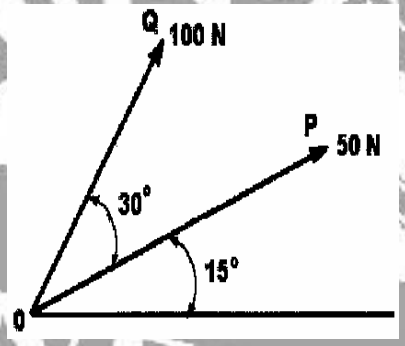
Code.No: R09A1BS05 | R09 | SET-1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I B.TECH – REGULAR EXAMINATIONS, JUNE - 2010
ENGINEERING MECHANICS
(COMMON TO CE, ME, CHEM, MECT, MMT, MEP, AE, AME)

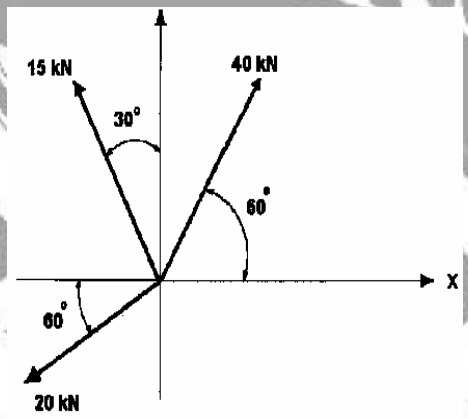
Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

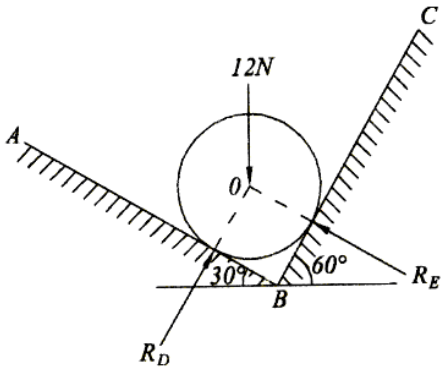
1.a) Two forces are acting at a point O as shown in figure. Determine the resultant in magnitude and direction of the force.



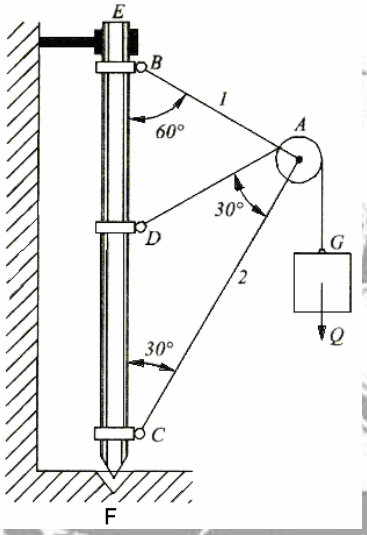
b) Three forces of magnitude 40 kN, 15 kN and 20 kN are acting at a point O as shown in figure. The angles made by 40 kN, 15 kN and 20 kN forces with X-axis are 60^0, 120^0 and 240^0 respectively. Determine the magnitude and direction of the resultant force. [7+8]



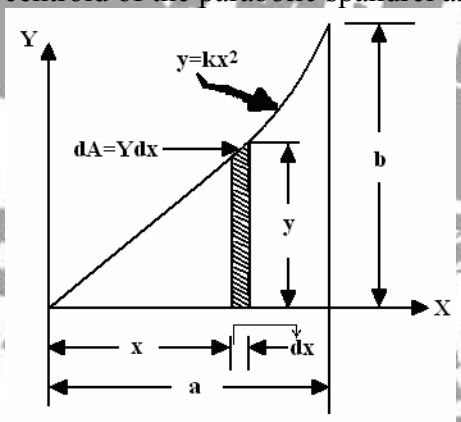
2. a) A ball of weight Q = 12 N rests in a right - angled trough, as shown in figure. Determine the forces exerted on the sides of the trough at D and E if all surfaces are perfectly smooth.



