Code No: R21031 **R10** SET - 1

II B. Tech I Semester Supplementary Examinations, September - 2014
ENGINEERING MECHANICS
(Com to ME, AE, AME, MM)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. A system of loads acting on a beam as shown in Figure 1. Determine the resultant of the loads and its orientation?

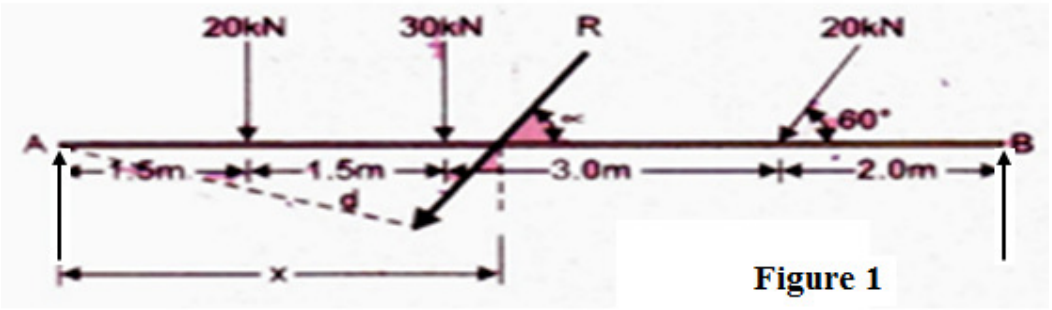

Figure 1

2. Determine the reactions at A & B of the overhanging beam as shown in Figure 2? Show the beam in equilibrium?

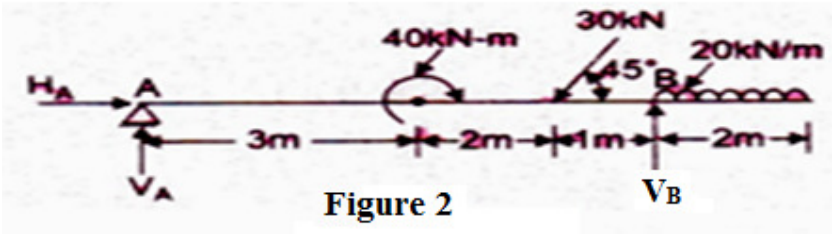

Figure 2

3. From a circular lamina of 2d, smaller circle of diameter d is removed as shown in Figure 3. Locate the centroid of the remaining area?

4. Determine the moment of Inertia of the built up section as shown in Figure 4 about its centroidal axes x-x & y-y?

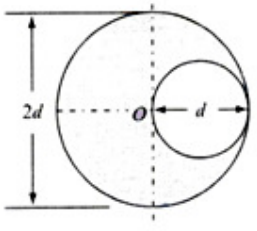

Figure 3

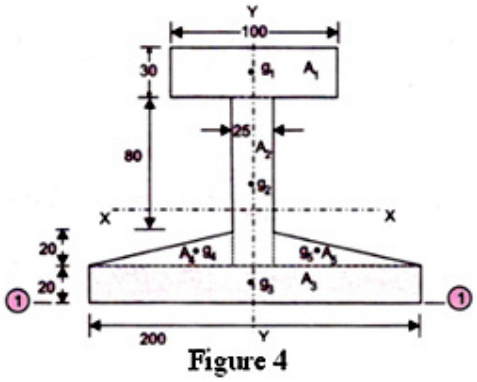

Figure 4

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5. Find the forces in the members 1, 2 and 3 of the French truss as shown in Figure 5?

