B.M.S. College of Engineering, Bengaluru – 560019

Autonomous Institute Affiliated to VTU

February / March 2024 Semester End Main Examinations

Programme: B.E. **Semester: I**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV1ESENM **Max Marks: 100**
Course: Engineering Mechanics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit
2. Missing data, if any, may be suitably assumed.

UNIT-1

1 a) State and prove the theorem of moments with neat diagram **5**

b) A steel post holds four cables and the forces exerted from the cables on the post is shown in Figure 1.b. Determine the magnitude and direction of the resultant force. **7**

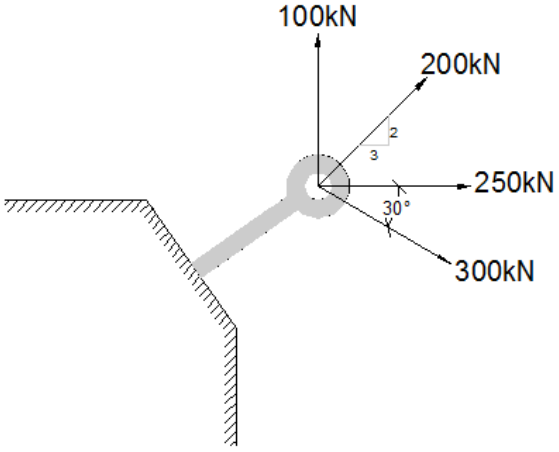

Figure 1. b

c) A resultant force R of magnitude 26kN is generated from two concurrent forces acting on a shaft is shown in the figure 1.c. Determine the magnitude of the second force, if the magnitude of the first force is 10kN and acting as shown in Figure 1. c. **8**

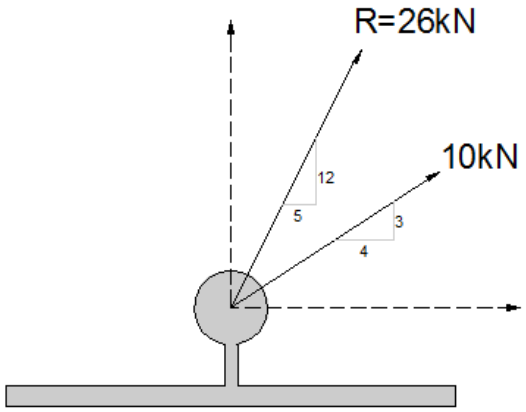

Figure 1. c

OR

2 a) Explain the method of finding resultant using parallelogram law of forces. **5**

A crate of mass 200kg is to be supported by a rope and pulley arrangement as shown in Figure 2. b. Determine the minimum required magnitude of force F. Also, find the direction of force F.

b) **7**

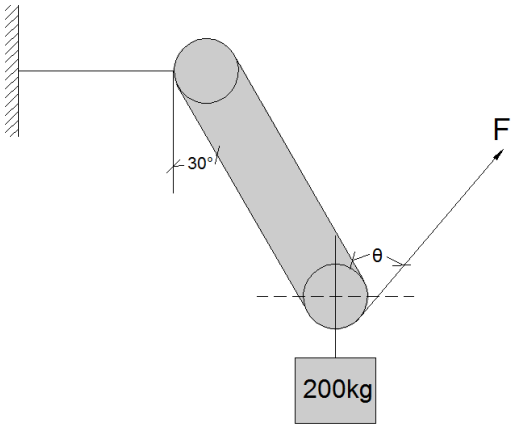

Figure 2. b

Two rollers are placed inside rectangular ditch as shown in figure 2.c. Determine the reactions at contact points P, Q, R, and S. The radii of the roller 1 and 2 are 20mm and 30mm respectively. Assume all contact surfaces to be smooth.

c) **8**

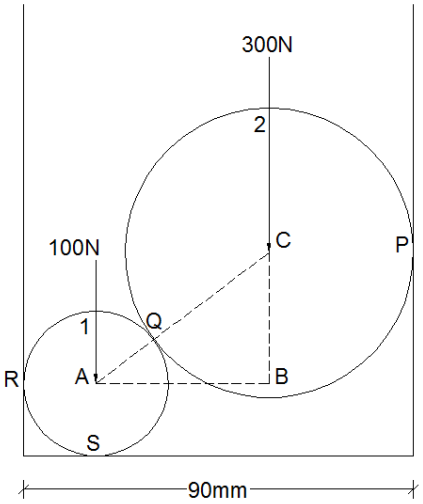

Figure 2. c

UNIT-2

Find the support reactions at A and B for the beam loaded as shown in Figure 3. a.