b) A pulley A is supported by two bars AB and AC which are hinged at points B and C to a vertical mast EF as shown in figure. Over the pulley hangs a flexible cable DG which is fastened to the mast at D and carries at the other end G a load Q = 20 kN. Neglecting friction in the pulley, determine the forces produced in the bars AB and AC. The angles between the various members are as shown in the figure. [7+8]

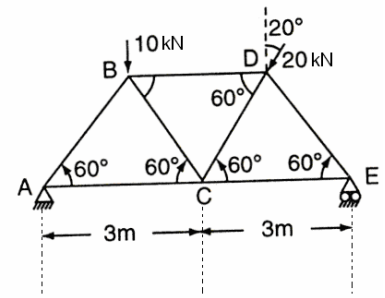


3.a) What is centroid and center of gravity? State the differences clearly.
b) Determine the centroid of the parabolic spandrel as shown in figure. [6+9]



4.a) State and prove parallel axis theorem of area moment of inertia.
b) Determine the product of inertia of a rectangle of base 'a' and height 'h' about x axis and y axis by direct integration. [6+9]

5.a) What are the assumptions made for forces in members of a perfect frame?
b) Find the forces in all the members of the truss as shown in the figure using method of joints. [4+11]



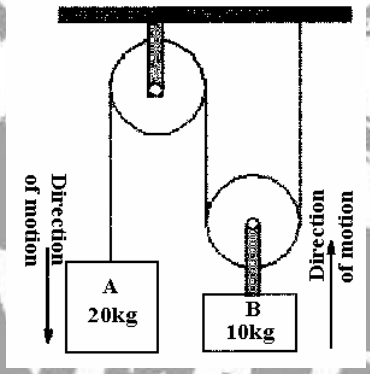
6.a) Derive the equations of motion of a particle with uniform acceleration.

b) Two bodies of weight 20 N and 10 N are connected to the two ends of a light inextensible string, passing over a smooth pulley. The weight of 20 N is placed on a horizontal surface while the weight of 10 N is hanging free in air. The horizontal surface is a rough one, having coefficient of friction between the weight 20 N and the plane surface equal to 0.3, determine:

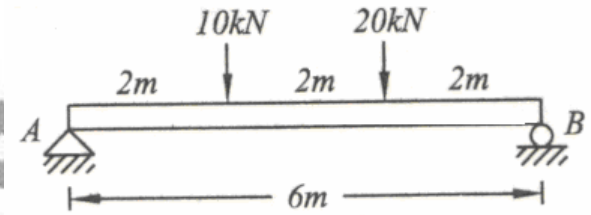
i) The acceleration of the system.

ii) The tension in the string. [7+8]

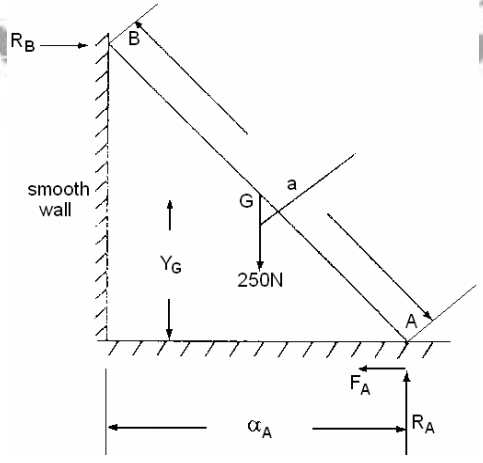
7. In the pulley system shown in figure the masses of blocks A and B are 20 kg and 10 kg respectively. The masses of pulley and rope may be neglected. Find the velocity of the blocks 5 sec after they start from rest. [15]



8.a) Determine the reactions at supports as shown in figure using the principle of virtual work.



b) A uniform ladder of weight 250 N as shown in the figure rests with its upper end against a smooth vertical wall and its foot on a rough horizontal ground making an angle of 45^0 with the ground. Find the force of friction of the ground using the method of virtual work. [7+8]