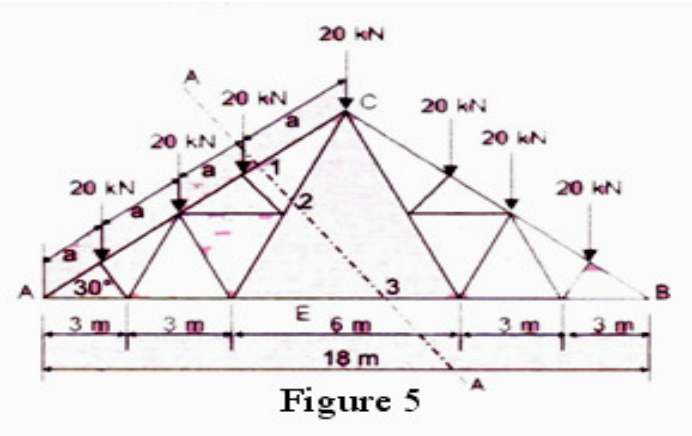

Figure 5

6. a) The rotation of the rod OA is defined by the relation $\theta=0.3\ t^2$. A Collar P slides along this rod in such a way that its distance from O is given by $r=t^3/3+2t$. In these relations θ is expressed in radians, r in centimeters and t in seconds. Determine the i) velocity of the collar, ii) the total acceleration of the collar when t=2s.
   b) A motor cycle accelerates linearly, starting with an initial acceleration of $1.5m/s^2$ to $6m/s^2$ over a distance of 50 m. find the velocity acquired and the time taken, assuming the initial velocity to be 5m/s at t=0.

7. A man of mass 75 kg and a boy of 25 kg dive off the end of the boat of the mass 20 kg so that their relative horizontal velocity with respect to the boat is 3m/s. If the boat initially at rest find its final velocity if (a) the two dive off simultaneously (b) the man dives first followed by the boy.

8. Two identical blocks A & B are connected by a rod and rest against vertical and horizontal planes, respectively, as shown in Figure 6. If sliding impends when $\theta=45^0$, determine the coefficient of friction μ, assuming it to be the same at both floor and wall.

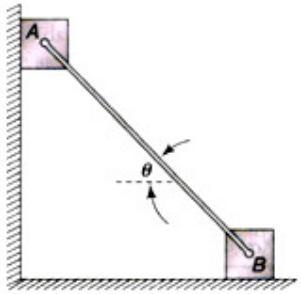

Figure 6

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II B. Tech I Semester Supplementary Examinations, September - 2014
ENGINEERING MECHANICS
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1. Describe the four fundamental principles
   a) Newton's laws of motions
   b) Newton's law of gravitation
   c) Parallelogram law for the addition of forces
   d) Principle of transmissibility of forces

2. Three cylinders are piled in a rectangular ditch as shown in Figure 1. Neglecting friction, determine the reaction between cylinders A and the vertical wall. Weights of the cylinders are 75 N, 200 N and 100 N for A, B & C respectively. Radii of the cylinders are 100mm, 150 mm and 125 mm for A, B & C respectively.

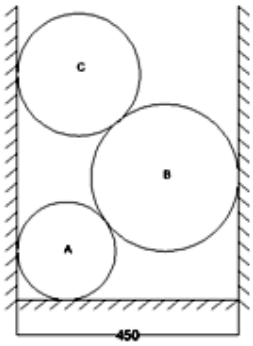

Figure 1

3. Determine the coordinates of the centroid of the plane area as shown in Figure 2, with reference to the axis shown. Take x=40mm.

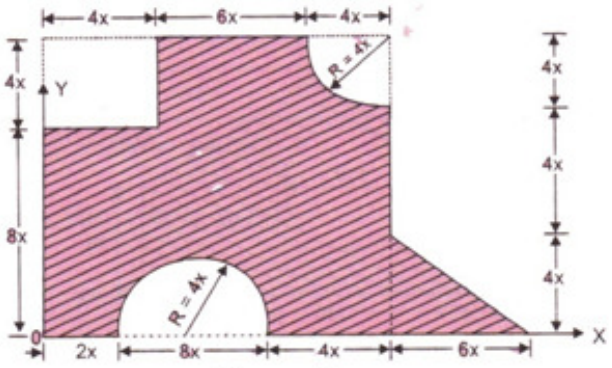

Figure 2

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4. The cross section of a cast iron beam as shown in Figure 3. Determine the moments of inertia about the centroidal axes.

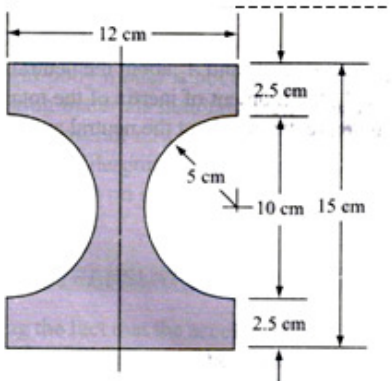

Figure 3

5. Determine the forces in the all the members of the frame as shown in Figure 4, and make an abstract of the member forced?

