U.S.N.										

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

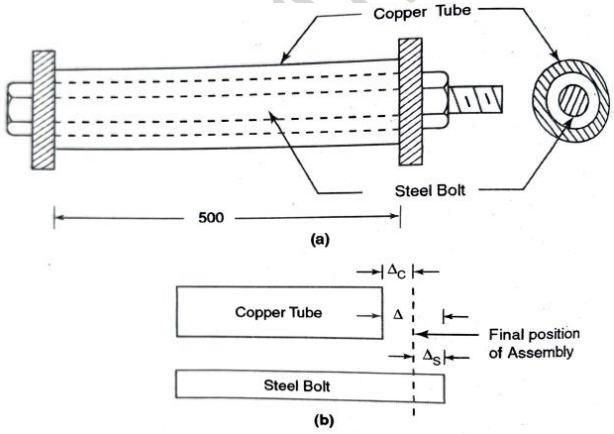
Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 22AS4PCSDM **Max Marks: 100**
Course: Solid Mechanics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

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	CO	PO	Marks
1	a)	Derive the relations between the material elastic constants.	CO 2	PO 2	**10**
	b)	Solve for a steel bolt of 16 mm diameter passes centrally through a copper tube of internal diameter 20 mm and external diameter 30 mm as shown in Fig. 1b. The length of the whole assembly is 500 mm. After tight fitting of the assembly, the nut is over tightened by a quarter of a turn. What are the stresses introduced in bolt and tube, if the pitch is 2 mm. Take Es=200GPa and Ec=1.2X10^5 N/mm^2  Fig. 1b	CO 2	PO 2	**10**
		OR			
2	a)	Explain the stress strain diagram for ductile and brittle material with a neat diagram	CO 1	PO 1	**8**
	b)	Solve for the bar of 20mm diameter when tested in tension. It is observed that when a load of 37.7 kN is applied, the extension measured over a gauge length of 200mm is 0.12 mm and contraction in diameter is 0.0036mm. Find μ and elastic constant E,G and K.	CO 2	PO 2	**12**
		UNIT - II			
3	a)	Derive an expression for bending moment equation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$, by listing the assumptions.	CO 2	PO 2	**10**

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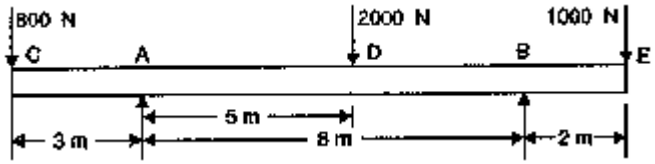
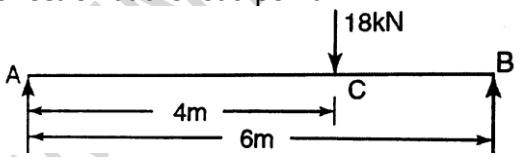
		b)	Draw SFD & BMD for the beam shown in the Fig. 3b. Also find the point of contra flexure  Fig. 3b	*CO 2*	*PO 2*	**10**
			OR			
	4	a)	Derive the expression for shear stress in a beam section with stating the assumptions.	*CO 2*	*PO 2*	**10**
		b)	A 2m long simply supported beam with rectangular section (b = 50 mm, d = 100 mm) is subjected to 10 kN point load at mid of span. Draw the bending and shear stress distribution along the depth of the section at mid of the span length from a support.	*CO 2*	*PO 2*	**10**
			UNIT - III			
	5	a)	Determine the displacement at free end of the cantilever beam by drawing the diagram. Having over all L=5m which carries W_1= 20KN at 2m, W_2= 30KN at 5m take E = $2X10^5$ N/mm^2, I = $2X10^8$ mm^4. Use double integration method.	*CO 2*	*PO 2*	**08**
		b)	A simple supported beam of 6m span as shown in Fig. 5b is subjected to a concentrated load of 18kN at 4m from the left support. Taking E=200GPa and I=$15x10^6$mm^4. Determine the following using Macaulay's method. i) The position and the value of maximum deflection ii) Slope at mid-span iii) Deflection at the load point  Fig. 5b	*CO 2*	*PO 2*	**12**
			UNIT - IV			
	6	a)	Derive the Euler's crippling load for buckling of a column with fixed – free support.	*CO 2*	*PO 2*	**08**
		b)	Investigate the diameter of a solid shaft which transmits 440kW at 280rpm. The angle of twist should not exceed one degree per meter length and the maximum torsional shear stress is to be limited to 40 MPa. Assume G=84×10^3 MPa.	*CO 2*	*PO 3*	**12**
			UNIT-V			
	7	a)	Determine the direction of the principle plane, the magnitude of the principal stresses and the magnitude of maximum shear stress and its direction and also indicate all the above plane in the sketch for the strained material shown in the figure have the state of stress as shown in Fig. 7a.	*CO 1*	*PO 2*	**10**

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			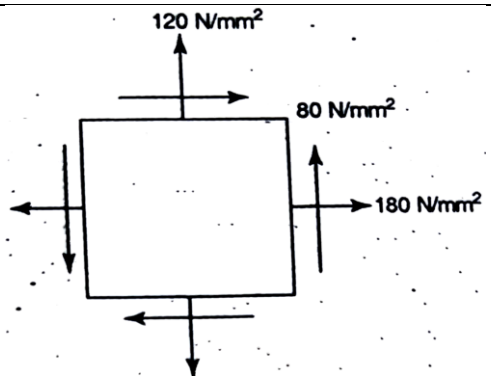 Fig. 7a			
		b)	Explain briefly the various theories of failure.	*CO 1*	*PO 1*	**10**

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