Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, May 2023

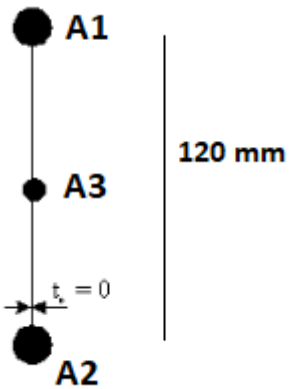
Course: Aircraft Structures-II **Semester: VI**

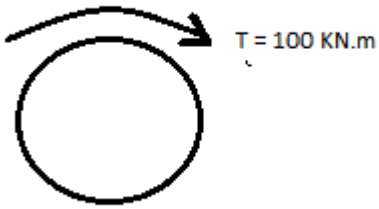
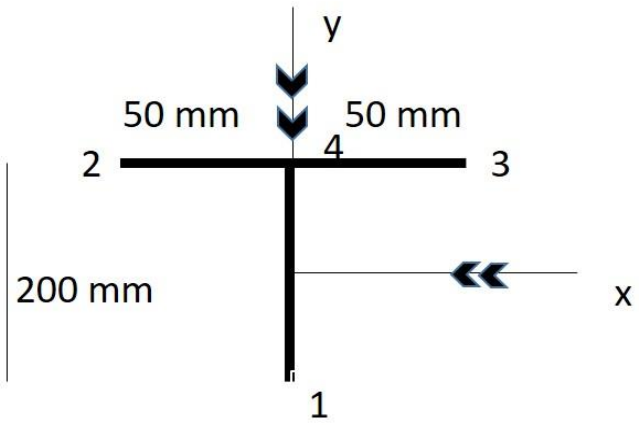
Program: B. Tech ASE & ASE+AVE **Time : 03 hrs.**

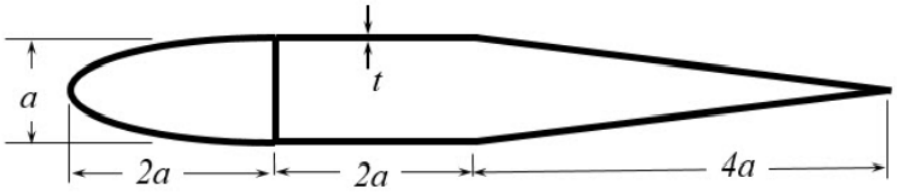
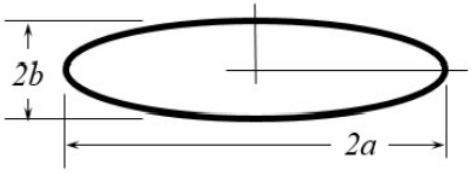
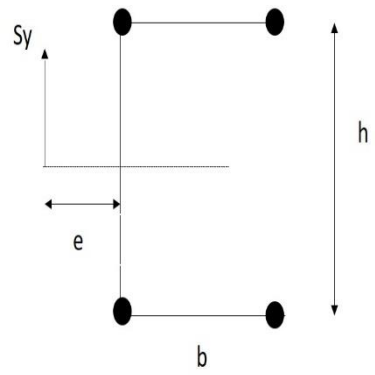
Course Code: ASEG 3021 **Max. Marks: 100**

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 $A_1 = A_2 = 100$ mm^2 and $A_3 = 50$ mm^2 	**4**	**CO2**

Q5	A thin circular beam cross-section of radius = 20 cm and thickness = 2 mm is subjected to torque T = 100kNm, the value of maximum shear stress is?  	**4**	**CO3**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	A T- section shown in fig. below. Calculate the maximum Flexural (bending) stress value and position, if the beam is subjeted to moment, M_x and My of magnitude 100 KN mm and 50 KN mm respectively.  	**10**	**CO3**
Q7	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 σ_x = 150 MPa, σ_y = 200 MPa, and σ_z = 250 MPa. The shear stresses acting on the block are τ_{xy} = 100 MPa, τ_{yz} = 50 MPa, and τ_z = 75 MPa. The elastic modulus of the steel is 200 GPa and Poisson's ratio is 0.3. Find the below. 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	**10**	**CO2**

