R20

SET - 1

I B. Tech II Semester Supplementary Examinations, March- 2022
ENGINEERING MECHANICS
(Com. 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

Unit-I

1 a) Define free body diagram, Transmissibility of a force and resultant of a force.   (6M)

   b) A force vector is represented by a line AB. The coordinates of point A are (2, 4,   (8M)
       3) and of point B is (1, -5, 2) respectively. If the magnitude of force is 10 N, then
       determine the:
       (i)   Components of the forces along x, y and z axis
       (ii)   Angles with the x, y and z axis.
   (iii) Specify the force vector.

Or

2 a) Four forces of magnitude 10kN, 15kN, 20kN and 40 kN are acting at a point O   (8M)
       as shown in Figure 1. The angles made by 10 kN, 15 kN, 20 kN, and 40 kN with
       X-axis are 30°, 60°, 90° and 120° respectively. Find the magnitude and direction
   of the resultant force.
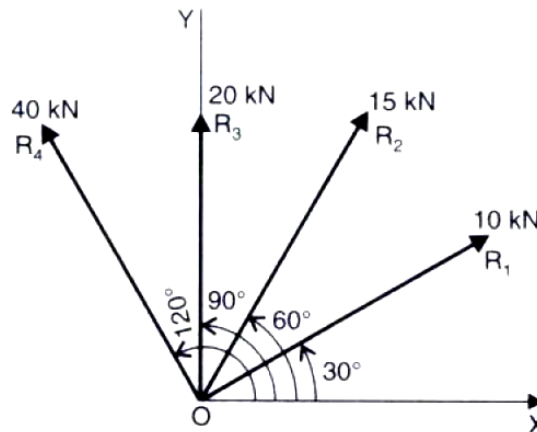
   b) A force of 250 N pulls a body of weight 500 N up an inclined plane, the force   (6M)
       being applied parallel to the plane. If the inclination of the plane to the
       horizontal is 15^0, find the coefficient of friction?

Unit-II

3 a) Two spheres, each of weight 1000 N and radius 25 cm rest in a horizontal   (8M)
       channel of width 90 cm as shown in the fig. 2. Find the reactions on the points of
   contact A, B and C.

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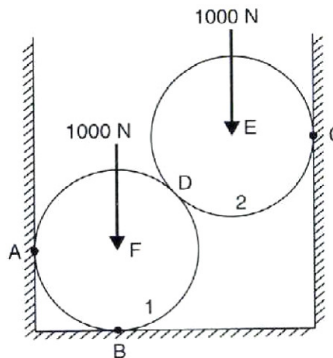
b) Determine the reaction forces at the supports A and D of the beam loaded as shown in   (6M)
      Figure.
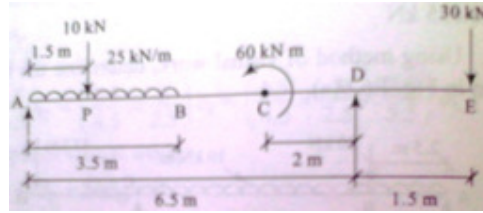
Or

4   A strut AB attached to the face of a vertical wall at A by a spherical hinge stands   (14M)
          perpendicular to the wall and is supported by two guy wires, as shown in Figure
          3. 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 = 400 N and Q = 700 N.
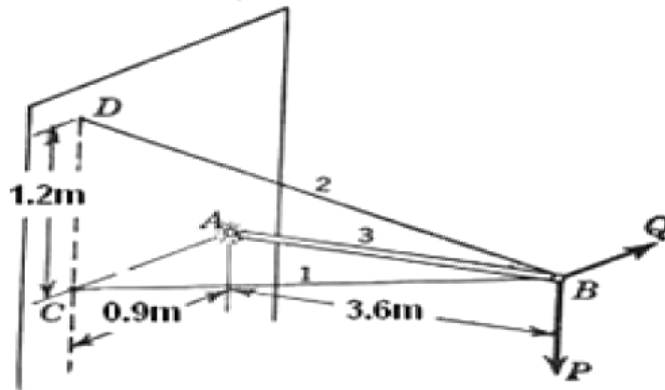
Unit-III

