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INTERNATIONAL CENTRE FOR APPLIED SCIENCES
III SEMESTER B.S. DEGREE EXAMINATION – OCT. / NOV. 2017
SUBJECT: STRENGTH OF MATERIALS (CE 232A)
(BRANCH: BM, CHEM, CIVIL & ARCH)
Monday, 6 November 2017

Time: 3 Hr. **Max. Marks: 100**

✓ **Answer any FIVE full questions.**

1A. Define the four elastic constants and give any two of their relationships. (8)

1B. A beam simply supported at ends A and B separated by distance 6m is loaded with two point loads of 60kN and 50kN at a distance of 1m and 3m respectively from end A. Determine the position and magnitude of maximum deflection. Take E = 210 kN/mm^2, I = 85 x 10^6 mm^4. (12)

2A. What is Macaulay's method? Give any four of its conditions to be followed in the determination of deflection. (6)

2B. A hollow circular shaft 12 m long is required to transmit 1000kW power when running at a speed of 300 rpm. If the maximum shearing stress allowed in the shaft is 100 N/mm^2 and the ratio of inner diameter to the outer diameter is 0.75, find the dimensions of the shaft and also angle of twist of one end of the shaft to the other ends. Take G = 80 kN/mm^2. (14)

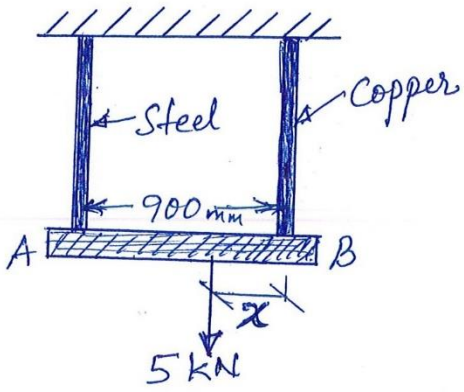
3A. Explain (i) Section Modulus (ii) Flexural Rigidity (iii) Pure Bending (iv) Slenderness Ratio (10)

3B. A Steel tube 45mm external diameter and 3mm thick encloses centrally a solid copper rod of 30mm diameter. The rod and tube are rigidly connected together at the ends and is 2m in length at a temperature of 30^{o}C. Find the stress in each metal when heated to 180^{o}C. Also find the change in length. Take coefficient of thermal expansion for steel and copper as 1x10^{-5} and 1.7x10^{-5} respectively per degree centigrade. Assume E for steel as 2.1x10^5 N/mm^2 and E for copper as 1.1x10^5 N/mm^2. (10)

4A. Determine the maximum deflection for a cantilever beam carrying UDL throughout the span. (06)

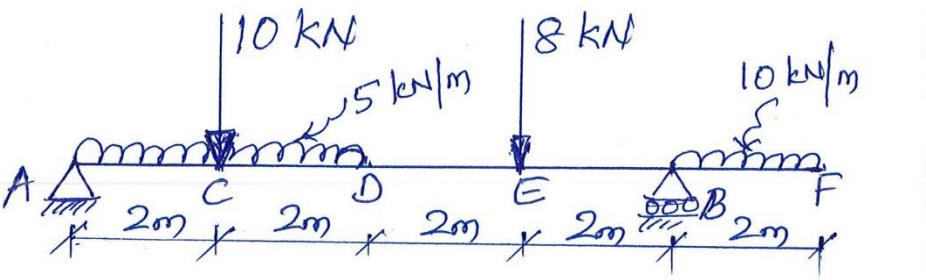
4B. A bar of steel is 40mm x 40mm in cross section is 120mm long. It is subjected to a tensile load of 200kn along the longitudinal axis and tensile load of 500kN & compressive load of 400kN on the y and z directions respectively. Find the change in length, breadth, thickness and volume. Take E= 2x10^5 N/mm^2 and Poisson's ratio 0.3. (14)

5A. A rigid bar AB 900mm long is suspended by two vertical rods, one steel and other copper as shown in Fig. The diameter and length of each rod is 20mm and 400mm respectively. The rigid bar carries a load of 5kN such that it will remain horizontal even after loading. Find the stress in each bar and the position of the load. Take E_s= 200 GPa and E_{cu} = 100Gpa. (10)



5B. At a certain point in a strained material the intensities of normal stresses on two planes at right angles to each other are 20MPa and 10MPa, both tensile. They are accompanied by shear stress of 10MPa. Find the principal planes & the principal stresses and show them on a sketch. Find also the maximum shear stress. (10)

6A. Draw the BMD and SFD for the beam loaded as shown in the Fig. Indicate the salient values on the diagram. (10)



6B. A structural member 30mm x 30mm x 250mm long is subjected to a pull of 90 kN in the direction of its length. The extension of the bar was found to be 0.125mm while the decrease in each lateral dimension is 0.00375mm. Find the Young's modulus, Poisson's ratio, Modulus of Rigidity and Bulk Modulus for the material of the bar. (10)

7A. Explain with a neat sketch the state of "Pure or Simple Bending". List any five assumptions made in the theory of simple bending. (08)

7B. A rolled steel joist of I-section has top and bottom flanges 150mm x 25mm and web of size 300mm x 12mm. It is used as a simply supported beam over a span of 4m to carry an UDL of 80 kN/m over its entire span. Draw bending stress and shear stress distribution across a section at 1m from the left support. (12)

8A. Derive an expression for the extension of a tapering rod having diameter varies from d_1 to d_2 in a length of L, when subjected to an axial load of P. (08)

8B. A hollow cylindrical column is fixed at both ends. The length of column is 4.2m and carries an axial load of 250kN. Design the column by Rankine's formula. Adopt a factor of safety of 5. The internal diameter may be taken as 0.8 times the external diameter. Take σ_c = 550 MPa and a = 1/1600 in the Rankine's formula. (12)