Register Number.....

B.E. DEGREE EXAMINATIONS: OCTOBER/NOVEMBER-2008

Third Semester

CIVIL ENGINEERING

U07CE303: Mechanics of Solids

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions: -

PART A (20 X 1 = 20 Marks)

1. Hooke's law is valid for a material behaving in
   a) Linearly inelastic range b) Linearly elastic range c) Non-linearly elastic range d) a and b

2. Poisson's ratio for an axially very rigid material is
   a) Zero b) Infinity c) one d) Two

3. An ideal example for a homogeneous and isotropic material is
   a) Concrete b) Brick c) Mild steel d) Wood

4. Major principal plane for an axially loaded member is always
   a) Horizontal b) Vertical c) 60 degree d) 45 degree

5. The Skeleton structure of a human being is completely
   a) Pin-jointed b) Rigid jointed c) simply supported d) a and b

6. The axial force developed in the members of any plane truss configuration hanging freely in the vertical plane under its own self-weight is
   a) Zero b) Both compression and tension c) Fully tension d) Fully compression

7. The bending moment at any section of a pipe flowing with full of water will be
   a) Zero b) Infinity c) Positive non-zero d) Negative non-zero

8. Out of plane shearing stresses in the walls of a thin cylinder is
   a) Exactly zero b) Infinity c) Negligibly small d) Considerable value

9. Rate of change of bending moment over a particular length gives
   a) Axial force b) Shear force c) Torsion d) Principal stress

10. The moment of resistance diagram for a cantilever beam with any uniform cross-section and same material throughout its length is
    a)Triangular b) Rectangular c) Circular d) Straight line

11. With every increase in external loads, the radius of curvature of a beam
    a) Increases b) Decreases c) Remains constant d) Zero

12. Product of elastic modulus and cross sectional area of a member is called as
    a) Shearing rigidity b) Flexural rigidity c) Torsional rigidity d) Axial rigidity

13. The vertical deflection at the tip of a cantilever beam subjecting to an axial load alone is
a) Zero b) Maximum c) Infinity d) Negative value

14. The ratio of the vertical deflection at the mid-span of a fixed beam and to that of a simply supported beam for an identical loading is
a) Less than 1 b) Greater than 1 c) Equal to 1 d) Zero

15. The direction of complimentary shear in a simply supported beam with vertical loading is
a) Upward b) Downward c) Horizontal d) Inclined

16. In the rectangular cross section of a homogeneous beam, shear stress is maximum at
a) Exterior compression fibre b) Exterior tension fibre c) Neutral axis d) except neutral axis

17. Select the cross-section which is more efficient in resisting torsion
a) Solid circular b) Hollow circular c) Solid square d) Hollow square

18. The coil section of a spring is subjecting to
a)shearing stress b) bending stress c) axial stress d) a and b

19. Stiffness of a spring is the ratio of
a) Load/Deformation b) Deformation/Load c) Stress/Strain d) Strain/Stress

20. Load Vs deformation graph of a spring is always
a) Linear b) Non-linear c) Tri-linear d) Bi-linear

PART-B (5 X 16 = 80 Marks)

21 (a) i) A steel rod of 18mm diameter and 400mm long is co-axially enclosed in a brass tube of 24mm external diameter and 2mm thick. Determine the stresses induced in each material and the change in length if the assembly is subjected to an axial compressive force of 80 kN. Assume young's modulus of steel is 2 times that of brass. Also the lengths of both the members are same. (10)

ii) Derive an expression for finding volumetric strain of a body subjecting to tensile stresses along three mutually perpendicular directions. (6)

OR

21 (b) A steel bolt 30mm diameter is subjected to direct tension of 16 kN and shearing force of 12 kN. Determine the intensities of normal and shearing stresses across a plane at an angle of 70 degree to the axis of the bolt. Also, calculate the principal stresses. Verify the results using Mohr's diagram. (16)

22 (a) Analyze the truss shown in fig.1 (refer page 4 of 4) using method of joints. (16)

OR

22 (b) A cylindrical shell has an internal diameter of 1m and a wall thickness of 15 mm. It is 3m long and closed at its ends. It is subjected to an internal pressure of 3 N/mm^2. Calculate the circumferential and longitudinal stresses induced and also the changes in the dimensions of the shell. Take Young's modulus= 200 GPa and Poisson's ratio=0.3 (16)

23 (a) Fig.2 (refer page 4 of 4) shows the shear force diagram of a beam with simple supports at 'A' and 'B'. From the shear force diagram, obtain the loading that acts on the beam and also plot corresponding bending moment diagram on the tension side of the member. (16)