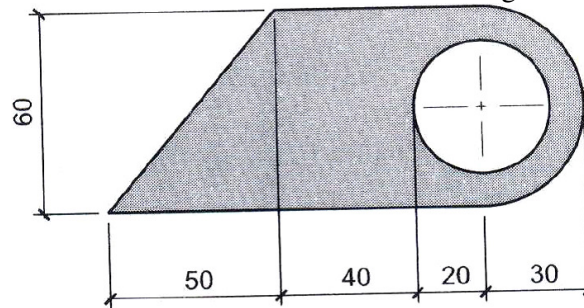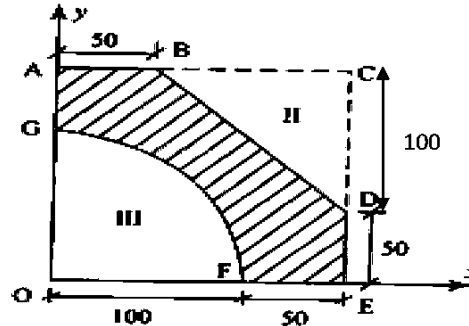5   a)   Locate the centroid for the shaded area as shown in the fig. below   (7M)

Fig. 4 (All dimensions are in mm)

     b)   Find the mass moment of inertia about the centroidal axes for a right circular   (7M)
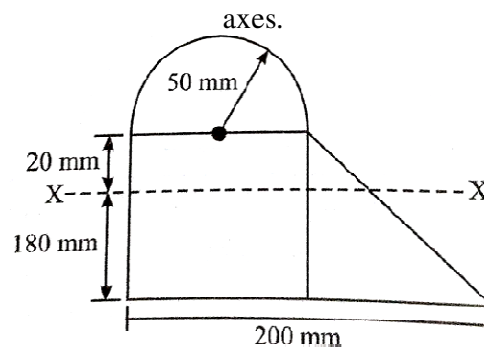   cone.

Or

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6   a)   Determine the centroid of the shaded area shown in the figure below   (7M)

(All dimensions are in mm)

   b)   Find the moment of inertia of the following figure below about the given X-X   (7M)
axes.

Unit-IV

7   a)   A Pelton wheel attains its operating speed of 900 revolutions per minute 3seconds after it starts from rest. Determine the constant angular acceleration of the Pelton wheel. Also find the total number of revolutions the wheel makes before it attains its operating speed.   (7M)

   b)   A stone is dropped from the top of a tower 50 m high. At the same time another stone is thrown up from the foot of the same tower with a velocity 25 m/s. At a distance from top and after how much time the two stones cross each other   (7M)

Or

8   The motion of a particle in rectilinear motion is defined by the relation $x=3t^3- 8t^2+16t-5$, where x and t are expressed in meters and seconds respectively. Determine (i) the instants when velocity is zero, (ii) the position and acceleration at those instants of time, (iii) the instant when the acceleration is zero. (iv) The position, the displacement, and the total distance travelled when the acceleration is zero.   (14M)

Unit-V

9   a)   Derive the mathematical expression for the impulse-momentum equation.   (7M)

   b)   A gun weighting 500kN fires a 4kN projectile with a velocity of 250 m/sec. With what velocity will the gun recoil? If the recoil is overcome by an average force of 50 kN. How far will the gun travel? How long it will take?   (7M)

Or

10   a)   A truck of 6 ton mass is moving on a level terrain at a speed of 80 kmph, when brakes are applied, if the braking force of constant magnitude 4 kN/ton, determine the distance it travels before coming to a stop.   (6M)

   b)   Derive work energy equation for translation?   (8M)

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