3 a) **8**

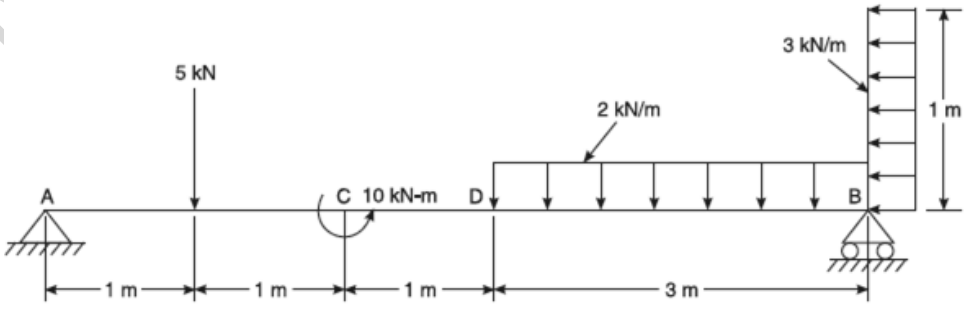

Figure 3. a.

b) Analyse the truss shown in Figure 3.b by the method of joints and indicate the member forces on a neat sketch of the truss. **12**

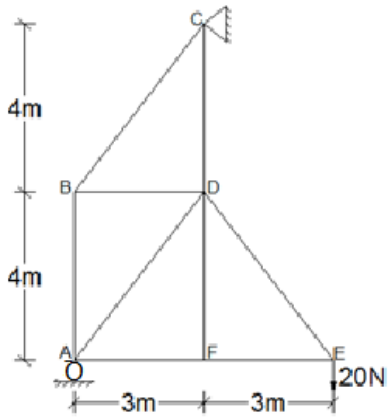

Figure 3. b

UNIT-3

4 a) Explain angle of repose and angle of friction with neat diagrams. **5**

b) A body resting on a horizontal plane required a pull of 18kN inclined at 30° to plane to just move it. It was also found that a push of 22kN inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. **7**

A uniform ladder of 4.0 m long and 200N weight is placed against a wall making an angle of 60° with the floor as shown in Figure 4. c. The coefficient of friction between the wall and the ladder is 0.25m and that between the ground and the ladder is 0.35. The ladder in addition to its own weight has to support a man of 1000N at the top point B.

Calculate:

i) The horizontal force P to be applied to the ladder at the ground level to prevent slipping

ii) If the force P is not applied, what should be the minimum inclination of the ladder with the horizontal, so that it does not slip with the man at the top B

c) **8**

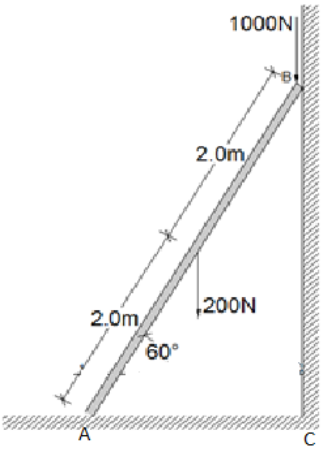

Figure 4. c

UNIT-4

5 a) Determine the location of the centroid of the shaded area shown in Figure 5. A wrt point 'O'. **8**

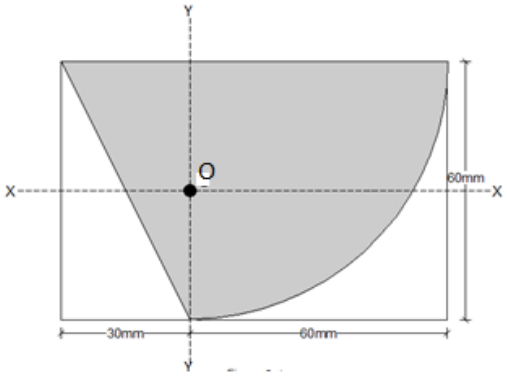

Figure 5. a.

Compute the least radius of gyration of the built-up section shown in Figure 5. b. All dimensions are in mm.

b)

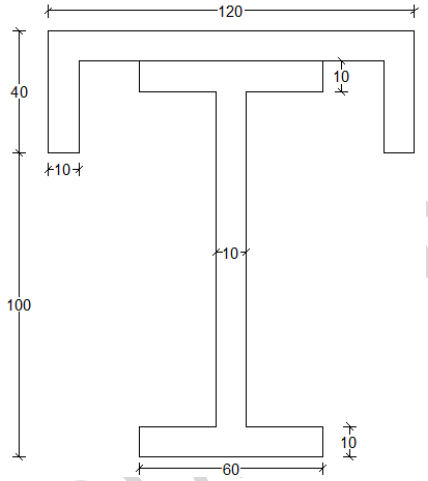

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Figure 5. b

UNIT-5

6

a) With a neat diagram prove that the path traced by a projectile is parabolic **5**

b) A body of mass 150kg is initially stationary on a 20^o inclined plane. For what distance should the body slide down the plane before it reaches a speed of 10m/s? Take the co-efficient of friction between the body and the plane as 0.12. **7**

c) A soldier fires a bullet upwards at an angle of 30^o with the horizontal from his position to strike a target which is 50m lower than the position of soldier. The initial velocity of the bullet is 80m/s. Calculate (i) The maximum height to which the bullet will rise (ii) The time required for the bullet to rise, and (iii) The actual velocity with which it will strike the target. **8**

OR

7

a) State and prove D'Alembert's principle **5**

b) A body of mass 200 kg is initially stationary on a 15^o inclined plane. What distance along the incline must the body slide before it reaches a speed of 10 m/s? Take coefficient of friction between the body and the plane as 0.1. **7**

c) A boy throws a ball so that it may just clear a wall of 4m high. The boy is at a distance of 5m from the wall. The ball was found to hit the ground at a distance of 3.8m on the other side of the wall. Find the least velocity with which the ball can be thrown. **8**

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