Code No: R19ES1104 **R19** SET - 1

I B. Tech I Semester Regular Examinations, January - 2020
ENGINEERING MECHANICS
(Com. to CE, Auto E, Min E**)**

Time: 3 hours Max. Marks: 75

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

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1. a) Write various laws of friction. (7M)

   b) Three forces of magnitude 40 kN, 15kN and 20 kN are acting at a point O. the angles made by 40kN, 15kN and 20kN forces with X-axis are 60^o, 120^o and 240^o respectively. Determine the magnitude and direction of the resultant force. (8M)

Or

2. a) For what value of the pull P in the system shown in figure.1. The motion will impend? Assume the pulley to be smooth and μ=0.30 between other surfaces in contact. (12M)

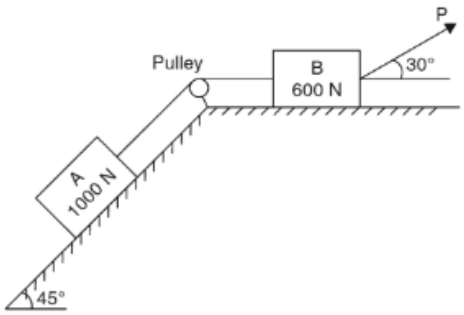

Figure.1

   b) What you meant by co-planer, concurrent, and collinear force? What is the condition of equilibrium for two such forces? (3M)

3. Two smooth circular cylinders, each of weight W = 1000N and radius 15cm, are connected at their centres by a string AB of length=40cm and rest upon a horizontal plane, supporting above them a third cylinder of weight=2000N and a radius 15cm as shown in figure.2. Find the force S in the string AB and pressure produced on the floor at the points of contact D and E. (15M)

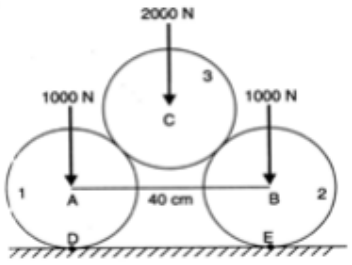

Figure.2

Or
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4. a) Block P =5 Kg and Block Q of mass m kg is suspended through the chord is in the equilibrium position as shown in figure. 3. Determine the mass of block Q. (10M)

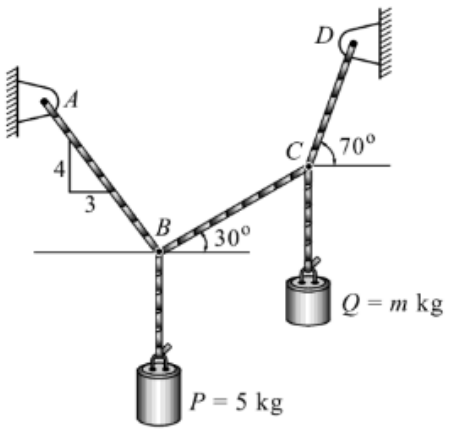

Figure.3

b) With sketches, explain different types of support and mark reaction lines. (5M)

5. a) Find the centroid of the plane uniform lamina shown in following figure.4 (10M)

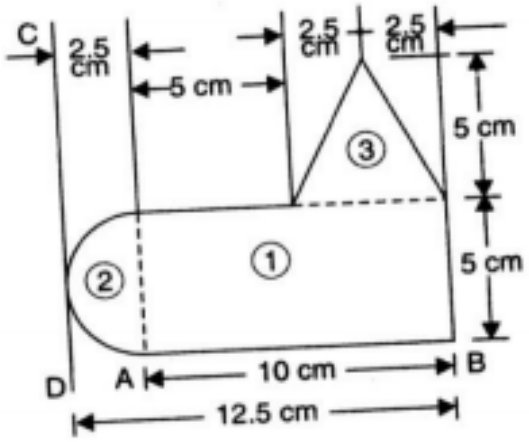

Figure.4

b) Using Pappus and Guldnus theorem compute the surface area and volume of a sphere of radius r. (5M)