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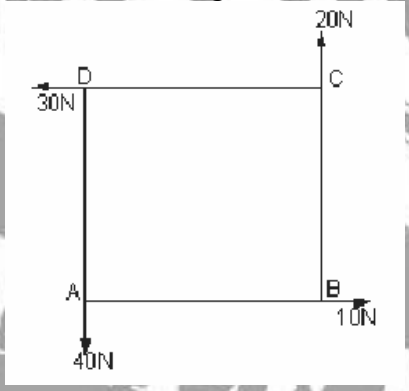
Code.No: R09A1BS05 | R09 | SET-2

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I B.TECH – REGULAR EXAMINATIONS, JUNE - 2010
ENGINEERING MECHANICS
(COMMON TO CE, ME, CHEM, MECT, MMT, MEP, AE, AME)

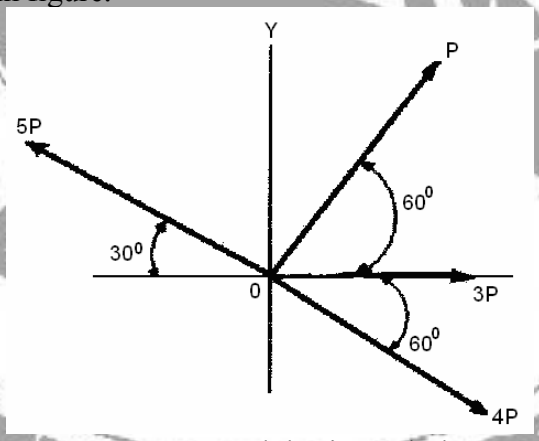
Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

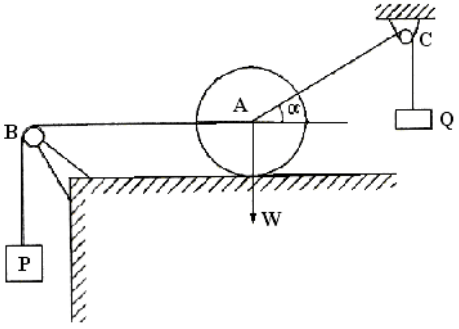
1.a) Four forces of magnitudes 10 N, 20 N and 30 N and 40 N are acting respectively along the four sides of a square ABCD with dimensions 500 mm × 500 mm as shown in Figure. Determine the magnitude and direction of the resultant force.



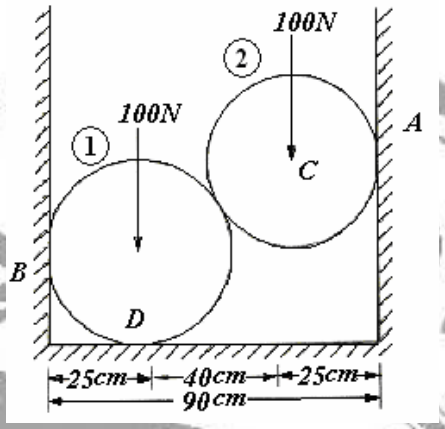
b) Find the magnitude and direction of the resultant R of four concurrent forces acting as shown in figure. [8+7]



2.a) A ball of weight W rests upon a smooth horizontal plane and has attached to its center two strings AB and AC which pass over friction less pullies at B and C and carry loads P and Q, respectively, as shown in the figure. If the string AB is horizontal, find the angle α that the string AC makes with the horizontal when the ball is in a position of equilibrium. Also find the pressure R between the ball and the plane.

