U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

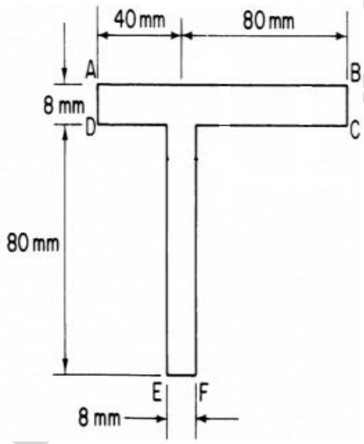
Programme: B.E. **Semester: VI**

Branch: Aerospace Engineering **Duration: 3 hrs.**

Course Code: 23AS6PCAST/22AS6PCAST/20AE6DCAST **Max Marks: 100**

Course: AEROSPACE STRUCTURES

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

		UNIT - I	CO	PO	Marks
1	a)	A beam having the cross-section shown in figure 1a is subjected to a bending moment of 1,500 Nm in a vertical plane. Calculate the maximum direct stress due to bending stating the point at which it acts.  Figure 1a	CO1	PO2	14
	b)	Explain the following a) Anticlastic bending b) Product of second moment of area. c) Semi-monocoque d) Shear stress e) Shear flow f) Shear center	CO1	PO1	06
		OR			
2	a)	Figure 2a shows the section of an angle purlin. A bending moment of 3000Nm is applied to the purlin in a plane at an angle of 30◦ to the vertical y axis. If the sense of the bending moment is such that its components Mx and My both produce tension in the positive xy quadrant, calculate the maximum direct stress in the purlin stating clearly the point at which it acts.	CO1	PO1, PO2	10

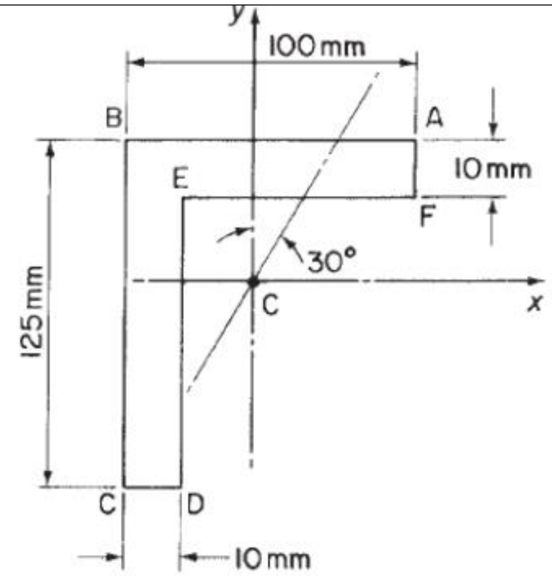


Figure 2a

		b)	Derive the bending stress equation for unsymmetrical bending using K method.	***CO1***	***PO1***	**10**
			UNIT - II			
	3	a)	Derive the equation of shear flow for the open thin-walled section.	***CO2***	***PO2***	**10**

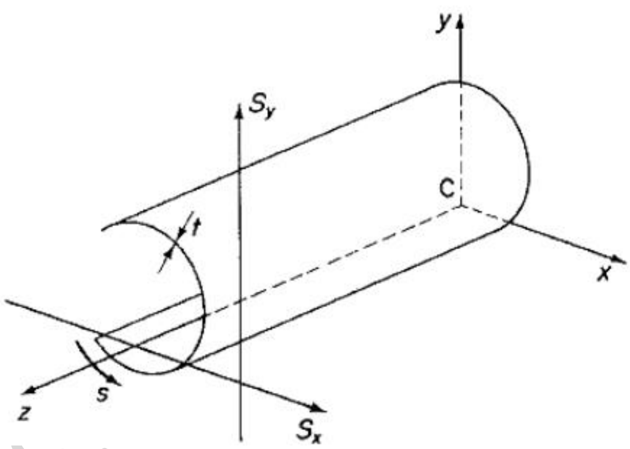
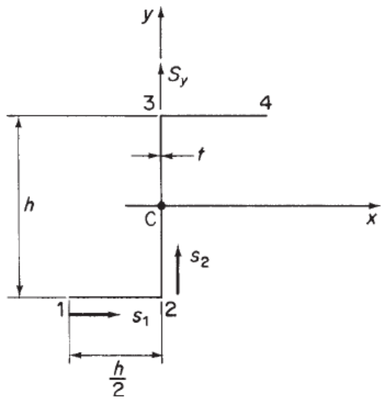
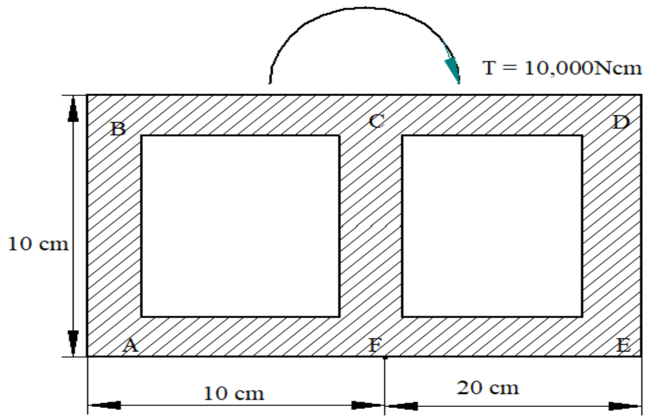