Or

||''|''||''||''''''|

6. a) Find out the CG of the hatched area formed by the eliminating a square with 40 mm sides from that of a quarter of a circle with 80 mm radius as shown in figure.5. (10M)

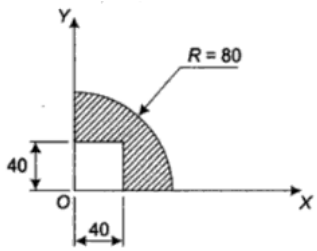

Figure.5

b) Differentiate between centriod and center of gravity. Under what conditions these will coincide? (5M)

7. Determine the product of inertia of the cross hatched area with respect to the x and y axes shown in figure.6. (15M)

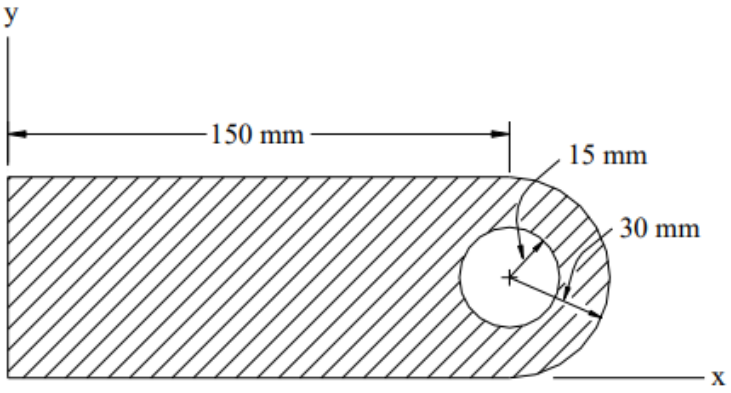

Figure.6

Or

8. a) Determine the mass moment of inertia of the frustum of the cone which has conical depression about its vertical geometric axis as shown in figure 7. Assume density of material as 7850 kg/m^3 (8M)

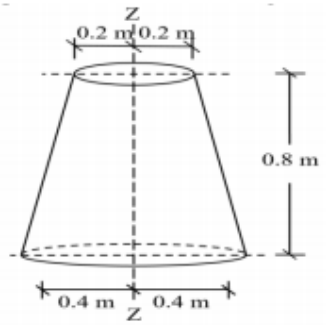

Figure.7

b) Determine the mass moment of inertia of a solid cylinder of radius 'R' and length 'L' about its centroidal axis. (7M)

9. a) Explain the following terms with respect to a projectile: (6M)
(i) Horizontal range (ii) Maximum height (iii) Time of flight

b) A stone is thrown vertically upwards with a velocity of 19.6m/s from the top of a tower 24.5m high. Calculate: (9M)
(i) Time required for the stone to reach the ground.
(ii) Velocity of the stone in its downward travel at the point in the same level as the point of projection.
(iii) The maximum height to which the stone will rise in its flight.

Or

10. a) Explain the impulse-momentum principle and its applications. (8M)

b) A particle moves along a straight line so that its displacement in metres from a fixed point is $S= t^3+3t^2+ 4t + 5$. Find the acceleration after 4 seconds. (7M)

Code No: R19ES1104 **R19** SET - 2

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ENGINEERING MECHANICS
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Time: 3 hours Max. Marks: 75

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

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1. a) Describe the methods of resolution of forces. (7M)
   b) Determine the resultant of the concurrent forces shown in figure.1. (8M)

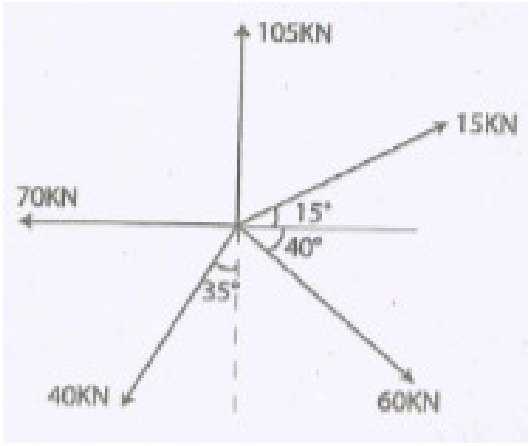

Figure.1

Or

2. a) Two blocks A and B of weights 1 kN and 2 kN, respectively are in equilibrium position as shown in figure.2 if coefficient of friction between the two blocks as well as the block B and the floor is 0.3, find the force P required to move the block B. Also find the force in the string. (10M)