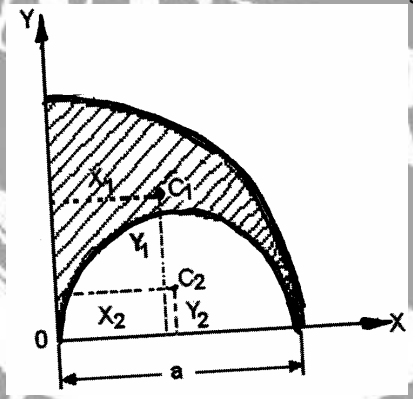


b) Two smooth spheres, each of radius r and weight Q, rest in a horizontal channel having vertical walls, the distance between which is 90 cm. Find the pressures exerted on the walls and floor at the points of contact A, B and D. The following numerical data are given: r =25cm, Q =100N. [8+7]



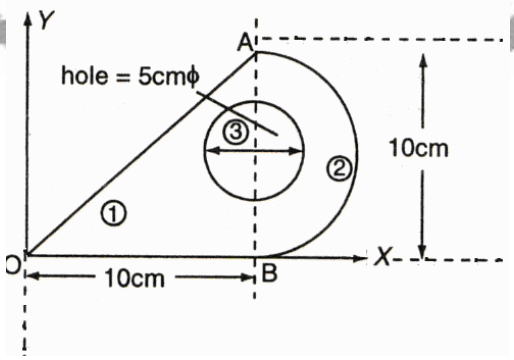
3.a) State and explain Pappus theorem.

b) Locate the centroid of shaded area obtained by removing a semicircle of diameter 'a' from a quadrant of a circle of radius 'a' as shown in figure. [6+9]



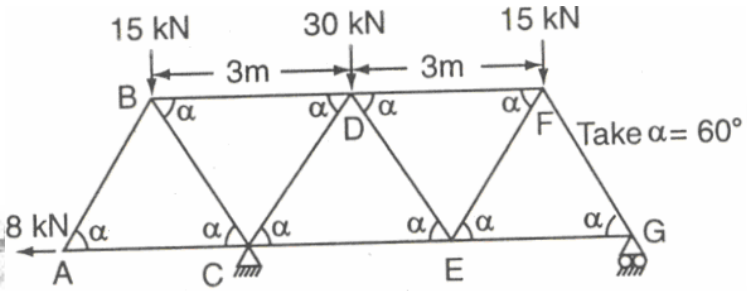
4.a) State and prove perpendicular axis theorem.

b) Find the moment of inertia of the area in the given figure about the axis 'AB' [4+11]



5.a) Explain the force table with suitable example.

b) Find the forces in all the members of the truss shown in the figure using method of sections. [4+11]



6. A ball is thrown vertically upward from 15 m level in an elevator shaft with an initial velocity of 20 m/sec. At the same instant an open platform elevation passes the 5 m level, moving upward with a constant velocity of 2 m/sec. Determine:

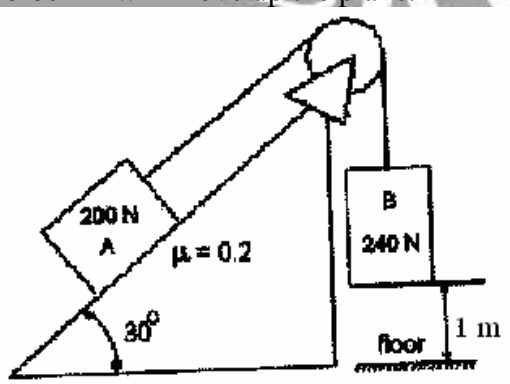
a) When and where the ball will hit the elevator.

b) The relative velocity of the ball with respect to the elevator when the ball hit the elevator. [15]

