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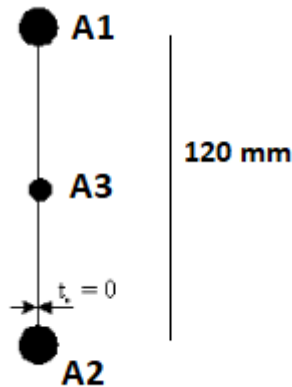
UPES
End Semester Examination, May 2023

Course: Aircraft Structures-II Program: B. Tech ASE & ASE+AVE Course Code: ASEG 3021	Semester: VI Time : 03 hrs. Max. Marks: 100
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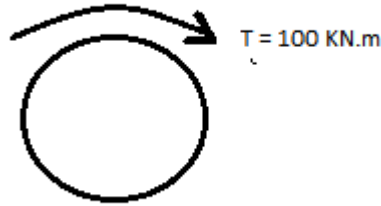
Instructions: Assume any suitable value for the missing data

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	True/False with justification in not more than two sentence. a) Skin of idealized aircraft wing rib cross-section carry only shear stress and booms bending stress. b) Shear center coincide with centroid for doubly axis symmetry cross-section.	4	CO1
Q2	True/False with justification in not more than two sentence. a) Flange predominantly carry shear stress and web bending stress in I- Section b) Shear flow distribution in a idealised fuselage cross-section will always has symmetry about both axis.	4	CO1
Q3	True/False with justification in not more than two sentence. a) In a plane of max. shear stress normal stress is zero. b) Twist is constant across the junction of thin walled section under pure torque	4	CO1
Q4	Determine the maximum bending stress carried by the idealized section subjected to positive bending moment of 100KNm about the centroid of section. Take $A_1 = A_2 = 100 \text{ mm}^2$ and $A_3 = 50 \text{ mm}^2$	4	CO2



Q5	<p>A thin circular beam cross-section of radius = 20 cm and thickness = 2 mm is subjected to torque $T = 100\text{kNm}$, the value of maximum shear stress is?</p>		
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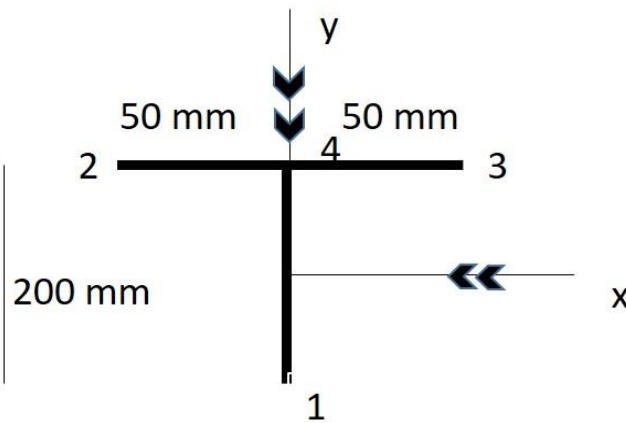


4

CO3

SECTION B
(4Qx10M= 40 Marks)

Q 6	<p>A T- section shown in fig. below. Calculate the maximum Flexural (bending) stress value and position, if the beam is subjected to moment, M_x and M_y of magnitude 100 KN mm and 50 KN mm respectively.</p>		
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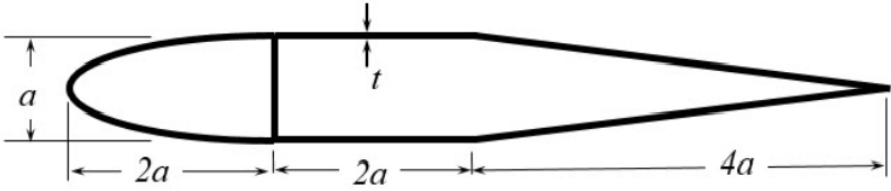
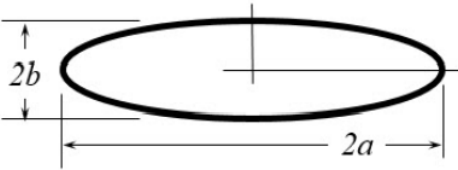
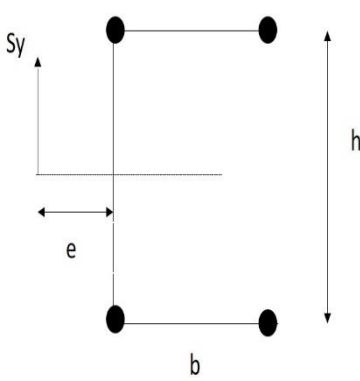
10