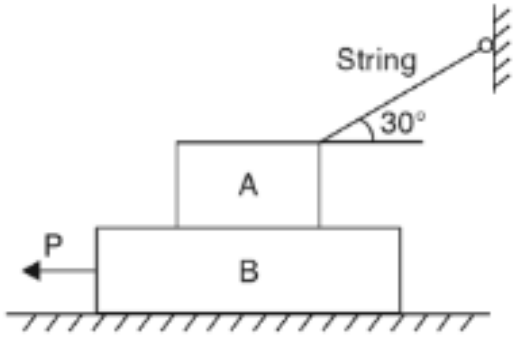

Figure.2

   b) State and explain law of parallelogram of forces. (5M)

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3. a) Calculate the support reactions for the beam shown in figure.3. (7M)

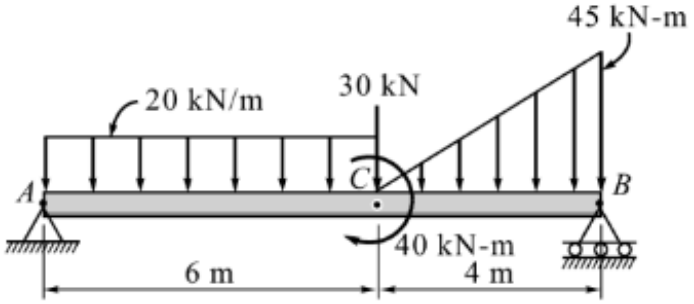

Figure.3

b) Briefly discuss about Converse of the law of Triangle of forces? (8M)

Or

4. a) Explain different types of loadings on beams. (5M)

b) Three cables AB, AC and AD hold down a balloon as shown in figure.4 Find vertical force exerted at the base of balloon A, knowing that tension in cable AB is 259 N. (10M)

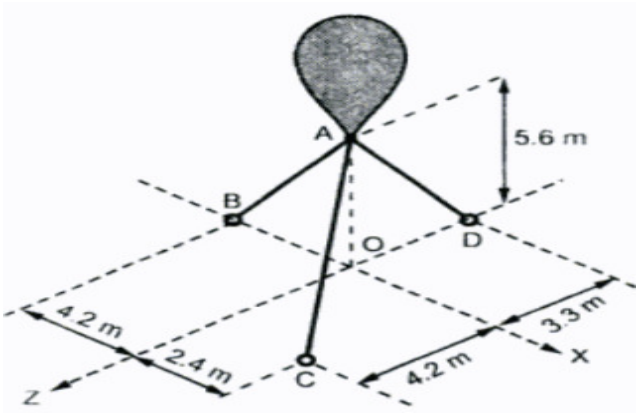

Figure.4

5. a) Locate the centroid of the composite as shown in figure.5 (10M)

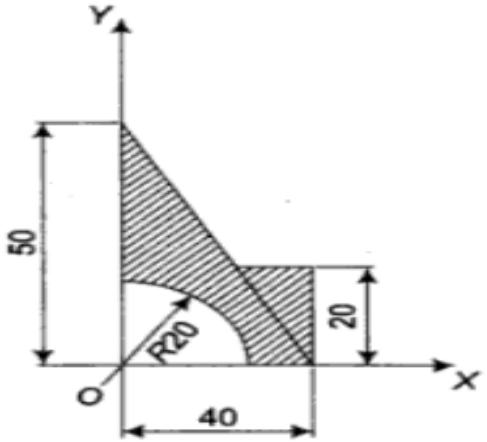

Figure.5

b) Using Pappus and Guldinus theorem, compute the volume of a right circular cone of height h and base radius r. (5M)