OR

23 (b) The built-up triangular beam section is composed of three bars placed as shown in fig.3 (refer page 4 of 4). This section will be used as a beam over a simply supported span of 6m. Calculate the maximum udl it can carry if the maximum allowable bending stress is limited to 150 N/mm^2. (16)

24 (a) A simply supported beam of span 6m carries two point loads of 60kN and 15 kN at distances of 2m and 4m from the left hand support respectively. Find the vertical deflection under the 60kN load and the position and magnitude of maximum deflection. Take E=200 GPa and moment of inertia = 4 X $10^7 mm^4$. (16)

OR

24 (b) The cross section of the beam is a T-section having total depth of 140mm, thickness of flange and thickness of web each equal to 20mm as shown in fig.4 (refer page 4 of 4). The beam has an effective span of 4m and carries a total uniformly distributed load of 20kN over the whole span and a concentrated load of 30kN at its centre. Find the maximum intensity of shear stress and draw the shear stress distribution diagram. (16)

25 (a) A stepped solid shaft ABC consists of a segment AB of length1.2m and diameter 100mm, the segment BC of 1.8m long and 50mm in diameter. The end A is fixed and the end C is free. It is subjected to torque 'T' at free end and a torque of '2T' in the opposite direction to that of torque at A, at the junction B. Calculate the angle of twist at the free end if the shear stress is limited to 70 N/mm^2. Assume G = 0.84 x 10^5 N/mm^2. (16)

OR

25 (b) Two bars of equal lengths and of the same material are subjected to the same axial force. However, one of them is of uniform cross-section having an area of 5 cm^2 throughout its length and for the other the cross-section is 10 cm^2 over the middle half of its length and 5 cm^2 over the remainder of its length. Compare the strain energy. (16)

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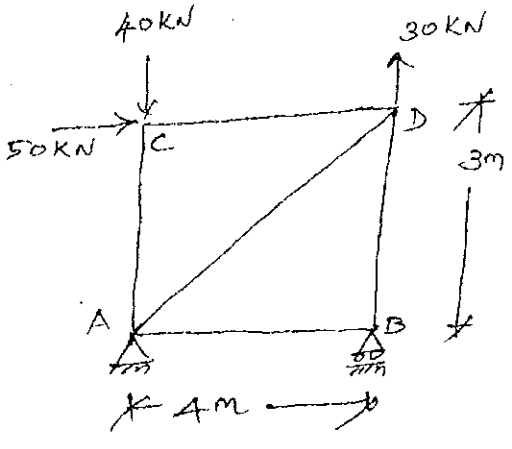

Fig.1

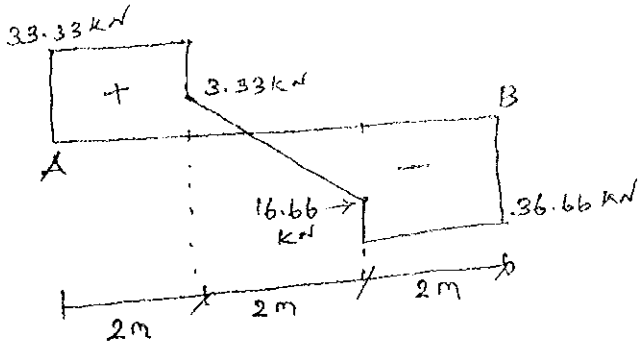

Fig.2

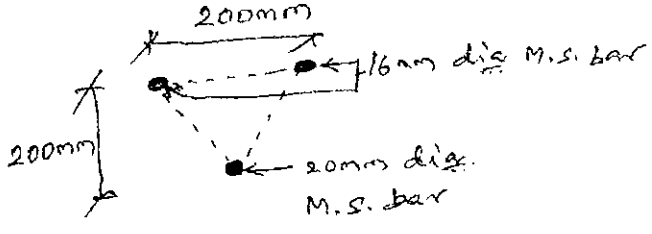

Fig.3

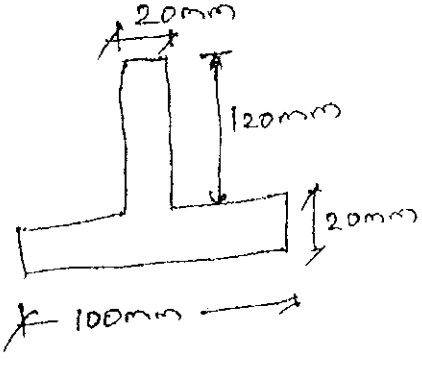

Fig.4