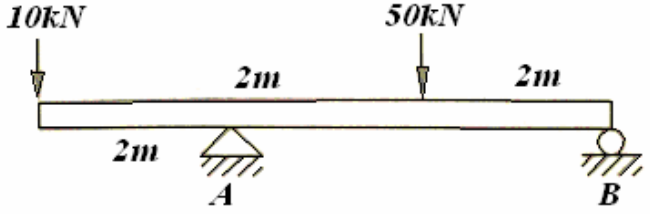
7. Two blocks of A (200 N) and B (240 N) are connected as shown in figure. When the motion begins, the block B is 1 m above the floor. Assuming the pulley to be frictionless and weightless, determine:

a) The velocity of block A when the block B touches the floor and

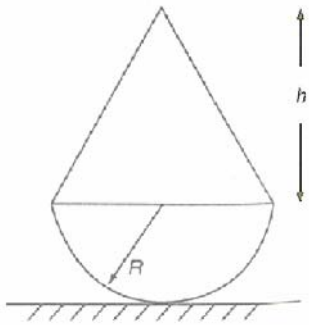
b) How far the block A will move up the plane. [15]



8.a) Determine reaction at supports as shown in figure using the principle of virtual work.



b) A karagam dancer balances a karagam on her head. The karagam pot consists of hemispherical vessel consisting of lead and aluminium hollow cone as shown in the figure. Use appropriate densities to determine the ratio of h/R for stable equilibrium. [7+8]



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Code.No: R09A1BS05 | R09 | SET-3

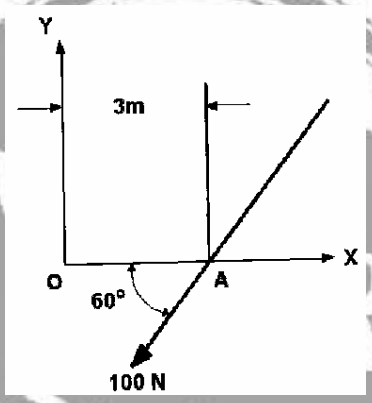
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I B.TECH – REGULAR EXAMINATIONS, JUNE - 2010
ENGINEERING MECHANICS
(COMMON TO CE, ME, CHEM, MECT, MMT, MEP, AE, AME)

Time: 3hours **Max.Marks:80**

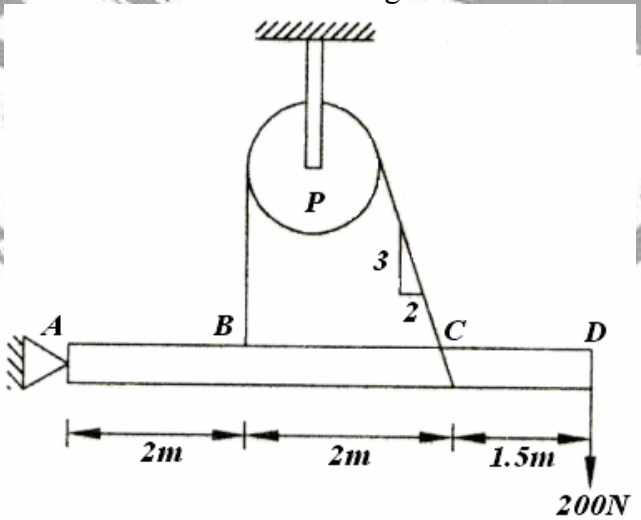
Answer any FIVE questions
All questions carry equal marks

1.a) A Horizontal line PQRS is 12 m long, where PQ = QR = RS = 4m. Forces of 1000, 1500, 1000 and 500N act at P, Q, R and S respectively and line of 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.

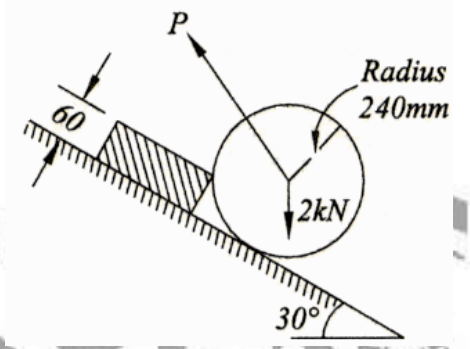
b) A force of 100 N is acting at a point A as shown in figure. Determine the moments of this force about 0. [8+7]



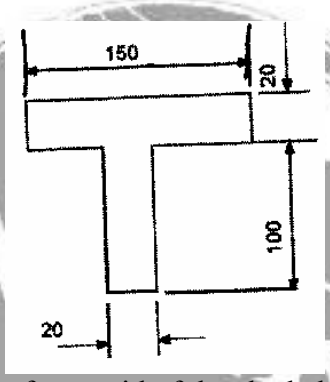
2.a) Determine tension in cable and horizontal and vertical component of reactions at pin A. The pulley P is frictionless as shown in figure.