Or

6. a) What is limiting friction? State the laws of friction. (5M)

b) Find out the CG of an "I" section as shown in figure. 6 (10M)

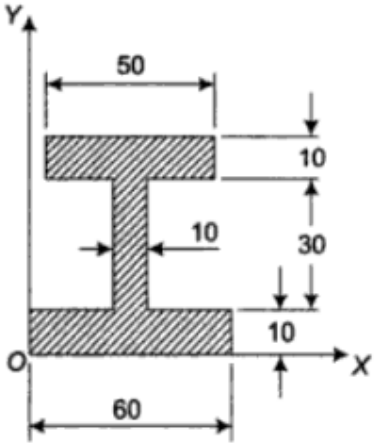

Figure.6

7. a) Determine the product of inertia of the crosshatched region with respect to the x and y axes shown in figure.7 (8M)

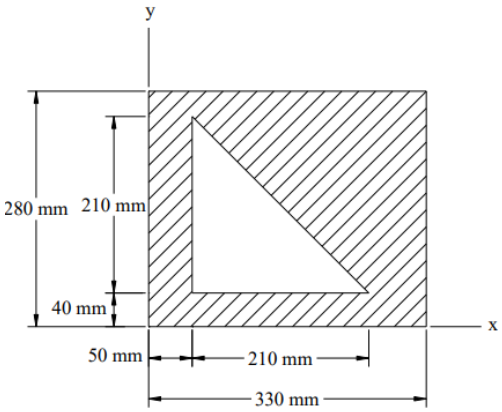

Figure.7

b) Derive an expression for the moment of inertia of triangular section about an axis passing through the C.G of the section and parallel to the base. (7M)

Or

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8. Find the mass moment of inertial of the rectangular block shown in figure.8, about the vertical y axis. A cuboid of 20 mm x 20 mm x 20 mm has been removed from the rectangular block as shown in figure.8. The mass density of the material of the block is 7850 kg/m^3. (15M)

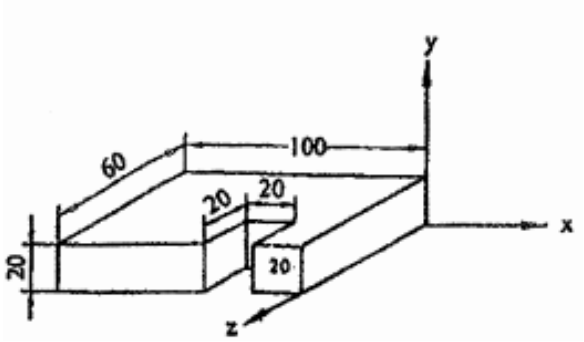

Figure.8

9. a) A body moves along a straight line so that its displacement from a fixed point on the line is given by $s = 4t^3 - 6t^2 + 20$. Find the displacement, velocity and acceleration at the end of 3 seconds. (8M)

b) What is meant by instantaneous center of rotation? How can it be located for a body moving with combine motion of rotation and translation? (7M)

Or

10. a) Distinguish between rectilinear motion and curvilinear motion giving at least two examples. (5M)

b) A bullet of mass 80 gm, moving at a velocity of 300 m/s is fired into a log of wood. The bullet penetrates to a depth of 50cm. If the bullet is fired into a similar piece of wood 30cm thick, with what velocity would the bullet emerge? Find also force of resistance assuming it to be uniform in both cases. (10M)

Code No: R19ES1104 **R19** SET - 3

I B. Tech I Semester Regular Examinations, January - 2020
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Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
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1. a) A coplanar force system consists of five forces keeps the body in equilibrium. Find the resultant force 'F' of the force system, if the other four forces are shown in figure.1. (8M)

