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Code No: R21011 **R10** SET - 1

II B. Tech I Semester, Regular Examinations, Nov – 2012
MECHANICS OF MATERIALS
(Civil Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) Explain classification of Force System

   b) Two forces P and Q are acting at a point O as shown in Figure 1. The force P=250N and force Q= 200N. If the resultant is equal to 400N then find the value of the angles α (BOA), β BOC), and γ (COA)

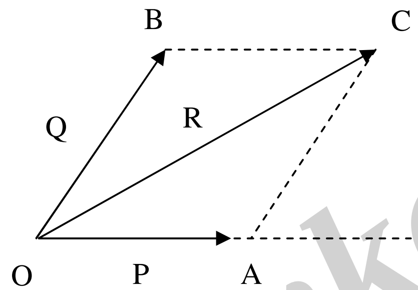

Figure 1

2. A stone block of weight 1500N is to be slid over a concrete floor, ties a rope to the block and pulls it in a direction inclined upward at an angle 22^0 to the horizontal. Calculate the maximum pull necessary to slide the block if the co-efficient of friction, μ=0.6. Calculate also pull required if the inclination of the rope with horizontal is equal to the angle of friction and prove that this is the least force required to slide the block.

3. a) Explain open belt drive.

   b) A shaft running at 220r.p.m is to drive a parallel shaft at 300 r.p.m. the pulley on the driving shaft is 60cm diameter. Calculate the diameter of the pulley on the drive shaft

   i) Neglecting belt thickness ii) taking belt thickness into account, which is 4mm thick

   iii) Assuming in later case a total slip of 4%.

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4. Find the Center of gravity of the I Section Shown in Figure 2.

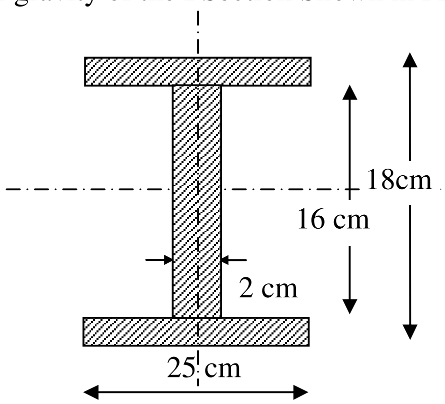

Figure 2

5. A steel bar of 30 mm diameter was subjected to a tensile load of 12×10^4 N. The extension in a length of 250mm was found to be 12mm. Find the young's modulus and modulus of rigidity and also the reduction in diameter. Assume poissons ratio as 0.30

6. Draw the shearing force and bending moment diagrams for the beam in Figure 3 and identify salient features.

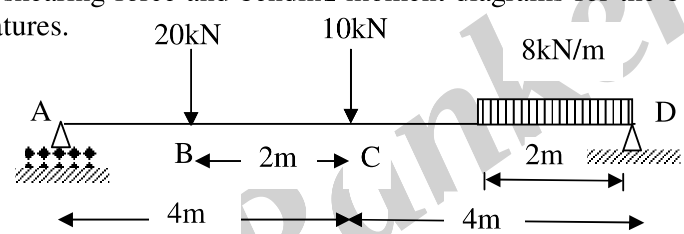

Figure 3

7. A symmetrical I section of size 180mm × 400mm, 8mm thick is strengthened with 240mm × 10mm rectangular plate on top flange as shown in Figure 4. If the permissible stress in the material is 150N/mm^2, determine how much concentrated load the beam of this section can carry at centre of 4m span. Give and of the beam are simple supported

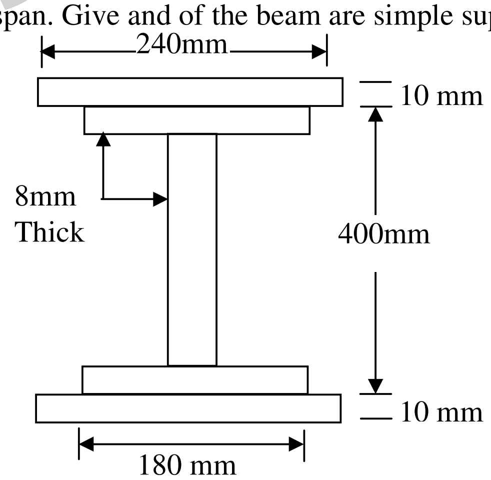

Figure 4

8. a) A rolled steel joist 550mm by 200mm having flange and web thickness 15mm and 10mm respectively is used as a beam. If at a section, it is subjected to a shear force of 100kN find the greatest intensity of shear stress in beam taking a) web vertically b) web horizontally.
   b) State the assumption in theory of shear and derive the governing formula.

