Code No: **R201210** **R20** **SET - 1**

I B. Tech II Semester Supplementary Examinations, Jan/Feb-2024
ENGINEERING MECHANICS

(Common to ME, PE, Agri. E, Food E)

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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UNIT-I

1 a) A horizontal line PQRS is 12 m long, where PQ = QR = RS = 4m. Forces of 1000, 1500, 1000 and 500 N act at P, Q, R and S respectively and action of these forces make angles of 90^0, 60^0, 45^0 and 30^0 respectively with PS. Find the magnitude, direction and position of the resultant force. [7M]

b) A force of 100 N is acting at a point A as shown in figure 1. Determine the moments of this force about O. [7M]

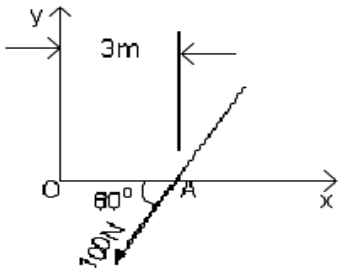

Figure 1

(OR)

2 A body weighing 50 N is just pulled up on inclined plane of 30^0 by a force of 40 N applied at 30^0 above the plane. Find the coefficient of friction. [14M]

UNIT-II

3 a) State and prove Lame's theorem. [5M]

b) Find the reactions R_a and R_b induced at the supports A and B of the right angle bar ACB supported as shown in figure 2 and subjected to a vertical load P applied at the mid-point of AC. [9M]

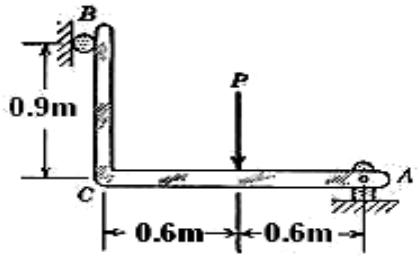

Figure 2
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(OR)

4 A strut AB attached to the face of a vertical wall at A by a spherical hinge stands perpendicular to the wall and is supported by two guy wires, as shown in figure 4. At B, in a plane parallel to the wall, two forces P and Q acts as shown, Q being horizontal and P vertical. Find the axial forces produced in the members if P = 500 N and Q = 1000 N. [14M]

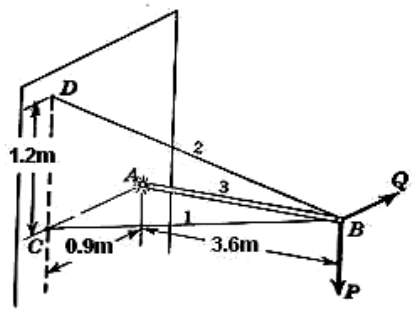

Figure 3

UNIT-III

5 a) Deduce an expression from first principle to determine the center of gravity of a sight circular solid cone about its base. [7M]

b) Locate the centroid of the shaded area as shown in figure 4. [7M]

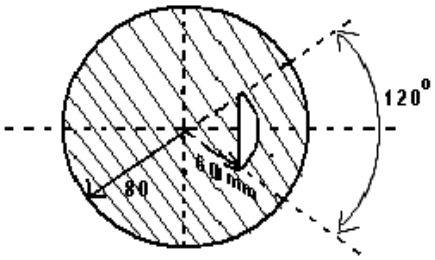

Figure 4

(OR)

6 Derive the expression for the moment of inertia of a cylinder length ‘l, radius ‘r’ and density ‘w’ about longitudinal centroidal axis and about the centroidal transverse axis. [14M]

UNIT-IV

7 The horizontal component of velocity of a projectile is twice its vertical component. Find the range on the horizontal plane through the plane of projection if the projectile passes through a point 18 m horizontally and 3 m vertically above the point of projection. Determine also initial velocity of the projectile. [14M]

(OR)

8. Two blocks are joined by an inextensible cable as shown in figure 5. If the system is released from rest, determine the velocity of block A after it has moved 2 m. Assume that μ equals to 0.25 between block A and the plane and that the pulley is weightless and frictionless. [14M]

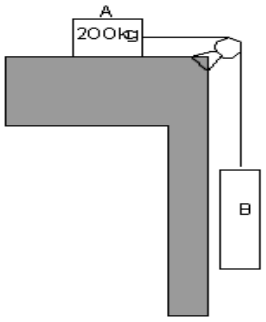

Figure 5

UNIT-V

9 a) A body weighing 20 N is projected up a 20^0 inclined plane with a velocity of 12 m/s, coefficient of friction is 0.15. Find [7M]
i) The maximum distance S, that the body will move up the inclined plane
ii) Velocity of the body when it returns to its original position.

b) Find the acceleration of the moving loads as shown in figure 6. Take mass of P=120 kg and that of Q=80 Kg and coefficient of friction between surfaces of contact is 0.3. Also find the tension in the connecting string. [7M]

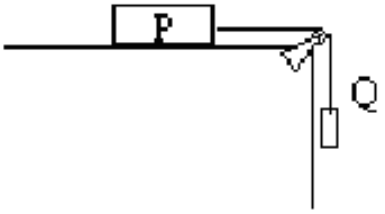

Figure: 6

(OR)

10 a) The figure 7 shows a sphere of mass M and radius R that rolls without slipping down an incline. Its moment of inertia about a central axis is 2/5MR2. i) Find the linear acceleration of the CM. ii) Which is the minimum coefficient of friction required for the sphere to roll without slipping. [7M]

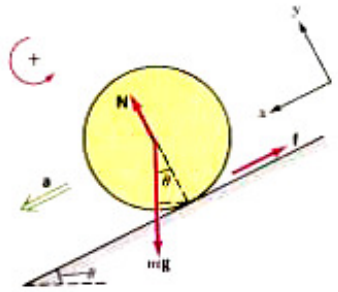

Figure 7

b) A uniform rod of length L and mss M is pivoted freely at one end. i) What is the angular acceleration of the rod when it is at angle θ to the vertical? ii) What is the tangential linear acceleration of the free end when the rod is horizontal? The moment of inertia of a rod about one end is $1/3ML^2$. [7M]

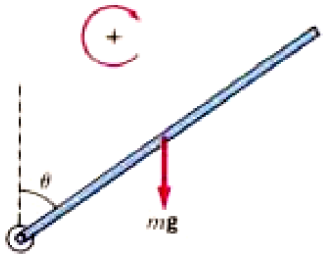

Figure 8

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