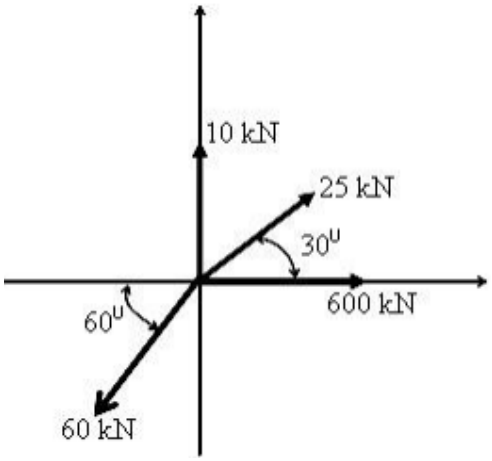

Figure.1

b) State and explain the laws of static friction. (7M)

Or

2. a) Figure.2 shows a block A weighting 160 N rests on a rough plane inclined at 60^0C to the horizontal. Block A is connected to block B weighting 450N resting on a rough horizontal plane by a rigid bar of negligible weight. Find the horizontal force P required for the motion of the blocks to just begin. Take μ=0.25. (10M)

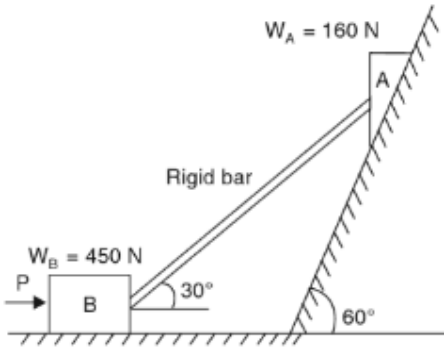

Figure.2

b) Derive the expression for finding resultant of two forces acting at a point. (5M)

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Code No: R19ES1104 **R19** SET - 3

3. a) Determine the reactions at supports A and B for the loaded beam as shown in figure.3. (8M)

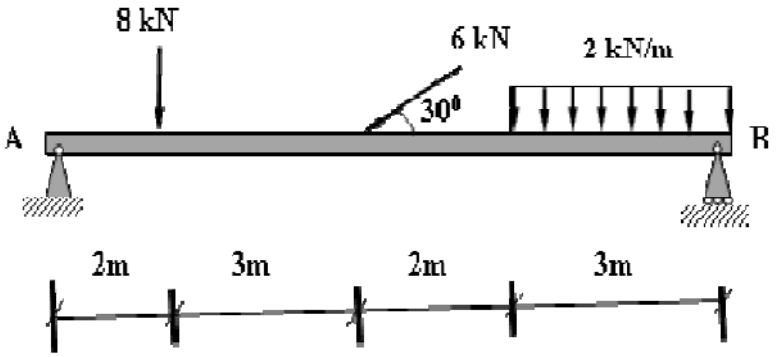

Figure.3

b) State and prove lami's theorem. (7M)

Or

4. A tripod is acted upon by forces at 'p' as follows: 20 kN along positive x direction, 40 kN along the negative y direction. The three legs rest on ground at points A (-4, 0, 0) , B (5,0,2) and C(-2,0,-3). Height of 'p' above origin is 10m. Coordinates of P(0,10,0). Find the forces in legs of tripod. (15M)

5. a) A semi circular area is removed from the trapezium as shown in the figure.4 Determine the centroid of the remaining shaded area. (All dimensions in mm). (10M)

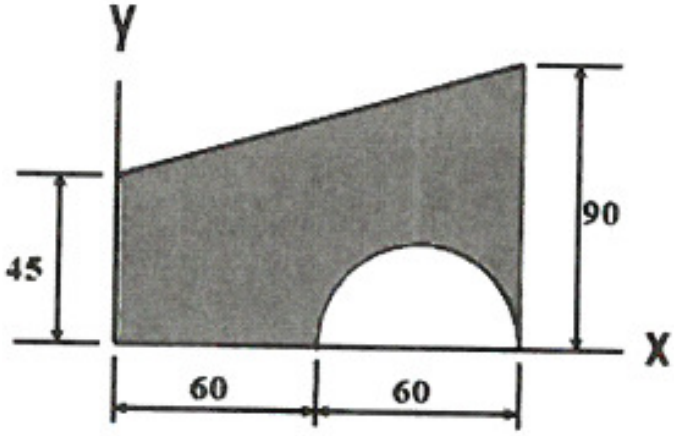

Figure.4

b) State Pappus & Guldinus theorems I and II and prove them. (5M)