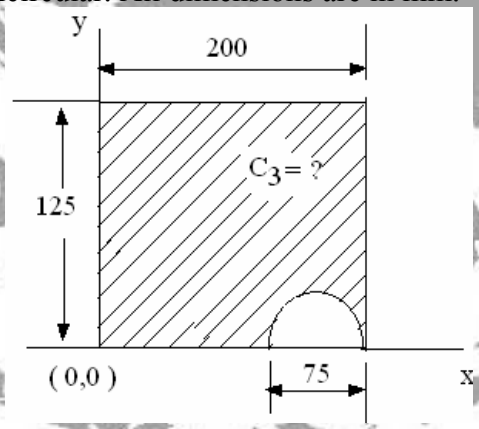
b) Determine the amount and direction of smallest force P required to start the wheel over the block. What is the reaction of the block as shown in figure? [8+7]



3.a) Find the centre of gravity of the lamina as shown in figure. All dimensions are in mm.



b) Determine the coordinates of centroid of the shaded area as shown in figure, if the area removed is semicircular. All dimensions are in mm. [7+8]

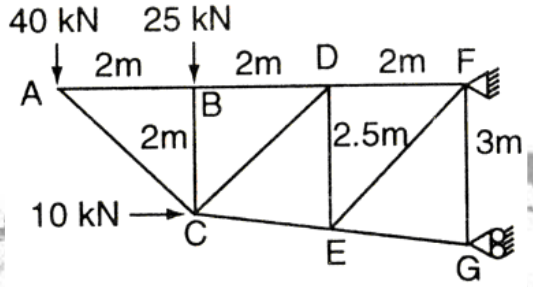


4.a) Determine the moment of Inertia of a triangle with respect to its centroidal x axis parallel to the base.

b) Determine the mass moment of inertia of a slender rod of length L and a mass 'm' with respect to an axis perpendicular to the rod and passing through one end of the rod. [7+8]

5.a) What are different types of frames? Explain with neat diagrams.

b) Find the forces in all the members of the truss shown in the figure (All forces are in kN) using method of joints. [7+8]



6.a) A ball is projected with an initial velocity of 10 m/s at an angle of 45^o with the horizontal. Find the time of flight, maximum height attained and the horizontal range.

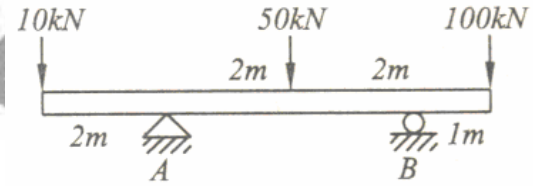
b) A projectile is fired from the edge of a 90 m high at an angle of 30^0 with the horizontal. If the velocity of projection is 120 m/s determine.

i) The horizontal distance from the point of projection to the point where it strikes the ground.

ii) The maximum height reached by the projectile above the ground. [7+8]

7. A spring is used to stop a 100 kg package which is moving down on an inclined plane and makes an angle of 25^0 with horizontal. The spring constant is k = 30 kN/m and is held by cables so that it is initially compressed by 80 mm. If the velocity of the package is 8 m/s when it is at 12.5m from the spring, determine the maximum additional deformation of the spring in bringing the package to the rest position. Assume μ = 0.30. [15]

8.a) Determine reaction at supports using the principle of virtual work.



b) Two beams AC and CD of length 9m and 10 m respectively are hinged at C. These are supported on rollers at the left and right ends (A and D). A hinged support is provided at B, 6m from A. Using the principle of virtual work, determine the reactions at the hinge C and at support B when a load of 600 N acts at a point 5 m from D. [7+8]

