U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV3PCSOM **Max Marks: 100**
Course: Strength of Materials

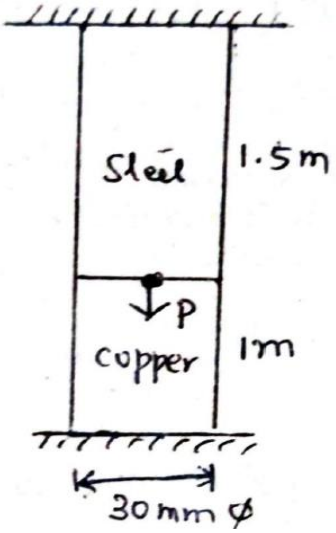
Instructions: Answer FIVE FULL questions choosing one full question from each unit
Internal choice provided in UNIT-1 and UNIT-5
Assume any missing data suitably and clearly state them.

UNIT - I

1 a) Explain the terms (i) Poisson's ratio (ii) Rigidity Modulus (iii) Factor of safety **06**

b) With usual notations derive an expression for the extension produced due to self weight for a homogeneous bar of uniform section suspended vertically from one end. **05**

c) Two bars of steel and copper are rigidly connected between two rigid supports as shown in Fig Q1(c). What axial load has to be applied at the junction between steel and copper such that the stresses in steel and copper do not exceed 140 MPa and 100 MPa respectively. Assume E_s -200 GPa and E_c - 105 GPa. **09**



FigQ1 (c).

OR

2 a) A tension test bar of circular section tapers from 28 mm to 22 mm in a length of 300 mm. When an axial load of 70 KN is applied the extension measured over its length was 0.5mm. Find the modulus of elasticity of the material. If the Poisson's' ratio of the material is 0.32, find the values of Rigidity modulus and Bulk modulus. **06**

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
Revealing of identification, appeal to evaluator will be treated as malpractice.

SUPPLEMENTARY EXAMS 2023

b) A rod is composed of three segments as shown in Fig Q 2(b). The rod is held between two rigid supports. When the temperature of system drops by 55^0 C, there is a yielding of 0.1 mm at supports. Evaluate the stress developed in each segment. **09**

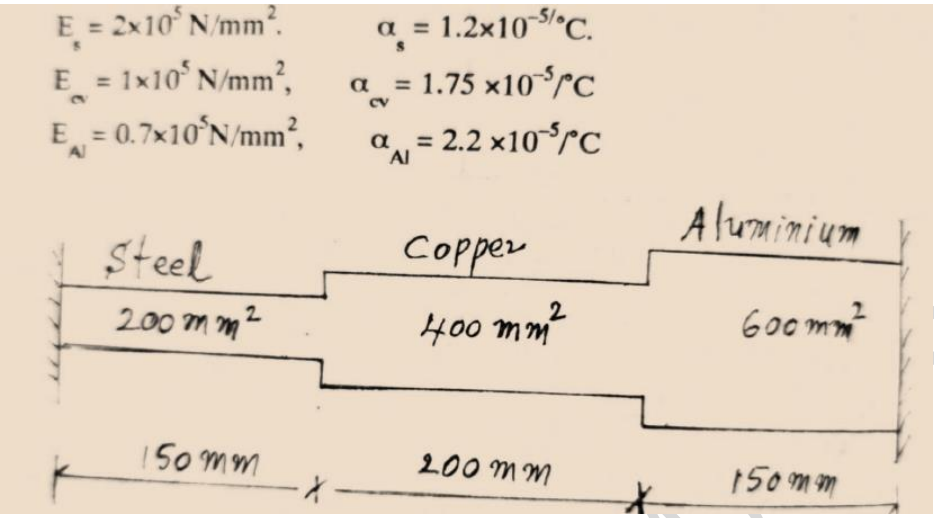


Fig Q 2(b).

c) A concrete column is reinforced with steel bars comprising 5% of the gross section of the column. What fraction of the compressive load is sustained by steel bars? The ratio of Young's modulus of steel to that of concrete is 13. **05**

UNIT - II

3 a) A simply supported beam of span 8 m is loaded with a uniformly varying load of zero intensity at one end and 20 KN / m at the other end. Sketch the bending moment and shearing force diagram indicating salient values. **08**

b) For the beam shown in Fig Q 3(b), draw the shear force and bending moment diagrams indicating all salient values. **12**