Or

||"|"||"||""""|

6. a) A small block of weight 1000N is placed on a 30^0 incline with a coefficient of friction at 0.25 as shown in figure.5 Determine the horizontal force to be applied for: (10M)
   (i) The impending motion down the plane
   (ii) The impending motion up the plane

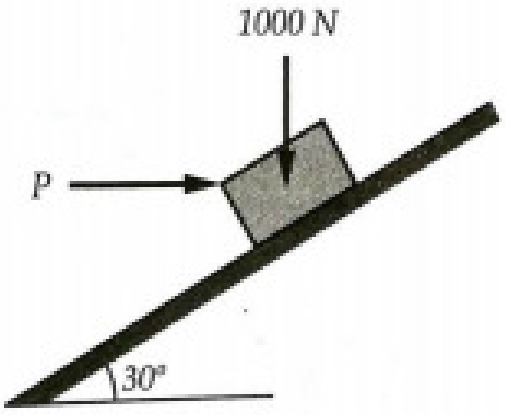

Figure.5

b) What is center of gravity? Does it differ from center of mass? If yes, under what condition? When did the term centroid get more relevance? (5M)

7. a) State and prove perpendicular axis theorem. (7M)

b) Calculate the moment of inertia of angle section about y axis as shown in figure.6 (8M)

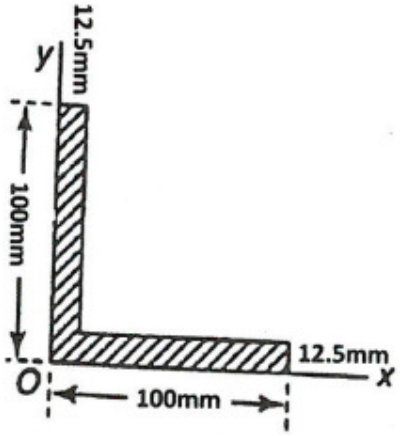

Figure.6

Or

8. A brass cone is mounted on top of aluminum cylinder as shown in figure.7. The density of brass is 8500 kg/m^3 and that of aluminum is 2560 kg/m3. Determine the mass moment of inertia of the system about it its vertical geometric axis 'zz'. (15M)

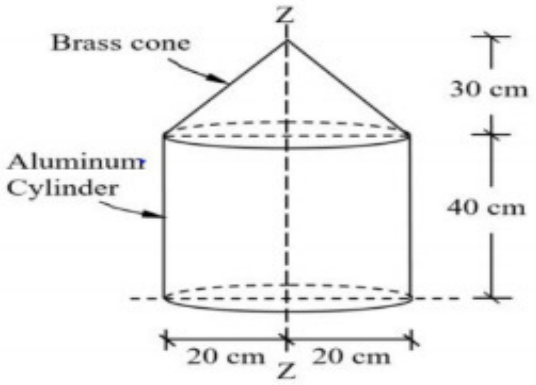

Figure.7

9. Two cars are travelling towards each other on a single lane road at the velocities 12 m/sec and 9 m/sec. respectively. When 100 m apart, both drivers realize the situation and apply their brakes. They succeed in stopping simultaneously and just short of colliding. Assume constant deceleration for each case determines. (15M)
(i) Time required for cars to stop
(ii) Deceleration of each car and
(iii) The distance travelled by each car while slowing down.