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MECHANICS OF MATERIALS
(Civil Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
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1. a) Explain principle of moments
   b) Four parallel forces of magnitude 100N, 150N, 25N and 250N are shown in Figure 1. Determine the magnitude of the resultant and also the distance of the resultant from point A.

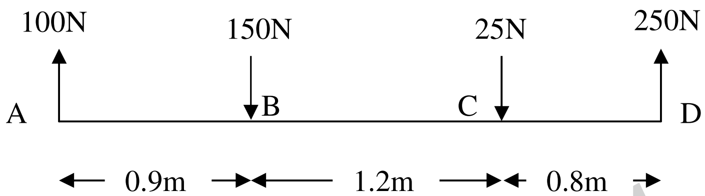

Figure 1

2. a) A 108 N block is held on a 40^0 incline by a bar attached to a 150 N block on a horizontal plane as shown in Figure 2. The bar which is fastened by smooth pins at each end, is inclined 20^0 to the horizontal. The coefficient of friction between each block and its plane is 0.325 for what horizontal force, P, applied to 150N block will motion to the right be un pending?

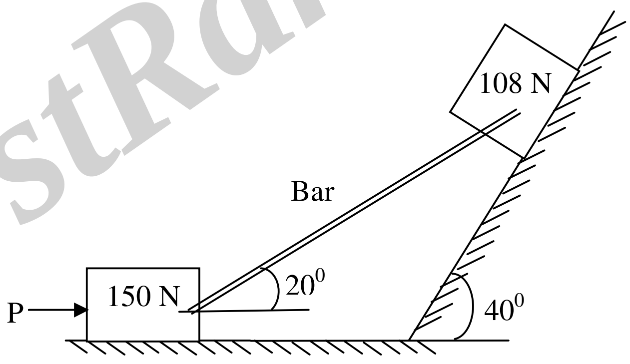

Figure 2

   b) A block weighing 100N is resting on a rough plane inclined 20^0 to the horizontal. If is acted upon by a force of 50N directed upward at angle of 14^0 to the above plane. Determine the friction. If the block is about to move up the plane, determine the coefficient of friction

3. a) Explain cross belt drive.
   b) The power is transmitted from a pulley 1.2 m diameter running at 200 r.p.m to a pulley 2.4m diameter by means of belt. Find speed lost by the driven pulley as a result of the creep, if the stress on the tight and slack side of the belt is 1.5 N/mm^2 and 0.5 N/mm^2 respectively. The young's modulus for the material of the belt is 110 N/mm^2.

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4. Find the Center of gravity of the I Section Shown in Figure 3.

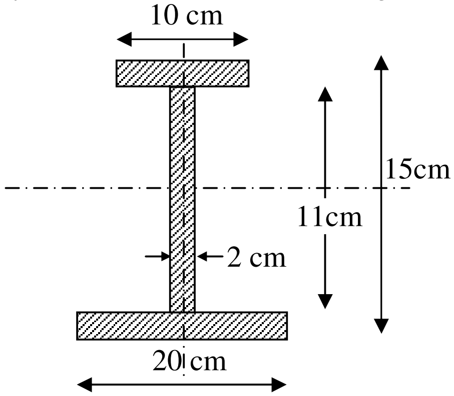

Figure 3

5. a) Derive relation between young's modulus and bulk modulus
   b) Explain simple and complimentary shear stresses with neat sketches.
   c) Two parallel walls 6 m apart are stayed together by a steel rod of 30mm diameter and is connected at each ends by nuts. The nuts are tightened when the rod is at a temperature of 100^0C. Determine the stresses in rod when the temperature falls down to 18^0C and the ends do not yield. Take E= 2.0×10^5 N/mm^2 and $\alpha = 12 \times 10^{-6}$ N/mm^2

6. Draw Shear forces and bending moment diagrams for the beam in Figure 4. Indicate the numerical values at all important sections.

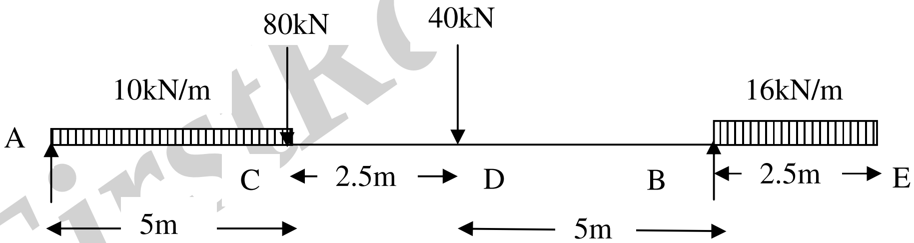

Figure 4

7. a) State the assumptions of the theory of simple bending and derive the governing formula.
   b) A test beam 30mm square in section is broken by a load of 2kN applied at the center of a span of 1.2meter. Using the factor of safety of 8, calculate the safe uniformly distributed load for a beam 100mm wide and 300mm deep of same material and freely supported over a span of 4.5m.