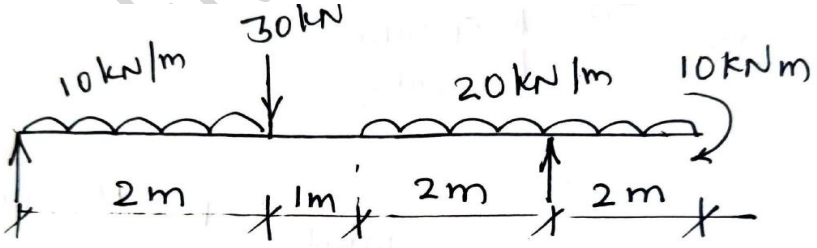


Fig Q 3(b),

UNIT - III

4 a) Show that for rectangular section of a beam, the maximum shear stress is 1.5 times the average shear stress. **06**

b) Sketch the shape of shear stress distribution for beam having following cross sections (i) Unsymmetrical I-section (ii) T-section **04**

c) A cantilever beam of span 3 m has a T-section as shown in Fig Q4(b). The beam carries a point load of 1 KN at the free end. Besides the point load, the beam is required to support a uniformly distributed load 'w' per mt acting over the entire span. Determine the magnitude of load intensity if the allowable stress is 24 MPa in tension and 30 MPa in compression.' **10**

SUPPLEMENTARY EXAMS

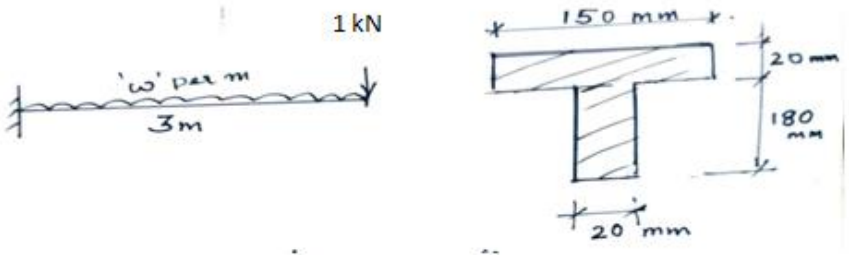


Fig Q 4(b)

UNIT - IV

5 a) Explain the use of Mohr 'circle of stress. With usual notations, derive the general algebraic form of equation for Mohr's circle of stress **08**

b) For the stressed element shown in Fig Q5(b), determine; **12**
(i) Normal and shearing stresses on a plane inclined at 30 ^{0} as shown
(ii) Principal stresses and their planes
(iii) maximum shear stresses and their planes
Indicate the stresses calculated as above in the element

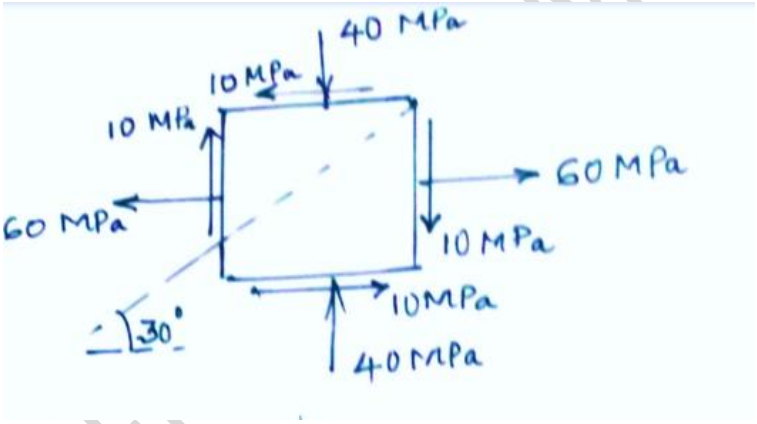


Fig Q5(b),

UNIT - V

6 a) A hollow circular shaft transmits 400 KW at 150 rpm. Allowable shear stress is 80 N/mm^2 and angle of twist is 1.5^0 over a length of 3 m. Find the diameters of shaft if the external diameter is 1.25 times the internal diameter. Find the torque carried by a solid shaft of same area of cross section, weight, material and length with the same allowable shear stress and angle of twist as that of hollow shaft. Modulus of rigidity of the material of shaft is 0.8 x 10^5 N/mm^2 **09**

b) Show that a hollow shaft is stronger in torsion than a solid circular shaft, given both shafts are of same material, length, weight and run at same speed **07**

c) Explain the terms Polar modulus and Torsional rigidity and write equations for the same **04**

OR

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7 a) Explain the limitations of Euler's' theory. **06**

b) A hollow cast iron rectangular column has external dimensions 150 mm x 200 mm and thickness of metal is 25 mm. The height of the column is 5m and both ends are fixed. If E=120 GPa for cast iron, compute the critical load for this column using Euler's formula and compare it with the value obtained from Rankine's formula. Take Rankine's constants as 500 N/mm^2 and $\alpha = 1/1600$ **14**

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