	F) The shear strain in the yz-plane		
Q8	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= 70GPa.   ***Ellipse*** 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	**10**	**CO3**
Q9	An idelaised chaneel section shown in Fig. 2 is subjected to a shear load, Sy = 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 $mm^{2.}$  	**10**	**CO4**
SECTION-C (2Qx20M=40 Marks)			
Q10	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	**20**	**CO4**

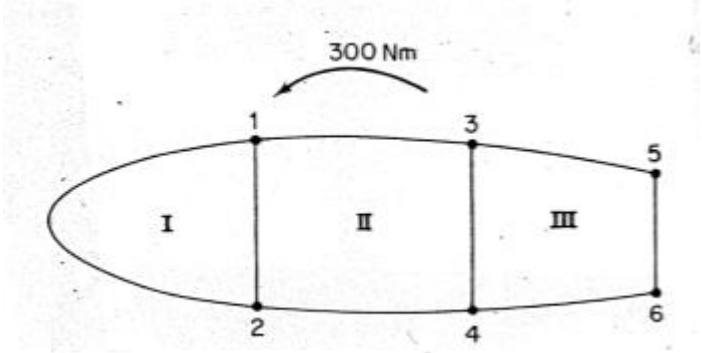


Table 1

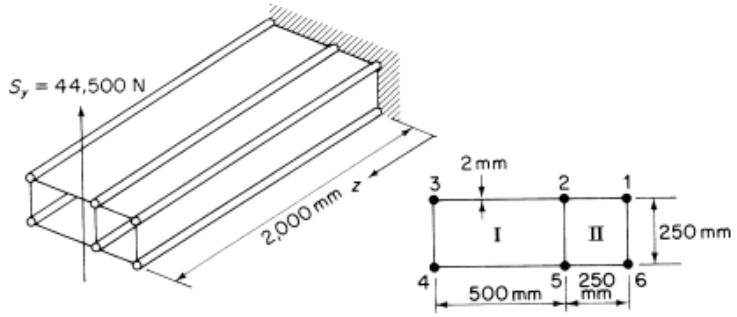
Wall	Length , mm	Thickness (mm)	G N/ mm^2	Cell area (mm^2
12^0	1500	1	25 000	A_I = 2500
12^i	500	2	30 000	A_{II} = 3000
13, 24	800	1	25 000	A_{III} = 2800
34	450	2	30 000	
35, 46	600	1	25 000	
56	400	2	30 000	

OR

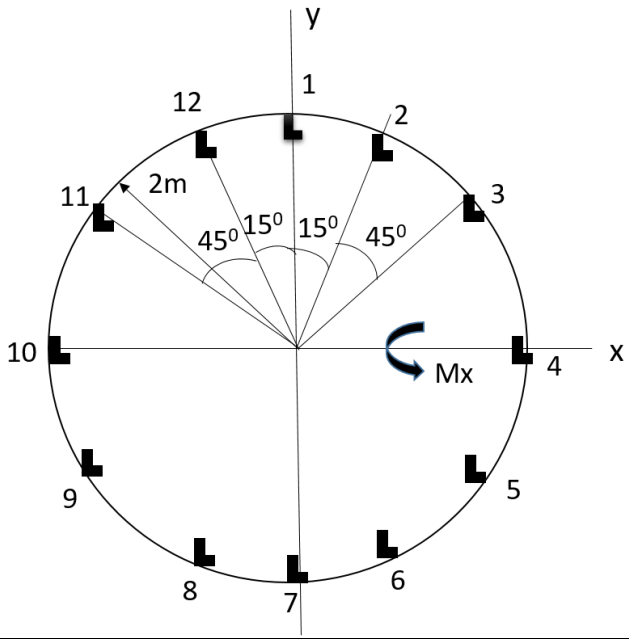
Determine the shear flow distribution carry by the two-cell beam shown in fig. below, allowing for both bending and shear effects. The booms carry all the direct stresses while the skin panels, of constant thickness throughout, are effective only in shear.

Take E = 69000 Nmm^2 and G = 25000 Nmm^2

Boom areas: B1 = B3 = B4 = B6 = 650 mm^2; B2 = B5 = 300 mm^2



Q11	Consider a fuselage of of circular cross-section shown in fig. below subjected to bending moment Mx= 200 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**


y
1
2
3
4
5
6
7
8
9
10
11
12
x
Mx
2m
45⁰
15⁰
15⁰
45⁰