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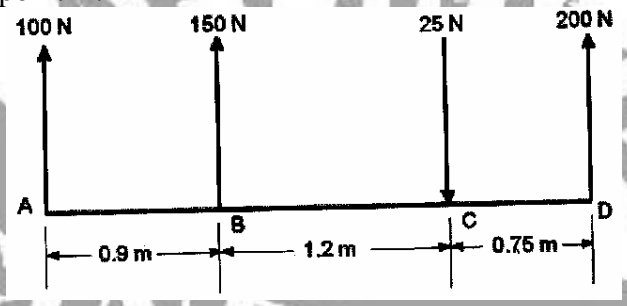
Code.No: R09A1BS05 | R09 | SET-4

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
I B.TECH – REGULAR EXAMINATIONS, JUNE - 2010
ENGINEERING MECHANICS
(COMMON TO CE, ME, CHEM, MECT, MMT, MEP, AE, AME)

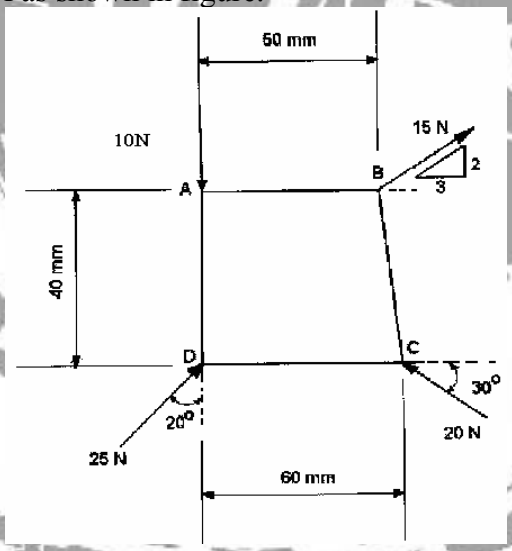
Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

1.a) Four parallel forces of magnitudes 100 N, 150 N, 25 N and 200 N are as shown in figure. Determine the magnitude of the resultant and also the distance of the resultant from point A.

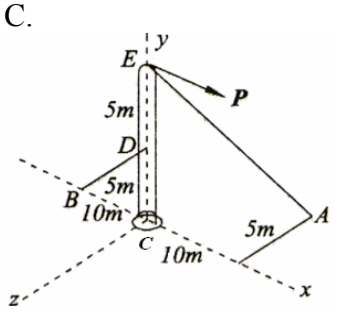


b) Replace the given system of forces acting on a body by a single force and couple acting at the point A as shown in figure. [8+7]



2.a) Write the equilibrium equations for a body in space.

b) A vertical mast CE is supported in a ball and socket joint at C by cables BD and AE as shown in figure. A pull $P = \left(400\bar{i} + 300\bar{k}\right)$ N acts at top of the mast. Find components of reaction at C. [4+11]

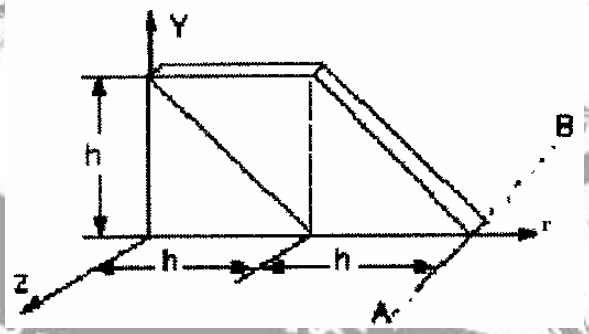


3.a) Locate the centroid of frustum of a cone of height 8 cm and having the diameter of 5 cm and 8 cm at the top and bottom of the frustum of cone respectively.

