Name:	UPES
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

END Semester Examination, December 2018

Programme Name: B.Tech ASE, ASEA **Semester : V**
Course Name : Aircraft Structures **Time : 03 hrs**
Course Code : ASEG 335 **Max. Marks : 100**
Nos. of page(s) : 03

Instructions:

1) Mention Roll No. at the top of the question paper.
2) Do not write anything else on the question paper except your roll number.
3) ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY.
4) Internal choice is given in question number 8 and 9. Assume any suitable data if missing.

SECTION A (5 x 4 = 20 Marks)

S. No.		Marks	CO
Q 1	State and explain the principle of stationary value of the total complimentary energy with suitable example.	5	CO2
Q 2	Explain Bredth-Batho theory for torsion in a thin walled closed section. Also derive the suitable mathemaical expression.	5	CO3
Q 3	Determine the moment of inertia about the horizontal centroid axis of the thin walled cross-section as shown in Figure-3. Assume r = 50 mm and t = 2mm.	5	CO2
Q 4	Calculate the direct stress due to bending in idealized section as shown in Figure-4 when the section is subjected to a positive bending moment of Mx = 5kN-m. All 6 flanges have equal areas of 150 mm^2. Assume skin ineffective in bending. Also, calculate the position of neutral axis.	5	CO3

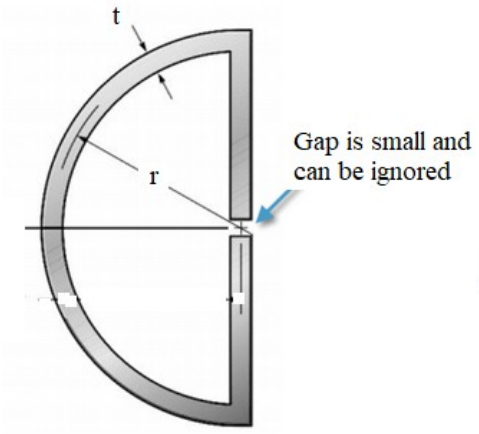


Figure – 3

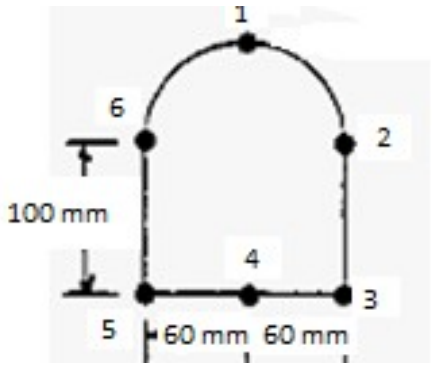
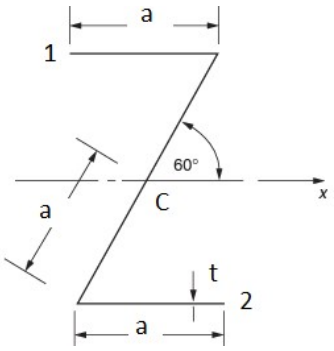
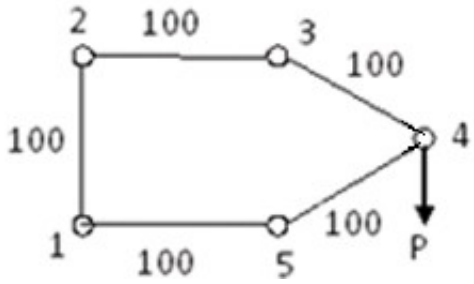
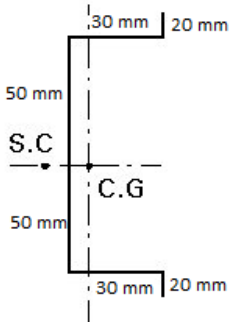
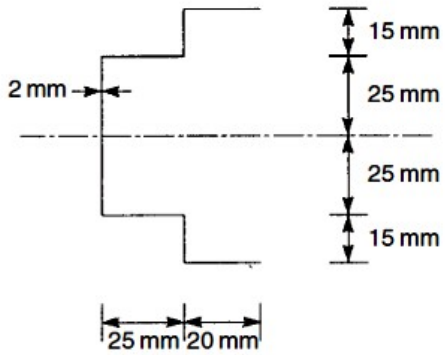
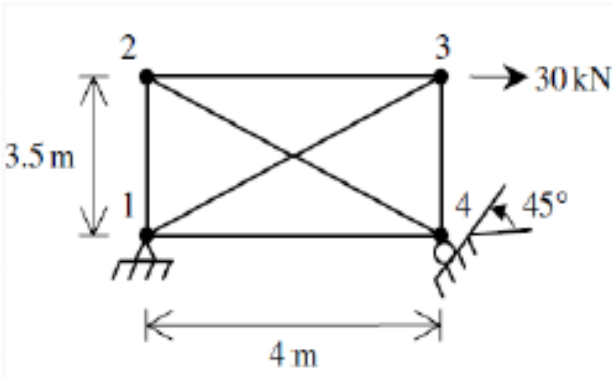
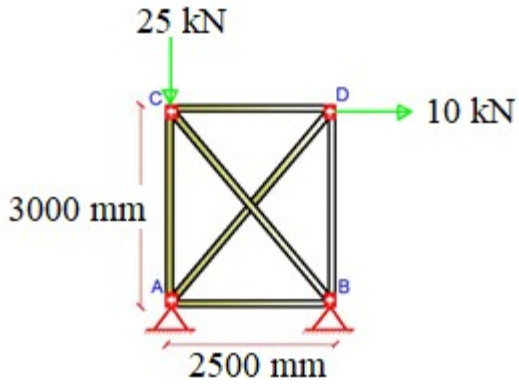
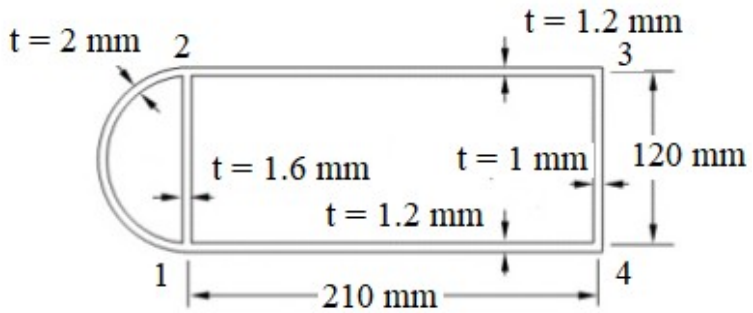