Or

10 a) Explain D' Alembert's principle. (7M)

.

b) Obtain expressions for time of flight, horizontal range and maximum height reached by a projectile. (8M)

Code No: R19ES1104 **R19** SET - 4

I B. Tech I Semester Regular Examinations, January - 2020
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Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
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1. a) Find the resultant of a system of force as shown in figure.1 (7M)

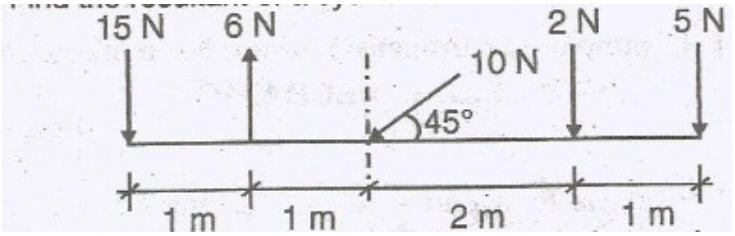

Figure.1

b) Define the terms: (i) Friction (ii) limiting force of friction (iii) coefficient of friction (iv) angle of friction. (8M)

Or

2. a) Bodies A and B are joined by a cord parallel to the inclined plane as shown in figure.2.Under body A which weighs 300 N, $\mu = 0.20$ while $\mu = 0.50$ under body B which weighs 300 N. Determine the angle Θ at which motion impends. What is then the tension in the cord? (10M)

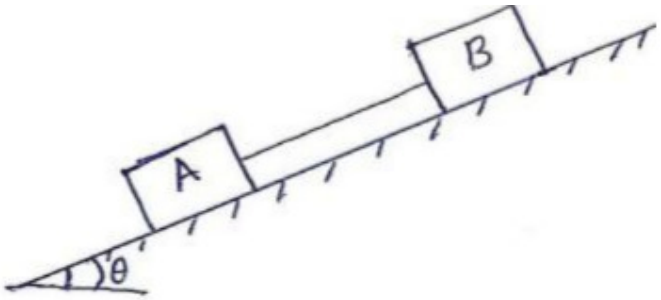

Figure.2

b) Discuss various coplanar force systems. (5M)

3. If in the figure.3, the force P is applied horizontally at the center of the roller, what would be the magnitude of this force? Also determine the least force and its line of action at the roller center, for turning the roller over the rectangular block. (15M)

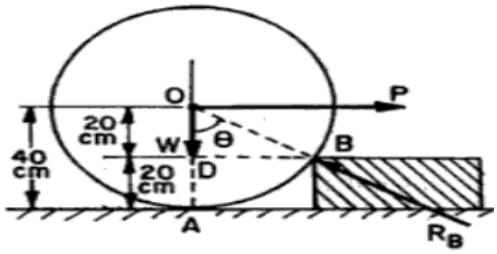

Figure.3

Or

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Code No: R19ES1104 **R19** SET - 4

4. a) Determine the reactions developed in the simply supported beam as shown in figure.4. Neglecting the self weight of the beam. (10M)

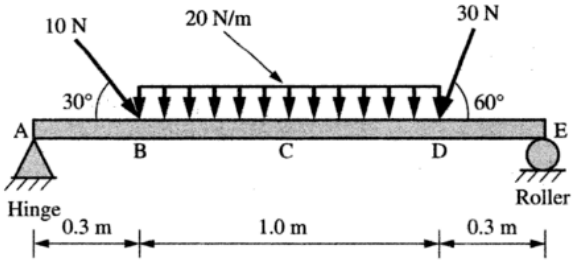

Figure.4

b) State the graphical conditions that must be satisfied for the equilibrium of a system of coplanar forces. (5M)

5. a) Determine the coordinates of the centroid of the following shaded area in figure.5 (10M)

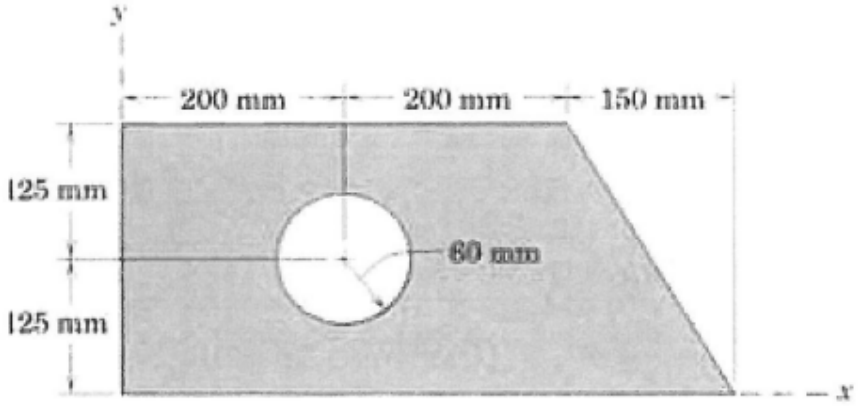

Figure.5

b) With sketch explain cone of friction. (5M)

