B.E. Mining Engineering Fourth Semester

MN405 - Strength of Material

P. Pages : 2 **GUG/W/18/1588**

Time : Three Hours * 1 2 5 2 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Answer **all** questions.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Draw the stress strain behaviour of mild steel and explain its salient features. **6**

b) A steel bar shown in fig. 1 is rigidly fixed at the two ends. If the temperature of the bar is raised to 40º over an initial temperature of 20º, find the forces applied by the rigid wall on the bar. **10**

$A_1 = 200\,mm^2,\ A_2 = 100\,mm^2$

$E = 200\,GPa, \quad \alpha = 11{\cdot}7 \times 10^{-6}$

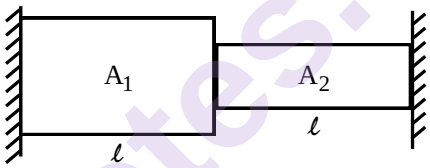

Fig. 1

OR

2. a) A M-S Bar of 40mm in diameter and 3m long is subjected to an axial pull of 60kN. To what length the bar should be bored centrally so that the total extension will increase by 20% under the same pull. **11**

b) Derive the expression for circumferential and longitudinal stress? **5**

3. a) The solid shaft in a small hydraulic turbine is 100mm in diameter. It supports an axial compressive load of 440kN. Determine the maximum power that will be developed at a speed of 240 rpm without exceeding a maximum shear stress of 70MPa and maximum normal stress of 90MPa. **9**

b) Derive the torsional formula with its assumptions. **7**

OR

4. a) Explain Mohr's circle to locate principal planes and determine principal stress when element subjected to biaxial stress and tangential stress along both planes. **6**

b) Two planes AB & BC which are at right angles carry shear stresses of intensity 17.5N/mm^2, while these planes also carry a tensile stress of 70N/mm^2 and a compressive stress of 35N/mm^2 respectively. Determine the principal plane and principal stresses Also determine the maximum shear stress and the plane on which it acts. **10**

5. Draw shear force and bending moment diagram for the beam shown in fig. 2. **16**

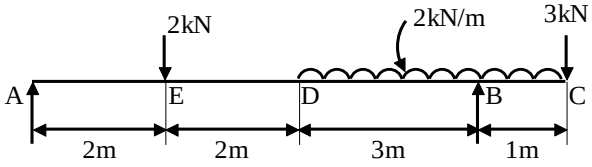

Fig. 2

OR

6. Draw bending moment and shear force diagram for the beam shown in fig. 3. **16**

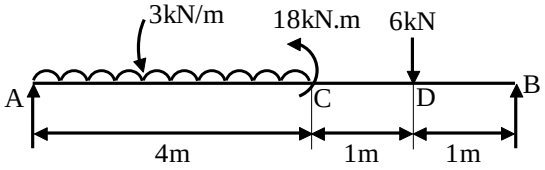

Fig. 3

7. a) Explain **any three.** **9**

i) Section modulus. ii) Manufacturing process of cement
iii) Grouting and shortcreting iv) Assumption of bending stress.

b) A beam of length 6m and uniform rectangular section is supported at its end and carry U. D. L. of 10kN/m over the entire span. Calculate width of beam section if the maximum permissible bending stress is 8 N/mm^2. Take width = 0.65 time depth. [i.e, B = 0.65D] **7**

OR

8. a) Derive Bending formula $\frac{M}{I}=\frac{F}{y}=\frac{E}{R}$ and explain its assumptions. **10**

b) Explain in detail manufacturing process of cement. **6**

9. a) A hollow cast iron column of 4.5m long with both end hinged to carry safe load of 250kN with F of S – 4. Internal diameter is 0.7 times external diameter, Find the diameter of column Take $a=\frac{1}{1600}$ and $6_c = 560\,N/mm^2$ **10**

b) Derive Euler's formula of one of column is fixed and other end is free. **6**

OR

10. a) Explain Euler's buckling load on column. **4**

b) Calculate the slope at 'A' and deflection at 'C' for the beam shown in fig. 4. **12**

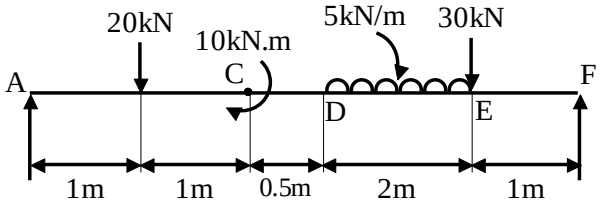

Fig. 4

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