

B.E. (Aeronautical Engineering) Fifth Semester (C.B.S.)  
**Aircraft Structure – II Paper – IV**

P. Pages : 4

Time : Three Hours



TKN/KS/16/7461

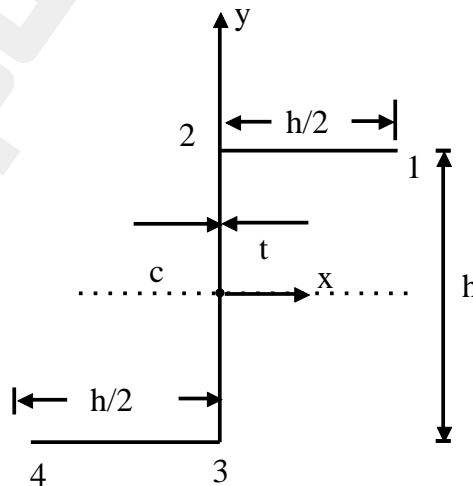
Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Solve Question 1 OR Questions No. 2.
  3. Solve Question 3 OR Questions No. 4.
  4. Solve Question 5 OR Questions No. 6.
  5. Solve Question 7 OR Questions No. 8.
  6. Solve Question 9 OR Questions No. 10.
  7. Solve Question 11 OR Questions No. 12.
  8. Due credit will be given to neatness and adequate dimensions.
  9. Assume suitable data whenever necessary.
  10. Diagrams and Chemical equations should be given whenever necessary.
  11. Illustrate your answers whenever necessary with the help of neat sketches.
  12. Use of non programmable calculator is permitted.

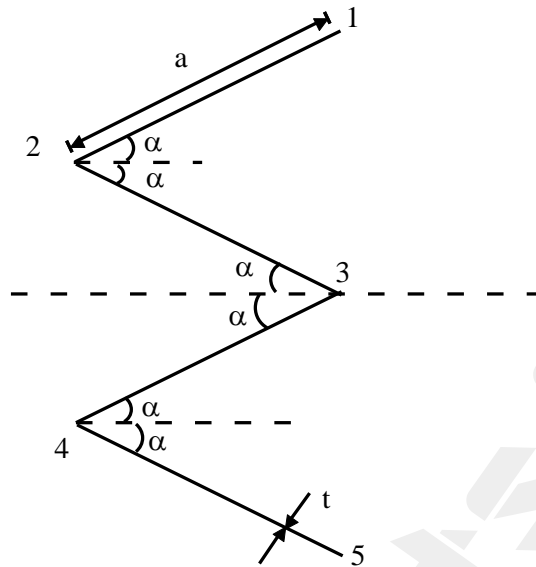
1. a) Using the equation of bending stresses due to unsymmetric bending, derive the equation for the position of neutral axis. **5**  
b) State and explain, parallel and perpendicular axis theorems. **5**  
c) Find  $I_{xx}$  and  $I_{yy}$ , for a rectangle having breadth 'b' and depth 'd'. **3**

**OR**

2. Determine the direct stress distribution in the thin walled z-section. shown below, due to positive bending moment  $M_x$ . **13**

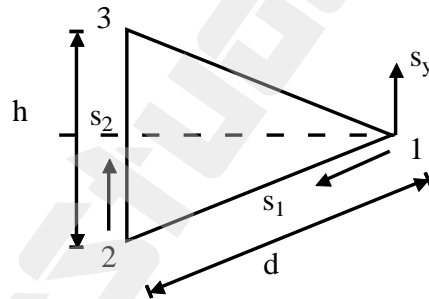


3. A beam has the singly symmetrical thin walled c/s shown in fig. Each wall of the section is flat and has same length 'a' and thickness 't'. Calculate the distance of shear centre from point 3. 13

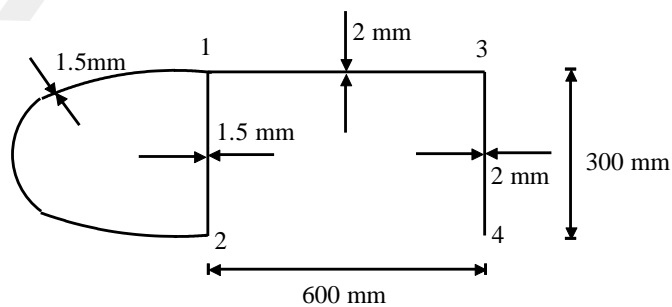


OR

4. A uniform Hain – walled beam of constant wall thickness 't' has a c/s in the shape of an isosceles triangle and is loaded with a vertical shear force  $s_y$  applied at the apex. Calculate the distribution of shear flow over the c/s. 13