Figure-4

SECTION B (10 x 4 = 40 Marks)			
Q 5	What are the importance of structural weight in aircraft structure? Explain the different strategy used in aircraft wings structure to reduce its weight.	**10**	**CO1**
Q 6	The thin-walled beam section as shown Figure-6 is subjected to a bending moment M_x applied in a negative sense. Find the position of the neutral axis and the maximum direct stress in the section.	**10**	**CO3**
Q 7	With reference to the idealized section as shown in Figure-7, find the shear flow in each webs. The area of each stringer member is 200 mm^2 and P = 100N. All dimensions are given in mm.  Figure – 6  Figure – 7	**10**	**CO4**
Q8	Determine the location of shear center of the thin walled section as shown in figure below, subjected to a vertical shear force of 50 kN through shear center. Assume t = 2mm is same for all the members.  Or Calculate the shear flow at each corner point of the thin walled section as shown below, subjected to a vertical shear force of 100 N in vertical direction through the shear center.	**10**	**CO4**

			
	SECTION-C (20 x 2 = 40 Marks)		
Q 9	Determine the horizontal displacement of point 3 of the pin jointed framework as shown in Figure below using matrix method. Assume A and E are 200mm^2 and 210 GPa same for all the members.  Or Determine the displacement of joint C and D of the pin-jointed framework as shown below using matrix method. 	**25**	**CO5**
Q 10	A thin walled wing box structure has two cells as shown below along with the dimensions. The wing box is subjected to a torque of T = 10 x 10^6 Nmm and the length of the wing box is 1.2m and the material of the wing box has a shear modulus G = 28 GPa. • Calculate the shear flows due to the applied torque.	**25**	**CO4**

- Calculate the twist angle of the wing box under the applied loading.
- Calculate the torsional rigidity GJ.



