CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   **18CV32**

Third Semester B.E. Degree Examination, Aug./Sept.2020
Strength of Materials

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Sketch a typical stress-strain curve for a ductile material and explain briefly the salient features of the curve. **(05 Marks)**

   b. Derive an expression for the deformation of a rectangular tapering bar of uniform thickness. **(05 Marks)**

   c. Determine the value of P that will not except a maximum deformation of 2mm or a stress of 120 MPa in steel, 80 MPa in Aluminium and 115 MPa in bronze (Fig.Q1(c)). Given the following data:
   $A_b = 600$ mm^2, $E_b = 0.84 \times 10^5$ N/mm^2
   $A_a = 800$ mm^2, $E_a = 0.7 \times 10^5$ N/mm^2
   $A_s = 400$ mm^2, $E_s = 2.1 \times 10^5$ N/mm^2

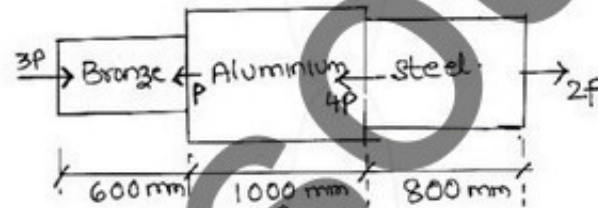Fig.Q1(c)   **(10 Marks)**

OR

2 a. Derive the relationship between Young's modulus and bulk modulus. **(05 Marks)**

   b. A load of 270 kN is acting on a RCC column of size 200mm × 200mm. The column is reinforced with 10 bars of 12mm diameter each. Determine the stress in steel and concrete. $E_s = 16.5 E_c$. **(05 Marks)**

   c. A bar of brass 25mm diameter is enclosed in a steel tube of 50mm external diameter and 25mm internal diameter. The bar and tube are both initially 1m long and rigidly fastened at both the ends. Find the stresses in the two materials when the temperature rises from 10°C to 90°C.
   If the composite bar is then subjected to an axial tensile load of 60 kN, find the resulting stresses given that : $E_s = 200 \times 10^3$ MPa, $E_b = 100 \times 10^3$ MPa, $\alpha_s = 11.6 \times 10^{-6}/°C$, $\alpha_b = 18.7 \times 10^{-6}/°C$. **(10 Marks)**

Module-2

3 a. Explain the maximum shear stress theory. **(05 Marks)**

   b. Explain the procedure for determining stresses in a general two dimensional stress system using Mohr's circle. **(05 Marks)**

   c. At a point in a strained material, the state of stresses is as shown in Fig.Q3(c), Determine the principal stresses, maximum shear stress and sketch the orientation of the principal planes.
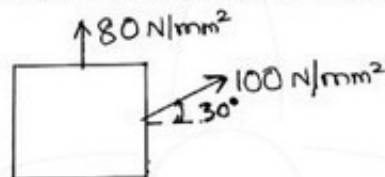

Fig.Q3(c)   **(10 Marks)**

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Module-5

9 a. Derive an expression for the slope and deflection of a simply supported beam carrying a central concentrated load. **(08 Marks)**

   b. A simply supported beam of constant cross section is 10m long. It is loaded with two point loads of 100 kN and 80 kN at points 2m and 6m from the left end respectively. Calculate the deflection under each load the maximum deflection. Take E = 200 GPa and I = 18×10^8 mm^4. **(12 Marks)**

OR

10 a. Distinguish between long and short columns. **(04 Marks)**

   b. What are the limitations of Euler's column theory? **(04 Marks)**

   c. A hollow cast iron column whose outside diameter is 200mm has a thickness of 20mm. It is 4.5m long and fixed at both ends. Calculate (i) Slenderness ratio (ii) Ratio of Euler's and Rankine's critical loads. Take E = 100 GPa, $\alpha = \dfrac{1}{1600}$ and $\sigma_c = 550$ N/mm^2. **(12 Marks)**

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