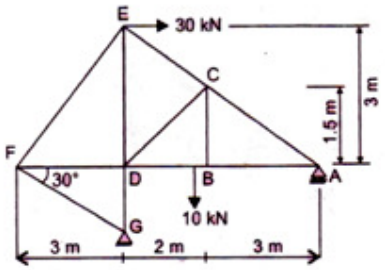

Figure 4

6. A ball of weight 10 N starts from rest from point O of a smooth vertical track and rolls down under gravity along the tract OAB shown in Figure 5. Find the reaction exerted on the ball at the point A if the curve OAB is defined by the equation $y = h \sin(\pi x/l)$. Assume $h=l/3$.

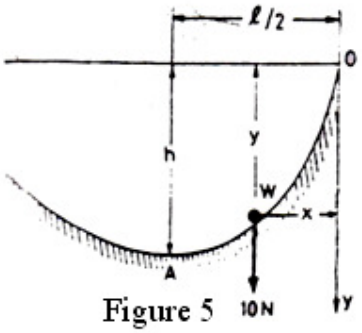

Figure 5

7. A 3000 N block starting from rest as shown in Figure 6, slides down a 50^0 incline. After moving 2m it strikes a spring whose modulus is 20N/mm. if the coefficient of friction between the block and the incline is 0.2, determine the maximum deformation of the spring and the maximum velocity.

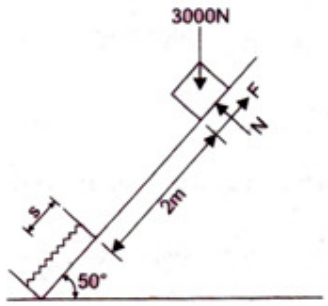

Figure 6

8. Coefficients of frictions are as follows: 0.25 at the floor, 0.3 at the wall, and 0.2 between blocks as referred figure 7. Find the minimum value of a horizontal force P applied to the lower block that will hold the system in equilibrium.

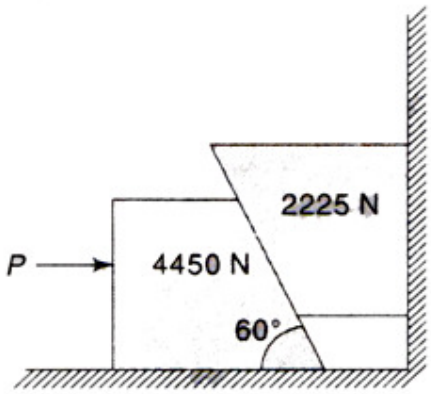

Figure 7

Code No: R21031 **R10** SET - 3

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ENGINEERING MECHANICS
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1. To move a boat uniformly along a canal at a given speed requires a resultant force R=1780N. This is accomplished by two horses pulling with forces P & Q on two ropes as shown in figure 1. If the angles that the two ropes make with the axis of the canal are $\beta=35^0$ & $\gamma=25^0$, what are the corresponding tensions in the rope.

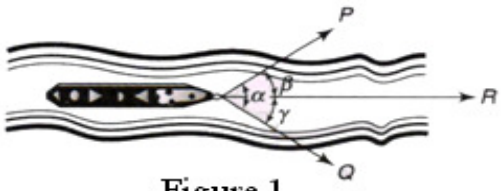

Figure 1

2. Three beams AB, BC and CD are hinged at their ends and loaded and supported as shown in Figure 2. Determine the reaction at points A, E, F & D.

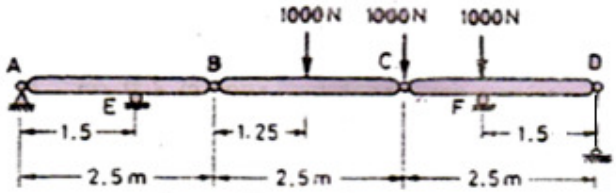

Figure 2

3. Determine the centroid of the shaded area which is bounded by straight line and a circular arc as shown in Figure 3.

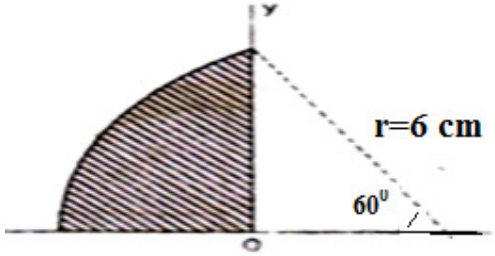

Figure 3
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4. Find the moment of inertia of the shaded area with respect to the centroidal axis parallel to AB Figure 4.