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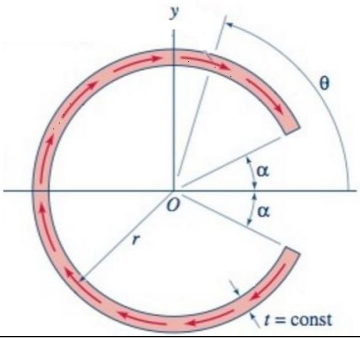
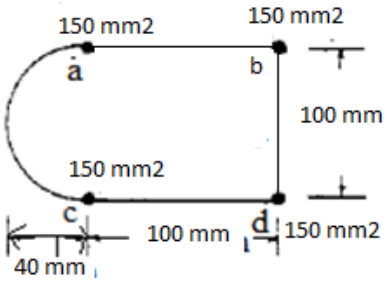
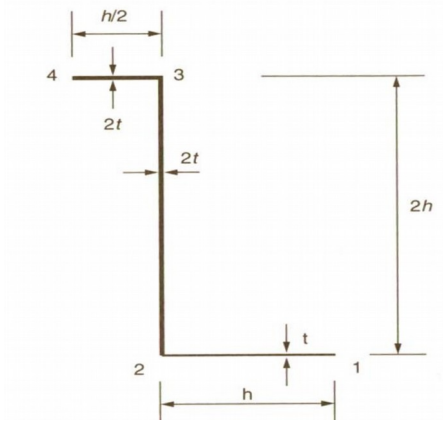
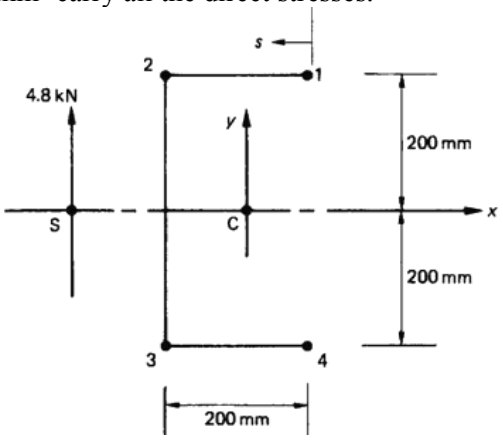
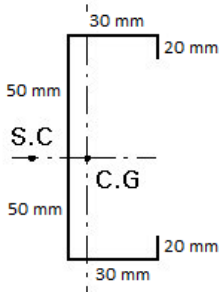
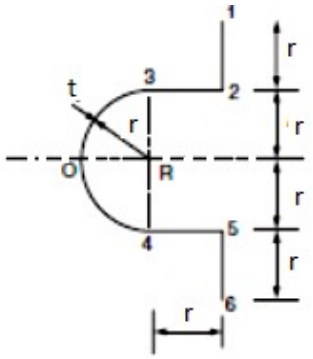
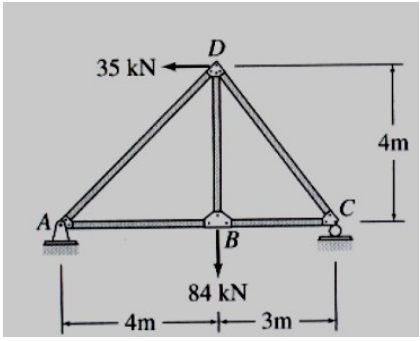
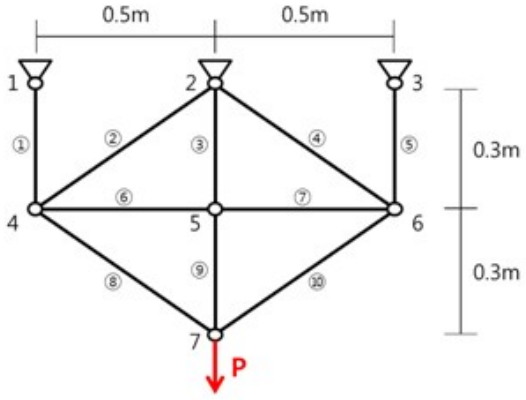
SECTION A
(5 x 4 = 20 Marks)

S. No.		Marks	CO
Q 1	Define, Strain Energy and Complementary Energy with a suitable Example?	5	CO2
Q 2	Determine the moment of inertia about the horizontal centroid axis of the thin walled cross-section as shown below. (Assume α = 30°, r = 50 mm and t = 2mm). 	5	CO2
Q 3	An Unsymmetrical fuselage section as shown in Figure below, has been idealized into an arrangement of direct stress carrying booms and shear stress carrying skin panels; the booms areas are given adjacent to booms. Calculate the direct stresses in the booms when the section is subjected to a bending moment of Mx = 200 kN-m.	5	CO3

			
Q 4	Define Shear Center? Explain its importance in aircraft structures.	**5**	**CO3**
SECTION B (10 x 4 = 40 Marks)			
Q 5	What are the importance of structural weight in aircraft structure? Explain the different strategy used in aircraft fuselage structure to reduce its weight.	**10**	**CO1**
Q6	A thin walled beam has the cross section shown in Figure - 6. If the beam is subjected to a bending moment about y-axis My = 1000 Nm at a particular location along its length, calculate and sketch the distribution of axial stress in the beam cross section. Assume h = 200 mm and t = 5 mm.	**10**	**CO3**
	Calculate the shear flow distribution and the location of shear center in the idealized channel section as shown in figure -7, produced by a vertical shear force of 4.8 kN acting through its shear center. The booms each of area 300 mm^2 carry all the direct stresses.  Figure – 6  Figure - 7	**10**	**CO4**
Q8	Determine the location of shear center of the thin walled section as shown in figure below, subjected to a vertical shear force of 50 kN through shear center. Assume t = 2mm is same for all the members.  Or Calculate the shear stress at each corner points (1,2,3,4,5,6) of the thin walled open	**10**	**CO4**

	section as shown below, subjected to a vertical shear force Sy through the shear center. 		
	SECTION-C (20 x 2 = 40 Marks)		
Q 9	Determine the displacement of joint B, C and D of the pin-jointed framework as shown in figure below using Matrix Method. Assume A = 1400 mm^2 and E = 200GPa is same for all members.  Or Determine the forces in the each member of the pin-joint framework as shown below. 	**25**	**CO5**
Q 10	A hollow thin-walled torsion member has two compartments with cross-sectional dimensions as indicated in the figure below. The material is an aluminum alloy for	**25**	**CO4**

	which G = 26 GPa. Determine the torque and angle of twist per unit length if the maximum shear stress at any point cannot exceeds 40 MPa.