5. a) Explain the theory of torsion for closed section beams. Derive the necessary formulas. What it is called? 7
- b) Find the angle of twist per unit length in the wing whose cross – section is shown in the fig. when it is subjected to a torque of 10 kN/m. Find also the maximum shear stress in the section  $G = 25000 \text{ N/mm}^2$  7  
 Wall 12 (outer) = 900 mm  
 Nose cell area = 20000mm<sup>2</sup>

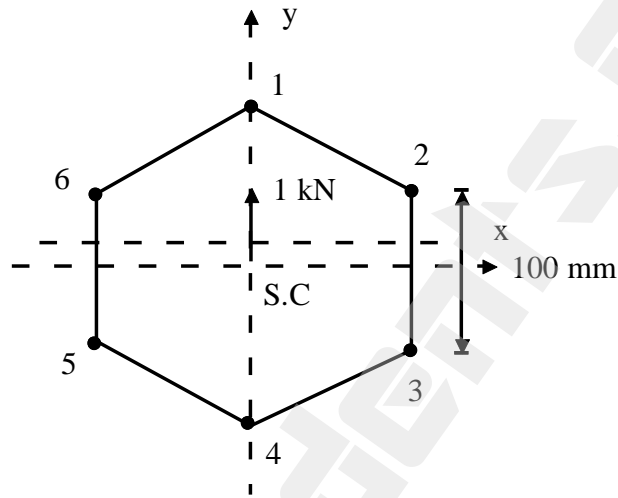


OR

6. A thin walled circular section beam has a diameter of 200mm and is 2m long, it is firmly restrained against rotation at each end. A concentrated torque of 30 kN/m is applied to the beam at its mid-span point. If the maximum shear stress in the beam is limited to  $200\text{ N/mm}^2$  and the maximum angle of twist to  $2^\circ$ , Calculate the minimum thickness of beam walls. 14

Take :  $G = 25000\text{ N/mm}^2$

7. The regular hexagonal idealised section is as shown below. All sides of the section are of 100mm length while it has a constant thickness of 1mm. The shear modulus 'G' is same for all walls. Calculate the shear flow distribution in the section due to a vertical shear load of 1KN through its shear centre. 13

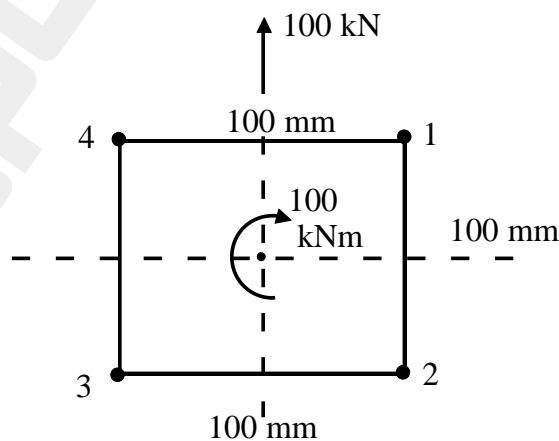


Boom areas,  $B_1 = B_4 = 100\text{ mm}^2$

$B_2 = B_3 = B_5 = B_6 = 200\text{ mm}^2$

OR

8. Find the shear flow distribution in the square – idealized section shown below due to a combination of shear load of 100 kN and torque of 100 kNm. 13



Shear modulus for all walls is constant and thickness is constant.

9. Prove that, the critical buckling load  $N_x$ ,  $C_r$  for a thin rectangular simply supported plate is given by **13**

$$N_x, C_r = \frac{K\pi^2 D}{b^2}$$

**OR**

10. a) Explain in detail, the elastic and in-elastic buckling of plates. **6**  
b) What do you mean by tension field beams? Explain in detail. **7**
11. Find the shear flow distribution in the 2 – square celled doubly symmetric idealized section of all walls 100 mm length, due to a clockwise torque of 100 kN/m. All beams have same cross sectional area of  $100 \text{ mm}^2$ . All walls have same thickness of 2 mm. Assume, shear modulus of all walls to be same. **14**

**OR**

12. Explain the following cases in detail for idealized sections. **14**  
a) Fuselage under the application of torque.  
b) Multicell wings under the application of shear load.

Explain the above with equations & examples.

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