CO3

Q7	<p>A steel block with dimensions of 20 cm x 20 cm x 20 cm is subjected to a triaxial stress state. The normal stresses acting on the block are $\sigma_x = 150\text{ MPa}$, $\sigma_y = 200\text{ MPa}$, and $\sigma_z = 250\text{ MPa}$. The shear stresses acting on the block are $\tau_{xy} = 100\text{ MPa}$, $\tau_{yz} = 50\text{ MPa}$, and $\tau_z = 75\text{ MPa}$. The elastic modulus of the steel is 200 GPa and Poisson's ratio is 0.3. Find the below.</p> <p>A) The strain in the x-direction B) The strain in the y-direction C) The strain in the z-direction D) The shear strain in the xy-plane E) The shear strain in the yz-plane</p>		
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10

CO2

	F) The shear strain in the yz-plane		
Q8	<p>Fig. below shows the thin walled approximated airfoil cross-section subjected torque of 100 KNm. Find the shear flow distribution and twist of the cross-section. Take $a = 100$ mm, $b = 50$ mm, $t = 2$ mm and $G = 70$ GPa.</p>  <p style="text-align: center;"><i>Ellipse</i> Cross-Section Area: $A = \pi ab$ Circumference (S): $S \approx \pi \left(3(a + b) - \sqrt{(3a + b)(a + 3b)} \right)$ where $(a > b)$ and $a =$ semi-major axis $b =$ semi-minor axis</p> 	10	CO3
Q9	<p>An idealised channel section shown in Fig. 2 is subjected to a shear load, $S_y = 100$ KN. Find out the shear flow distribution over the section and determine the location of shear centre (e) from web. Take $h = 100$ mm, $b = 50$ mm. Area of each boom = 100 mm².</p> 	10	CO4
SECTION-C (2Qx20M=40 Marks)			
Q10	<p>Determine and draw the shear flow distribution of idealized wing section as shown in Fig. below, the wing is subjected to CCW torsion = 300 N m. Required data is provided in Table 1</p>	20	CO4

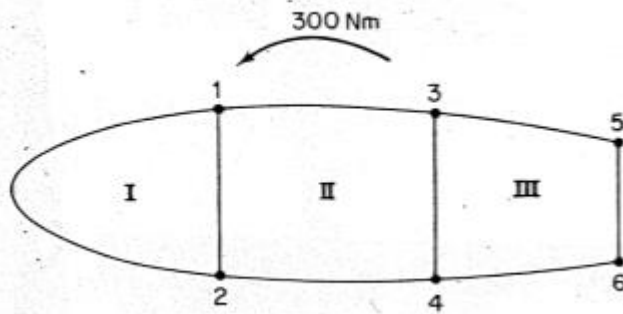


Table 1

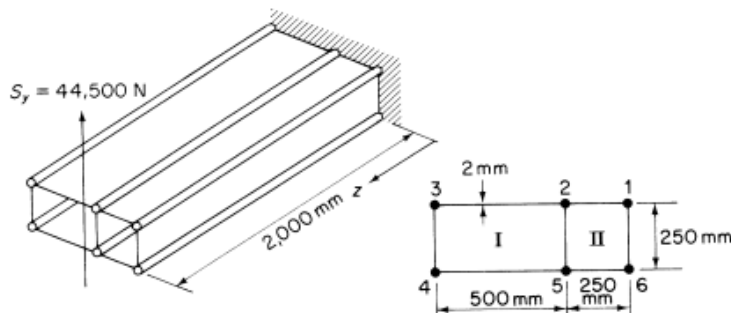
Wall	Length, mm	Thickness (mm)	G N/mm ²	Cell area (mm ²)
12 ^o	1500	1	25 000	A _I = 2500
12 ⁱ	500	2	30 000	A _{II} = 3000
13, 24	800	1	25 000	A _{III} = 2800
34	450	2	30 000	
35, 46	600	1	25 000	
56	400	2	30 000	

OR

Determine the shear flow distribution carry by the two-cell beam shown in fig. below, allowing for both bending and shear effects. The booms carry all the direct stresses while the skin panels, of constant thickness throughout, are effective only in shear.

Take $E = 69000 \text{ Nmm}^2$ and $G = 25000 \text{ Nmm}^2$

Boom areas: $B_1 = B_3 = B_4 = B_6 = 650 \text{ mm}^2$; $B_2 = B_5 = 300 \text{ mm}^2$



Q11

Consider a fuselage of of circular cross-section shown in fig. below subjected to bending moment $M_x = 200 \text{ Nm}$. The area of the stringers of L-cross-section are 200 mm^2 . Idealized the fuselage in boom and skin and determine the bending stress carried by the respective members.

20

CO4

