C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 53103

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Third Semester

Civil Engineering

15UCE303 - MECHANICS OF SOLIDS - I

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. The ratio of change in volume to the original volume is called CO1-U

   (a) Linear strain (b) lateral strain (c) Volumetric strain (d) Poisson's ratio

2. If Cross section of a bar is subjected to an uniaxial tensile stress p, then tangential stress on a plane inclined at Θ to the Cross section of the bar is CO2-U

   (a) psin θ (b) p $\frac{cos2\theta}{2}$ (c) p $cos2\theta$ (d) p $\frac{sin2\theta}{2}$

3. Which equation is used to find out the frame is perfect? CO3-R

   (a) m=j-3 (b) m=3j-3 (c) m=2j-3 (d) m=2j-4

4. The bending moment in the centre of a simply supported beam carrying a uniformly distributed load w per unit length is CO4-U

   (a) Zero (b) $wl^2/2$ (c) $wl^2/8$ (d) $wl^2/4$

5. When a closely – coiled helical spring is subjected to an axial load , it is said to be under CO5-R

   (a) Bending (b) Shear (c) Torsion (d) Crushing

PART – B (5 x 3= 15 Marks)

6. Distinguish between compression and tension CO1-R

7. What are principal planes and principal stresses. CO2-U

8. Differentiate between redundant frame and deficient frame CO3-R

9. Write briefly about types of beams and types of loads. CO4-U

10. Define torsional rigidity. CO5-R

PART – C (5 x 16= 80 Marks)

11. (a) (i) Derive the relationship between bulk modulus and young's modulus. CO1-App (8)

(ii) Derive relations for normal and shear stresses acting on an inclined plane at a point in a stained material subjected to two mutually perpendicular direct stresses. CO1-App (8)

Or

(b) A solid Cyldrical brass bar of 25mm diameter is enclosed in a steel tube of 50mm external diameter and 25mm internal diameter. The bar and the tube are both initially 1.5m long and are rigidly fastened at both ends. Find the stresses induced in the two materials when the assembly is subjected to an increase in temperature of 50^{o}c. take coefficient of thermal expansion of steel as $12x10^{-6}/^{o}$c and that of brass as $18x10^{-6}/^{o}$c. modulus of elasticity of steel as $2x10^{5}N/mm^{2}$ and modulus of elasticity of brass as $1x10^{5}N/mm^{2}$ CO1-App (16)

12. (a) An element has a tensile stress of 600 N/mm^{2} acting on two mutually perpendicular planes and shear stress of $100N/mm^{2}$ on these planes . Find the principal stress and maximum shear stress. CO2-App (16)

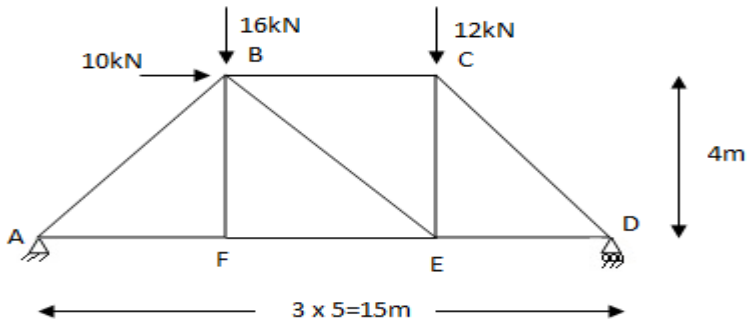
Or

(b) At a point in the web of a girder the bending stress is $60N/mm^{2}$ tensile and the shearing stress at the same point is $30N/mm^{2}$. Determine CO2-App (16)

(i) the principal stresses and principal planes.

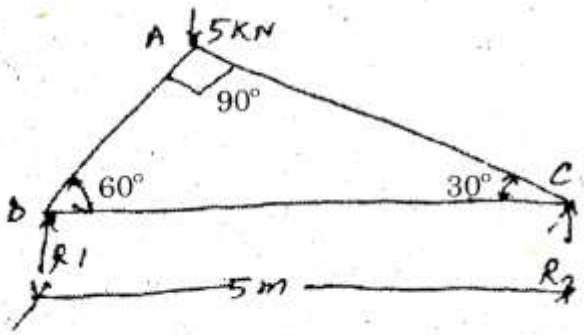
(ii) Maximum shear stress and its orientations.

13. (a) Analyze the simply supported truss as shown in Fig.1 by method of joints — CO3-App — (16)



Or

(b) A truss with a span of 5 m is carrying a load of 5KN at its apex as shown in fig. Find the forces in all the members by any one method. — CO3-App — (16)



14. (a) Draw the shear force and bending moment diagrams for the beam shown in Fig.3. Also mark the positions of the maximum bending moment and determine its magnitude. — CO4-App — (16)

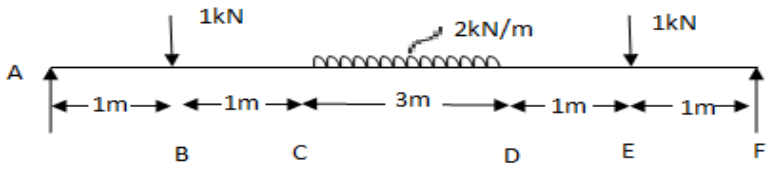


Figure.3

Or

(b) State the assumptions made in the theory of simple bending and derive the bending formula CO4-App (16)

15. (a) A hollow shaft of diameter ratio 3/8 is required to transmit 588 KW at 110 rpm, the maximum torque being 20% greater than the mean . the shear stress is not exceed $63MN/m^2$. Calculate the external diameter of the shaft which would satisfy these conditions. Rigidity Modulus is $84MN/m^2$. CO5-App (16)

Or

(b) A circular shaft is required to transmit a power of 220kw at 200rpm. The maximum torque may be 1.5 times the mean torque and the shear stress in the shaft not to exceed $50N/mm^2$. Determine the diameter
(i) the shaft is solid
(ii) the shaft is hollow with external diameter is twice the internal diameter. Take modulus of rigidity as $80kN/mm^2$. CO5-App (16)