Figure 3a

		b)	Determine the position of shear center for channel section having dimensions 120 mm x 110mm and 10 mm thickness, under 10 kN of applied force.	***CO2***	***PO2***	**10**
			OR			
	4	a)	Determine the shear flow distribution in the thin-walled Z-section shown in Figure 4a due to a shear load Sy applied through the shear centre of the section.	***CO2***	***PO2***	**10**

			 Figure 4a			
	b)	Formulate the general shear centre equation for channel section having dimensions b,t_1,t_2,h subjected to vertical force F applied at a distance e from the centre.	***CO2***	***PO2***	**10**
		UNIT - III			
5	a)	Find the shear flow and twist per unit length of two tube structure as shown in Figure 5a ,Take G = 25 X 10^5 N/cm^2 and thickness t = 0.1 mm  Figure 5a	***CO2***	***PO2***	**12**
	b)	Explain breifly about Bredt Batho theory.	***CO3***	***PO1, PO2***	**08**
		OR			
6		Derive the equation of shear flow for the rectangular closed thin-walled section.	***CO3***	***PO1, PO2***	**20**
		UNIT - IV			
7	a)	A thin rectangular plate of side a and b (parallel to x & y -axis respectively) and thickness t is simply supported opposite edges and unload edges are free, and has a slight initial curvature giving an initial deflected shape.	***CO3***	***PO2***	**10**

<table>
<tr><td></td><td></td><td></td><td>

$$w = \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} A_{mn} \sin\frac{m\pi x}{a} \sin\frac{n\pi y}{b}$$

If the plate is subjected to a uniform compressive stress σ in the x-direction, find an approximate expression for the magnitude of the stress σ which causes the plate to buckle.

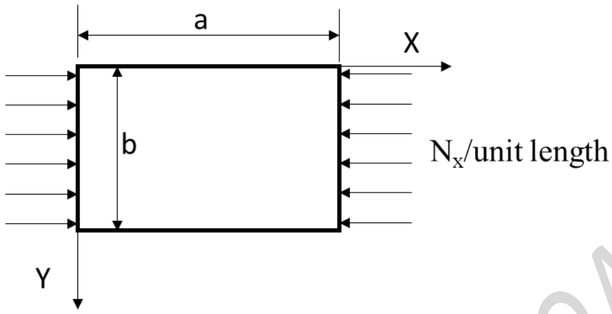


Figure 7a
</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>b)</td><td>

Calculate the crippling strength for the given formed section shown in the figure 6a using Needham's method. Assume E=75 GPa and the yield stress is 280 MPa. Thickness of the section is 1.0 mm and Total Area= 1.75cm^2.

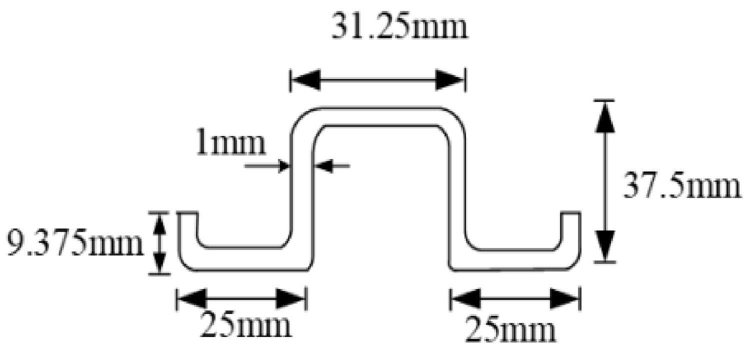


Figure 7b
</td><td>CO3</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>8</td><td>a)</td><td>

A thin rectangular plate of side a and b (parallel to x & y -axis respectively) and thickness t is simply supported opposite edges and unload edges are free, and has a slight initial curvature giving an initial deflected shape.

$$w = \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} A_{mn} \sin\frac{m\pi x}{a} \sin\frac{n\pi y}{b}$$

