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

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 22CV3PCSOM **Max Marks: 100**
Course: Strength of Materials **Date: 12.05.2023**

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.

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.

UNIT - I

1 a) Explain the terms: stress, strain, Young's modulus and Elasticity **08**

b) Two straight rods one made of steel and the other of brass hang vertically. Each rod is 1m long. The rods support rigid bar horizontally, when a load of 30kN is placed on the horizontal bar at 400 mm from the steel rod and 600 mm from the brass rod. The deformation of the two vertical rods are found to be equal. If the area of steel rod is 30000mm^2, find: **12**

i) Stresses in the rods
ii) Area of the brass rod

Take E_s = 200 GN/m^2, E_b = 85 GN/m^2

OR

2 a) A tension test bar of circular cross section tapers uniformly from 28 mm to 22 mm in a length of 300 mm. When an axial load of 70kN is applied the extension measured over its length is 0.5 mm. Find the modulus of elasticity of the material. Find rigidity modulus and bulk modulus if Poisson's ratio is 0.3 **08**

b) A railway is laid so that there is no stress in the rail at 10^{o}C. Calculate: **12**

i) The stress in the rails at 60^{o}C, if there is no allowance for expansion
ii) The stress in the rails at 60^{o}C, if there is an expansion allowance of 10 mm per rail.
iii) The maximum temperature to have no stress in the rails, if the expansion allowance is 13 mm per rail.

Take $\alpha = 12 \times 10^{-6}$ / ^{o}C
$E = 2 \times 10^5$ N/mm^2
Rails are 30 m long

UNIT - II

3 a) A simply supported beam of span 'L' is subjected to an uniformly distributed load of intensity w/unit length throughout. Show that the bending moment variation is parabolic. Also show that maximum BM is $wL^2/8$ and occurs at midspan. **08**

b) Draw BMD and SFD for the beam loaded as shown in Fig.Q.3(b). Locate all salient points. **12**

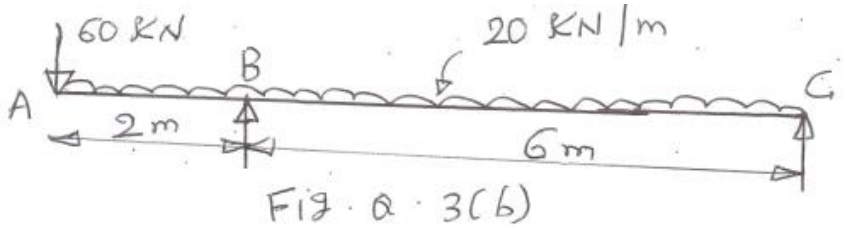

Fig. Q. 3(b)

UNIT - III

4 a) List the assumptions made in the theory of simple bending **06**

b) An I-section beam of overall dimensions 150 mm x 350 mm has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force at the section is 50 kN, determine: **14**

i) The shear stress at the bottom of top flange
ii) The maximum shear stress and its position

UNIT - IV

5 a) Briefly explain the following: **08**

i) Mohr's circle of stress
ii) Principal stresses and principal planes

b) A rectangular block of a material is subjected to tensile stresses of 60 N/mm^2 and 120 N/mm^2 on mutually perpendicular planes together with a shear stress of 80 N/mm^2. Find: **12**

i) The principal stresses
ii) The principal planes
iii) The maximum shearing stress

UNIT - V

6 a) Obtain Euler's equation for crippling load of a long column with both the ends hinged. **08**

b) A cast iron hollow column has 130 mm as external diameter, 80 mm as internal diameter with a length of 3 m. Calculate the safe load the column can carry if both the ends are hinged. Use Rankine's theory. **12**
Take $\alpha = 1/1600$ and $f_c = 600$ MPa
Factor of safety = 3

OR

7 a) Explain the terms: **06**

i) Pure torsion
ii) Polar modulus
iii) Torsional rigidity

b) A hollow circular shaft transmits power of 300 kN at 100rpm. If the shear stress is limited to 70 MPa and external diameter is twice the internal diameter, calculate the external and internal diameters of the shaft, assuming that the maximum torque is 1.5 times the average torque. **14**

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