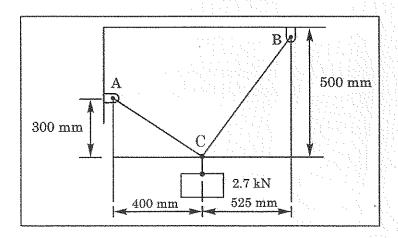


Fig. 11 (b)

12. (a) Determine the moments of a 200 N force about the two points A and B of the angle bracket (fig 12(a)).

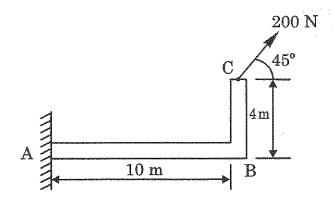


Fig. 12(a)

Or

- (b) The three forces and a couple in figure 12(b) are applied to an angle bracket
  - (i) Find the resultant of this system of forces
  - (ii) Locate the points where the line of action of the resultant intersects the line AC and a line BC.

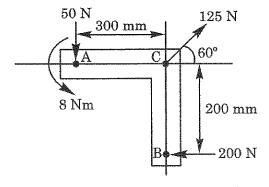


Fig. 12(b)

13. (a) Find the centroid of the Z section shown, in figure 13 (a). Also determine the first moments of the area about x and y axes. All the dimensions are in mm.

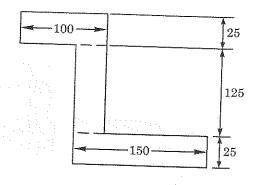


Fig. 13 (a)

Or

(b) Find the moment of inertia of T-section about XX-axis passing through its centroid as shown in figure 13 (b). All the dimensions are in mm.

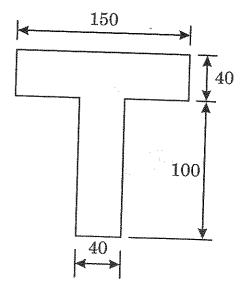


Fig. 13 (b)

14. (a) A body of weight 2 kN kept on an inclined plane is acted upon by a 0.75 kN as shown in figure 14 (a). The coefficients of friction between the block and the plane are  $\mu_s = 0.30$  and  $\mu_k = 0.25$ . Check whether the block remains in equilibrium or not.

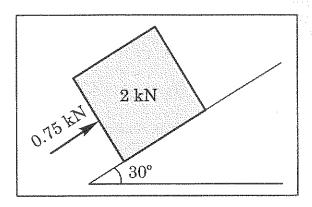


Fig. 14 (a)

Or

(b) Two blocks of weight 500 N and 900 N connected by a rod and kept on an inclined plane as shown in figure 14 (b). The rod is parallel to the plane. The coefficient of friction between 500 N block and the plane is 0.3 and that between 900 N and the plane is 0.4. Find the inclination of the plane with the horizontal when the motion down the plane is just about to start.

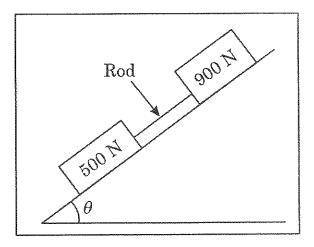


Fig. 14 (b)

15. (a) A car covers a distance of 30 m in 3 s and 70 m in 5 s. Find the initial velocity of car and acceleration assuming it uniform.

Or

(b) A projectile is thrown with a velocity of 5 m/s at an elevation of 60° to the horizontal. Find the velocity of another projectile thrown at an elevation of 45° which will have (i) equal horizontal distance, (ii) equal maximum height and equal time of flight with first.

PART C — 
$$(1 \times 15 = 15 \text{ marks})$$

16. (a) A external brake band assembly is shown in figure 16 (a). The coefficient of static friction between the flat belt and the drum is 0.28. Determine the minimum force P necessary to prevent the drum from rotating when subjected to a counter clockwise torque of 125 N-m.

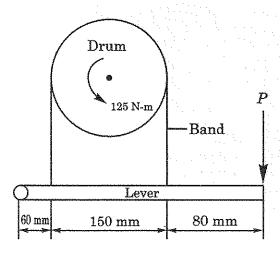


Fig. 16 (a)

Or

(b) A gun fires a bullet at the rate of 200 m/s penetrates a wooden panel to a depth of 50 cm. If the bullet with the same velocity penetrates a wooden panel of 25 cm thick, with what velocity would it emerge? Take the resistance offered by the wood to be uniform in both the cases.