Reg. No. : | | | | | | | | | | |

Question Paper Code: 51133

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Third Semester

Civil Engineering

15UCE303 - MECHANICS OF SOLIDS - I

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The combined effect of external forces acting on the body is called

   (a) Stress (b) Strain (c) Load (d) Deformation

2. Principal planes are those planes which has only

   (a) Shear stress
   (b) Normal stress
   (c) Shear stress and normal stress
   (d) Shear strain

3. If $n > 2j - R$, then the truss is called as _____. (n = number of joints, j = number of members, R = number of reaction components)

   (a) perfect truss
   (b) redundant truss
   (c) deficient truss
   (d) none of the above

4. Point of contra-flexure is a

   (a) Point where Shear force is maximum
   (b) Point where Bending moment is maximum
   (c) Point where Bending moment is minimum
   (d) Point where Bending moment=0 but also changes sign from positive to negative

5. Torsional rigidity is defined as

   (a) T/θ (b) $C\theta$ (c) CI_p (d) = θ

   Where, T = Torque, θ = Angle of twist, I_p = Polar moment of inertia, C = Shearing modulus of elasticity/Column length

PART - B (5 x 2 = 10 Marks)

6. Define Poisson's ratio.

7. State the application of Mohr's circle.

8. In what way method of joint is advantage in sloving the structures over method of sections.

9. What are the assumptions made in theory of simple bending?

10. Write down the torsion equation.

PART - C (5 x 16 = 80 Marks)

11. (a) A brass bar, having cross – sectional area of 1000 mm^2, is subjected to axial forces as shown in figure 1.

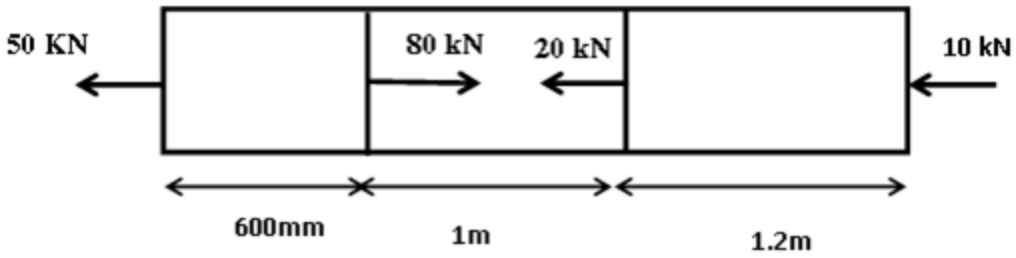

Figure 1

Find the total elongation of the bar. Take E = 1.05 x 10^5 N/mm^2. (16)

Or

(b) Two brass rods and one steel rod together support a load *'P'* as shown in figure 2. If the stresses in brass and steel are not to exceed 60 N/mm2 and 120 N/mm^2 respectively, find the safe load that can be supported. Take E for steel is equal to 2 x 105 N/mm^2 and for brass as 1 x 105 N/mm^2. The cross sectional area of steel rod is 1500 mm^2 and of each brass rod is 1000 mm^2. (16)

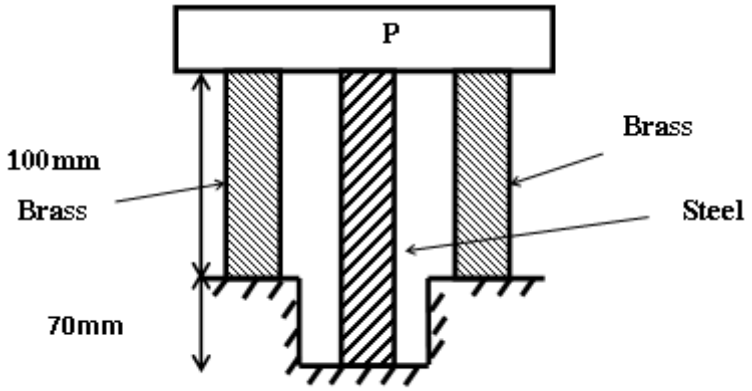

Figure 2

12. (a) At a point within a body subjected to two mutually perpendicular directions, the stresses are 80 N/mm^2 tensile and 40 N/mm^2 tensile. Each of the above stresses is accompanied by a shear stress of 60 N/mm^2. Determine the normal stress, shear stress and resultant stress on an oblique plane inclined at an angle of 45^o with the axis of minor tensile stress. (16)

Or

(b) A point in a strained material is subjected to stresses shown in figure 3. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. (16)