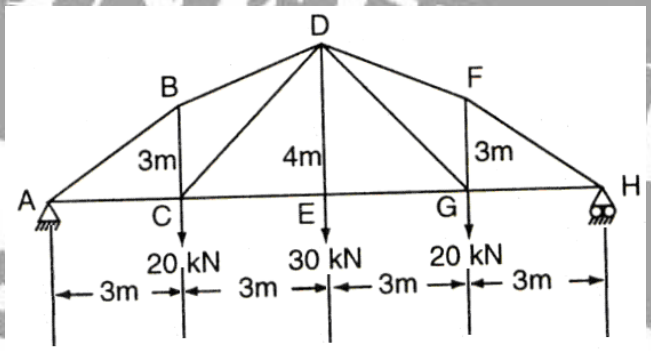
b) Locate C.G of a body formed of a solid sphere of radius 10 cm over a solid cylinder of same radius 10 cm and height 20 cm. Assume that sphere is made of steel (ρ = 7870kg/m^3) and cylinder is made of brass ρ = 8750kg/m^3). [7+8]

4.a) State and explain transfer formula for product of inertia.

b) Calculate the mass moment of inertia of thin plate shown in figure with respect to the axis A-B. Take mass of the plate as m. [6+9]



5. Find the forces in all the members of the truss shown in figure using method of sections. [15]



6. Two bodies of weights 40 N and 25 N are connected to the two ends of a light inextensible string, which passes over a smooth pulley. The weight 40 N is placed on a rough inclined plane while the weight 25 N is hanging free in air. If the angle of the plane is 15 ^{0} determine:

a) Acceleration of the system.

b) Tension in the string.(Take μ for inclined rough surfaces as 0.2).

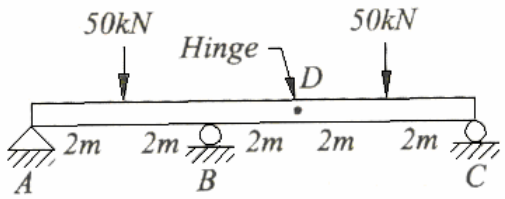
c) The distance moved by the weight 25 N in 3 seconds starting from rest. [15]

7. A grinding wheel has a rated speed of 1400 rpm and can be assumed to be a disc of 0.4 m radius and uniform thickness. It weighs 280 N. It is made to turn at 1400 rpm and then allowed to decelerate uniformly due to bearing friction. If it was allowed to come to rest in 110 seconds, find:

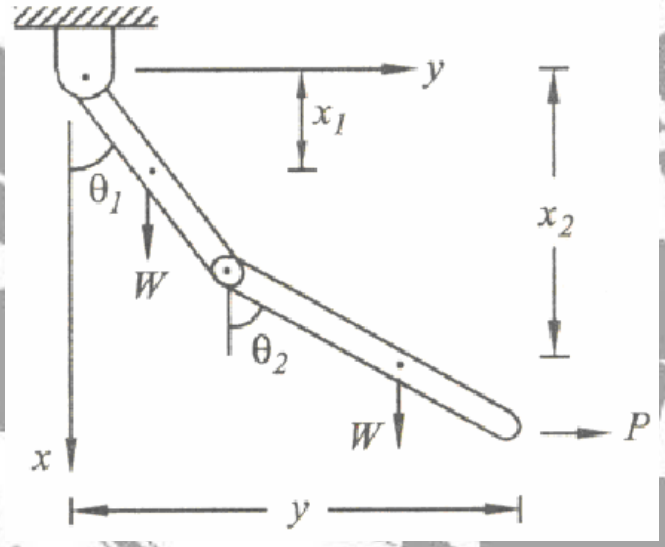
a) The number of revolution it shall execute before coming to rest.

b) The frictional torque. [15]

8.a) Determine reaction at supports as shown in fig using the principle of virtual work.



b) Two rods are connected to form a double pendulum as shown in the figure. If the weight of each rod is W and length L and if they are held in position by a horizontal force P, determine equilibrium position as defined by angle θ_1 and θ_2. [7+8]



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