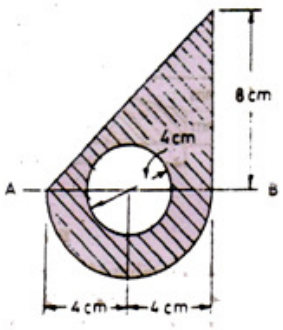

Figure 4

5. A truss is loaded and supported as shown in Figure 5. Find out the members in which the axial forces are zero.

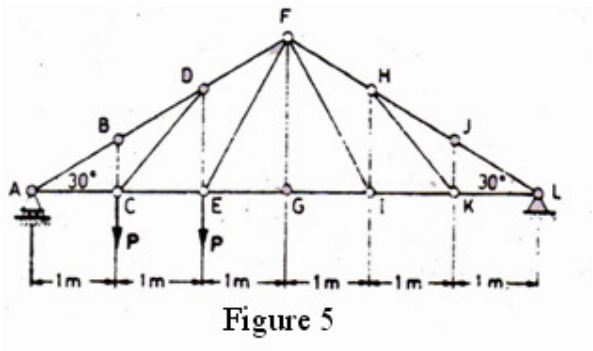

Figure 5

6. The composite pulley shown in figure weighs 800 N and has a radius of gyration of 0.6m. The 2000 N & 4000 N blocks are attached to the pulley by inextensible strings as shown in Figure 6. Determine the tensions in the strings and angular acceleration of the pulley.

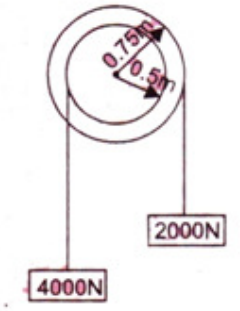

Figure 6

7. Determine the distance that Block A must move in order to reach velocity of 3m/sec, as shown in Figure 7. What is the acceleration of the system? Take coefficient of friction between the block and the plane as 0.2. Use work energy method. The radius of roller is 0.15 m.

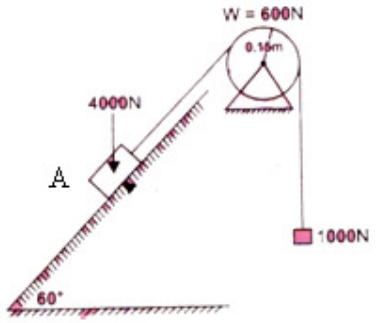

Figure 7

8. Two rough planes inclined at 30^0 and 60^0 to the horizontal are placed back to back as shown in Figure 8. The blocks of weights 50N & 100N are placed on the faces and are connected by a string running parallel to planes and passing over a frictionless pulley. If the coefficient of friction between planes and blocks is 1/3, find the resulting acceleration and tension in the string.

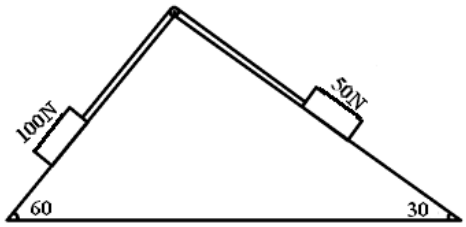

Figure 8

Code No: R21031 **R10** SET - 4

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ENGINEERING MECHANICS
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1. Find the magnitude of resultant and orientation of coplanar concurrent forces acting at a point O shown in Figure 1.

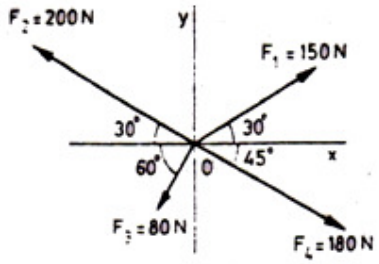

Figure 1

2. a) Define Moment of a force about a point? Given any two application related to it?
   b) Calculate the magnitude of resultant force acting at point A for the Figure 2 given below?