If the plate is subjected to a uniform compressive stress σ in the x and y -direction, find an approximate expression for the magnitude of the stress σ which causes the plate to buckle.
</td><td>CO3</td><td>PO2</td><td>15</td></tr>
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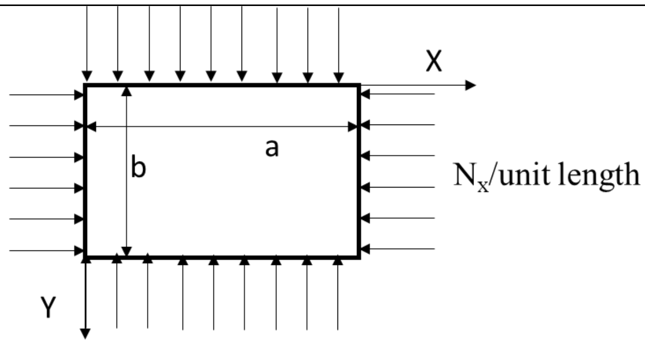
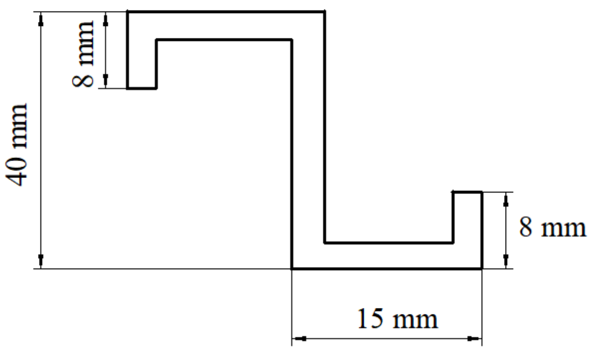
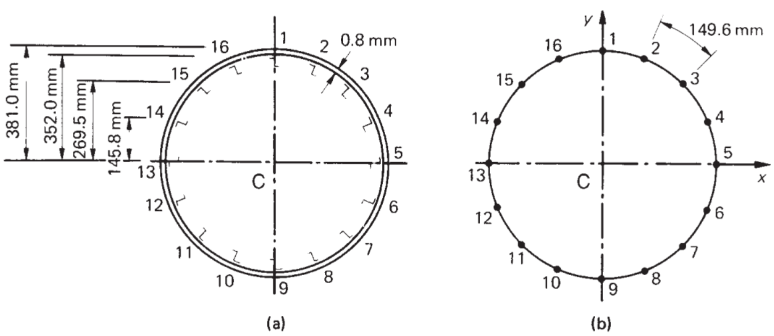
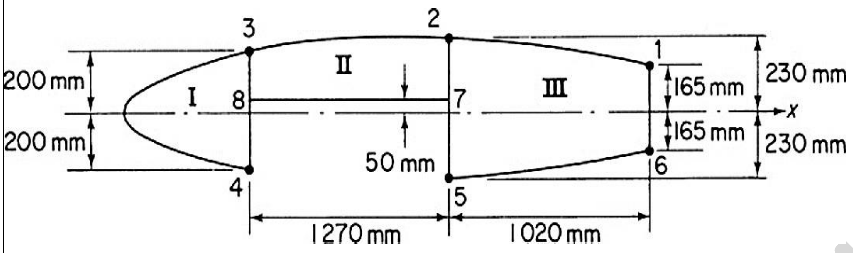
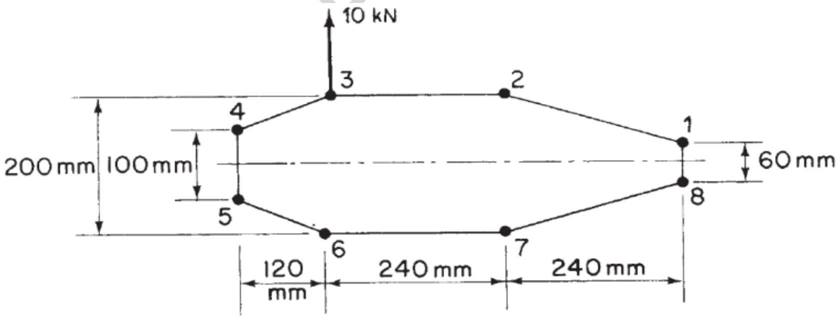
			 Figure 8a			
		b)	Calculate the crippling stress for the given extrusion section shown in the figure 8b using the Gerard method. Assume E=75 GPa and the yield stress is 280 MPa. Thickness of the section is 1.5 mm.  Figure 8b	*CO3*	*PO2*	**05**
			UNIT - V			
	9	a)	The fuselage of a light passenger carrying aircraft has the circular cross-section shown in Fig 9a. below. The cross-sectional area of each stringer is 100mm2 and the vertical distances given in Figure below are to the mid-line of the section wall at the corresponding stringer position. If the fuselage is subjected to a bending moment of 200 kNm applied in the vertical plane of symmetry, at this section, calculate the direct stress distribution.  Figure 9a	*CO5*	*PO2*	**12**

		b)	The wing section shown in Fig 9b. has been idealized such that the booms carry all the direct stresses. If the wing section is subjected to a bending moment of 300 kNm applied in a vertical plane, calculate the direct stresses in the booms. B1=B6=2580 mm2, B2=B5=3880 mm2, B3=B4=3230 mm2  Figure 9b	***CO5***	***PO2***	**08**
			OR			
	10		The thin-walled single cell beam shown in Fig 10. has been idealized into a combination of direct stress carrying booms and shear stress only carrying walls. If the section supports a vertical shear load of 10 kN acting in a vertical plane through booms 3 and 6, calculate the distribution of shear flow around the section. Boom areas: B1 =B8 =200mm^2 , B2 =B7 =250mm^2 , B3 =B6 =400mm2 , B4 =B5 =100mm^2 .  Figure 10	***CO4***	***PO2***	**20**

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