8. a) State the assumption in theory of shear and derive the governing formula.
   b) The section of the beam is an isosceles triangle with base of 300mm and side angles 30 degrees. It is used with the base horizontal and caries a shear force of 50 kN at a section. Find the magnitude of the maximum shear intensity at the section and the shear intensity at neutral axis.

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Answer any **FIVE** Questions
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1. a) Explain classification of Force System
   b) Two forces P and Q are acting at a point O as shown in Figure 1. The force P=250N and force Q= 120N. If the resultant is equal to 350N then find the value of the angles α (BOA), β BOC), and γ (COA)

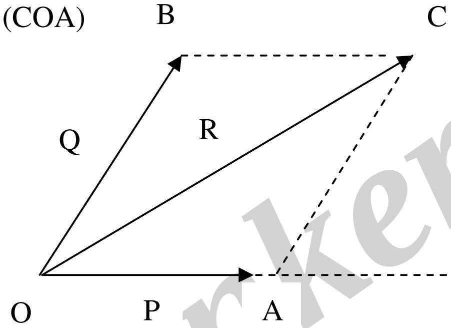

Figure 1

2. a) Explain analysis of ladder friction
   b) A uniform ladder of length 10m and weighing 20N is placed against a smooth vertical wall with its lower end 9m from the wall. In this position the ladder is just to slip. Determine (i) the coefficient of friction between the ladder and the floor and (ii) frictional force acting on the ladder at the point of contact between ladder and floor.

3. a) Explain compound belt drive.
   b) With the help of a belt, an engine running at 225r.p.m. drives a line shaft. The diameter of the pulley on the engine is 75cm and the diameter of the pulley on the line shaft is 40cm. A 100cm diameter pulley on the line shaft drives a 25cm diameter pulley keyed to a dynamo shaft. Find the speed of the dynamo shaft when i) there is no slip ii) there is a slip of 2% at each drive

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4. Find the Center of gravity of the C Section Shown in Figure 2. With reference to give axises

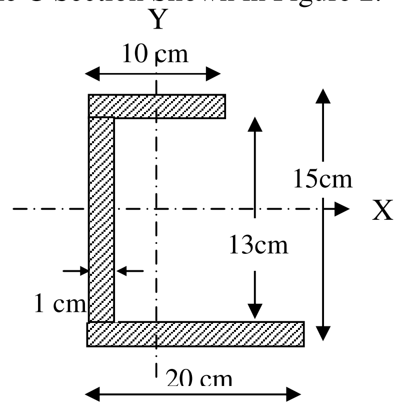

Figure 2

5. a) Sketch load deflection curve obtained from tension test on mild steel specimen, locate sailent points.
   b) In a tension test equipment a steel bar of 25mm diameter was subjected to a tensile load of 8×10^4 N. The extension in a length of 300mm was found to be 5mm. Find the young's modulus and modulus of rigidity and also the reduction in diameter. Assume poissons ratio as 0.30

6. Draw the shearing force and bending moment diagrams for the beam in Figure 3.

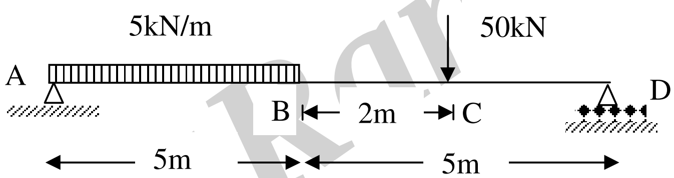

Figure 3

7. a) State the assumption in theory of simple bending and derive the governing formula.
   b) A timber beam of depth 150mm and width 75mm is reinforced with steel plates of 10mm thick along the longer sides. If bending stresses in the composite beam are to be limited to 100 N/mm^2 in steel and $8N/mm^2$ in the timber, estimate the maximum permissible bending moment in the beam. Assume E for steel to be 20 times E for timber.

8. The un symmetric I section shown in Figure 4 is the cross section of a beam, which is subjected to a shear force of 60 kN. Draw the shear stress variation diagram across the depth.