Or

6 Find the centroid of the following figure.6. (15M)

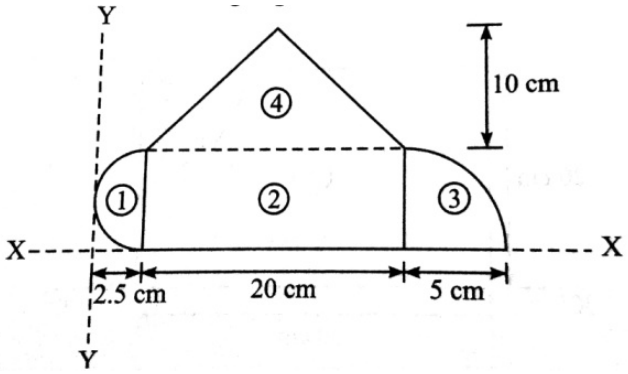

Figure.6

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7. Find the area moment of inertia for the angle section as shown in figure.7 (15M)

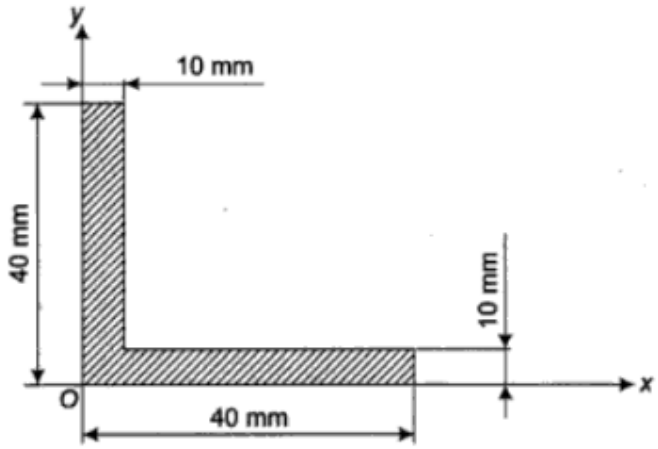

Figure.7

Or

8. a) Determine the mass moment of inertia of rectangular plate from basic principles. (7M)

   b) Find the moment of inertia of plate with a circular hole shown in figure.8 about the centroidal axis and about the base. (8M)

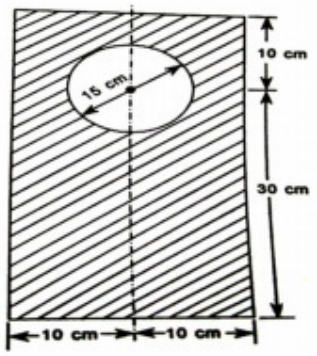

Figure.8

9. a) A block of mass 5kg slides 4m down a 30^0 inclined plane from rest and enters a horizontal plane. How far along the horizontal plane will it reach before coming to rest? The coefficient of kinetic friction between block and incline is 0.15 and between block and horizontal plane is 0.20. Solve using Work–energy principle. (8M)

   b) What are the advantages of Work–Energy method over Alembert's method? Discuss. (7M)

Or

10. The position of the particle which moves along a straight line is defined by $x= 2t^3-t^2-2t+4$ where x in m, t is in sec. Determine the following: (15M)
    (i) The time at which the velocity will be zero
    (ii) The position and distance travelled by the particle at that time.
    (iii) Acceleration of the particle at that time.
    (iv) The distance travelled by the particle from t= 3sec and t=5 sec.