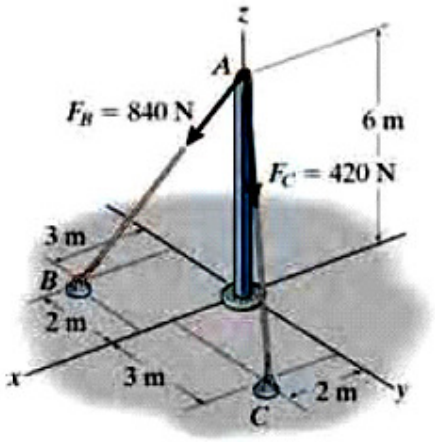

Figure 2

3. Locate the centroid of the plane area as shown in Figure 3.

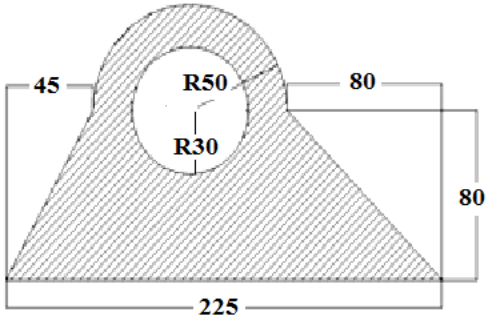

Figure 3

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4. Determine the moment of inertia of the shaded area about the x-axis & the y-axis in Figure 4.

5. A roof truss is supported and loaded as shown in Figure 5. Find the axial force in the members BD & CF.

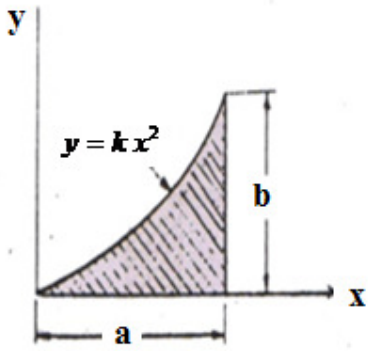

Figure 4

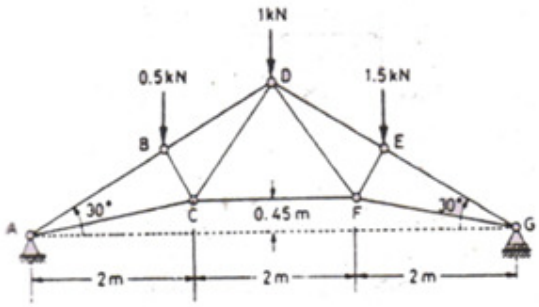

Figure 5

6. If the system in the Figure 6 is released from rest, find the velocity V of the block Q after it falls a distance h=3m. Neglect friction and inertia of the pulleys and assume that P=Q=44.5 N.

7. The system shown in Figure 7 has a rightward velocity of 3 m/sec. Determine its velocity after 5 sec. Take μ=0.2 for the surfaces in contact. Assume pulleys to be frictionless.

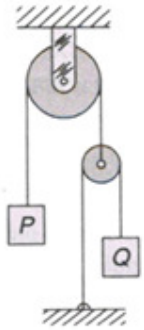

Figure 6

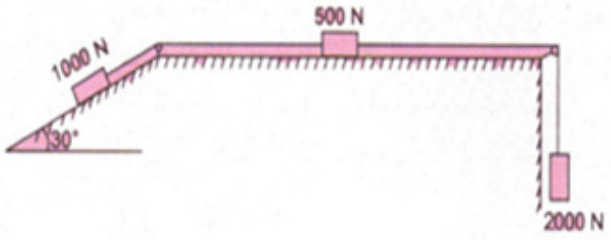

Figure 7

8. A block weighing 2500 N rests on a level horizontal plane which has coefficient of friction 0.2. This block is pulled by a force of 1000N, which is acting at an angle of 30^0 to the horizontal. Find the velocity of the block, after it moves 30m, starting from rest. If the force of 1000N is then removed, how much further it will move.