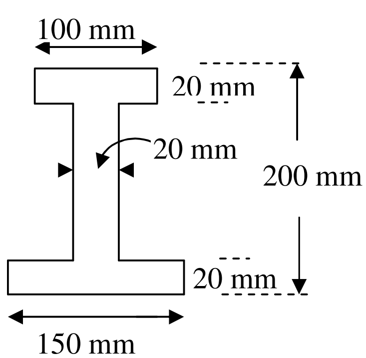

Figure 4

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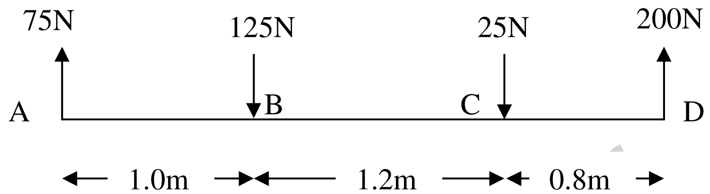
1. a) Explain principle of moments.
   b) Four parallel forces of magnitude 75N, 125N, 25N and 200N are in figure. Determine the magnitude of the resultant and also the distance of the resultant from point A.



2. A uniform ladder of length 12m and weighing 25N is placed against a smooth vertical wall with its lower end 5m from the wall. The coefficient of friction between the ladder and the floor is 0.28. Verify if the ladder remain in equilibrium in this position. What is the frictional force acting on the ladder at the point of contact between the ladder and floor?

3. a) Explain open belt driver.
   b) The power is transmitted from a pulley 1.2 m diameter running at 200 r.p.m to a pulley 2.5m diameter by means of belt. Find speed lost by the driven pulley as a result of the creep, if the stress on the tight and slack side of the belt is 1.5 N/mm^2 and 0.5 N/mm^2 respectively. The young's modulus for the material of the belt is 100 N/mm^2.

4. Find the Center of gravity of the L Section Shown in Figure 2.

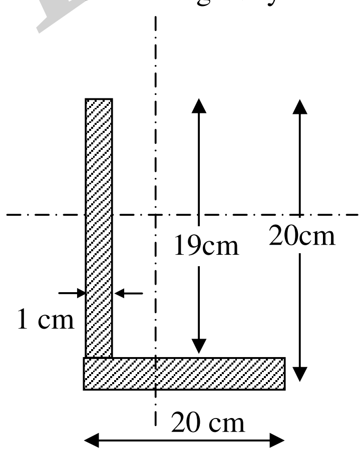


Figure 2

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5. a) Derive relation between young's modulus and bulk modulus

   b) Three bars made of Copper, Zinc and Aluminum are equal length and have cross sectional areas of 250, 500 and 750 mm^2 respectively. They are rigidly connected at their ends. If compound member is subjected to a longitudinal pull of 350kN, estimate the proportion of load carried by each bar and induced stresses. Elastic moduli of Copper, Zinc and Aluminum to be 1.2×10^5 N/mm^2 1.0×10^5 N/mm^2 and 0.89×10^5 N/mm^2 respectively.

6. A beam with overhanging ends rests freely on two supports A and B is loaded as shown in Figure 3. What must be the intensity of loading in KN/m on the beam between C and B if the shearing force is to be zero at a cross section 1.5 m to the left of support B. Draw S.F and B.M diagram and find out the point of contra flexure?

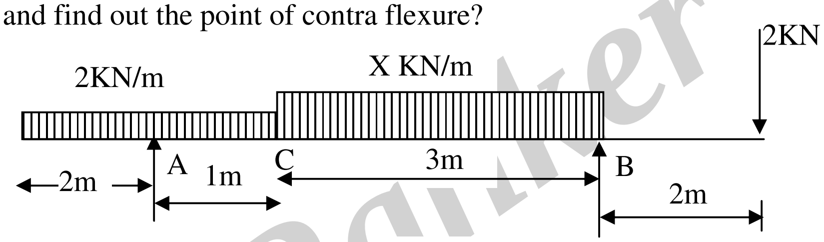

Figure 3

7. a) State the assumptions of the theory of simple bending and derive the governing formula.

   b) A test beam 25mm square in section is broken by a load of 1250N applied at the center of a span of 1meter. Using the factor of safety of 7.5, calculate the safe uniformly distributed load for a beam 100mm wide and 300mm deep of same material and freely supported over a span of 4.5m.

8. a) State the assumption in theory of shear and derive the governing formula.

   b) From the fundamental derive the shear stress distribution along the depth of a rectangular beam of width 'b' and depth 'd' for the shear force, F.

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