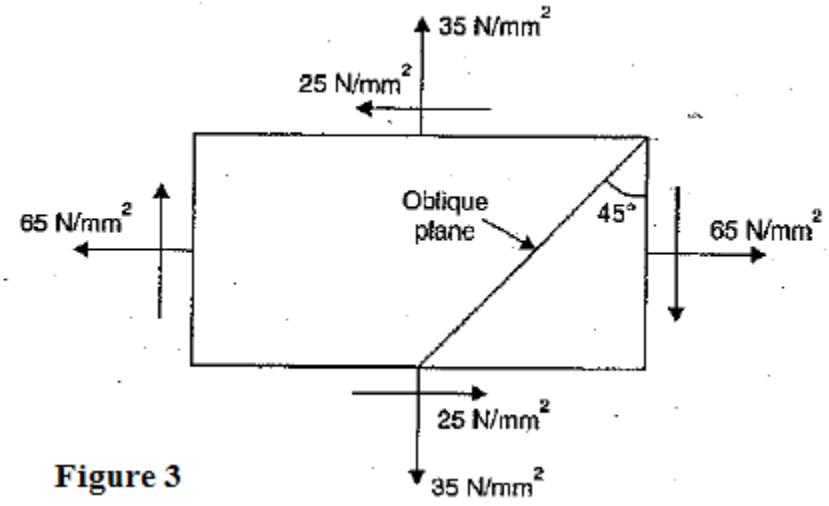

Figure 3

13. (a) Determine the forces in the truss shown in figure 4. Which carries a horizontal load of 12 *kN* and vertical load of 18 *kN* by method of joints. (16)

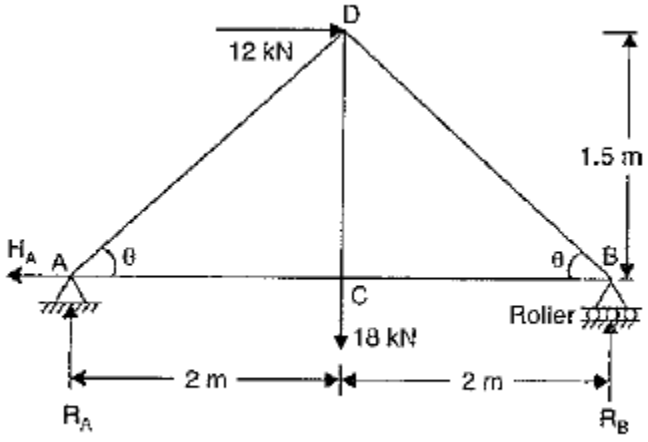

Figure 4

Or

(b) Determine the forces in the members of truss using tension coefficient method. (16)

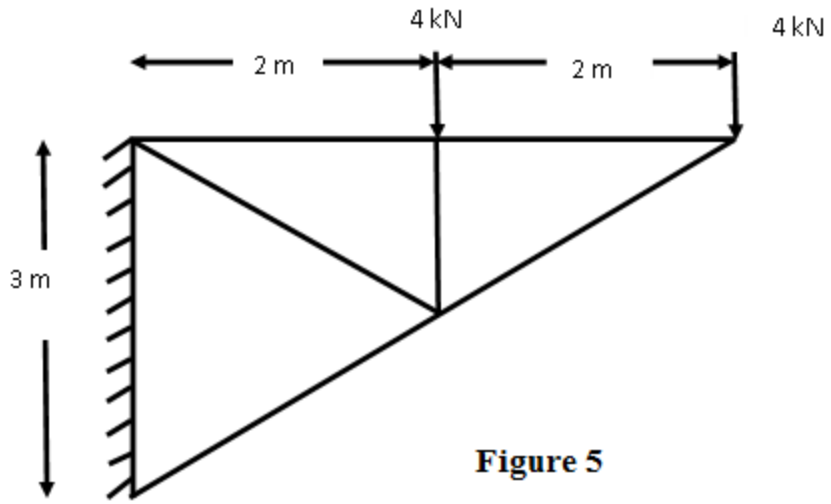

Figure 5

14. (a) Draw the *SFD* and *BMD* for the beam which is loaded as shown in fig. Also determine the points of contraflexure within the span *AB*. (16)

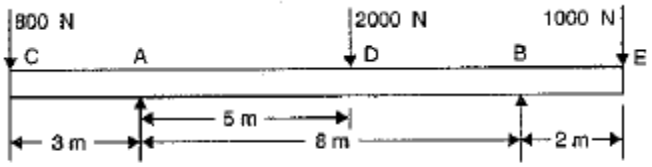

Figure 6

Or

(b) A rectangular beam 300 *mm* deep is simply supported over a span of 4 *metres*. Determine the uniformly distributed load per *metre* which the beam may carry, if the bending stress should not exceed 120 N/mm^2. Take $I = 8 \times 10^6$ mm^4. (16)

15. (a) A solid cylindrical shaft is to transmit 300 *kW* power at 100 *rpm*.

(i) If the shear stress is not to exceed 80 N/mm^2, find its diameter.

(ii) What percent saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same? (16)

Or

(b) A closely coiled helical spring made of 10 *mm* diameter steel wire has 15 coils of 100 *mm* mean diameter. The spring is subjected to axial load of 100 *N*. Calculate:

(i) The maximum shear stress induced

(ii) The deflection, and

(iii) Stiffness of the spring

(iv) Take modulus of rigidity, $C = 8.16 \times 10^4$ N/mm^2. (16)