NTK/KW/15/7461

Faculty of Engineering & Technology

Fifth Semester B.E. (Aeronautical Engg.) (C.B.S.) Examination

AIRCRAFT STRUCTURE-II

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Solve Question No. **1 OR** Question No. **2**.

(3) Solve Question No. **3 OR** Question No. **4**.

(4) Solve Question No. **5 OR** Question No. **6**.

(5) Solve Question No. **7 OR** Question No. **8**.

(6) Solve Question No. **9 OR** Question No. **10**.

(7) Solve Question No. **11 OR** Question No. **12**.

(8) Due credit will be given to neatness and adequate dimensions.

(9) Assume suitable data wherever necessary.

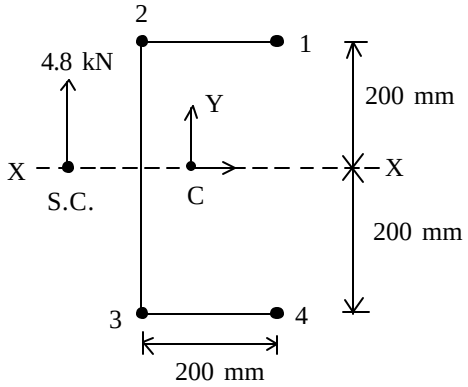
(10) Diagrams and chemical equations should be given wherever necessary.

(11) Illustrate your answers wherever necessary with the help of neat sketches.

(12) Use of Non-programmable calculator is permitted.

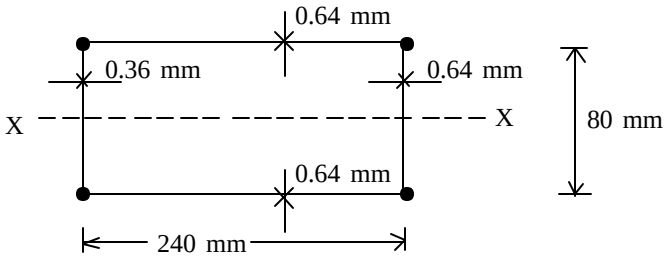
9. (a) Derive the relationship between the applied torque 'T' and induced shear flow 'q', in the closed thin walled sections. 7

(b) Calculate the shear flow distribution in the channel section shown below produced by a vertical shear load of 4.8 kN acting through its shear centre. All booms have cross sectional area of 300 mm^2. 6

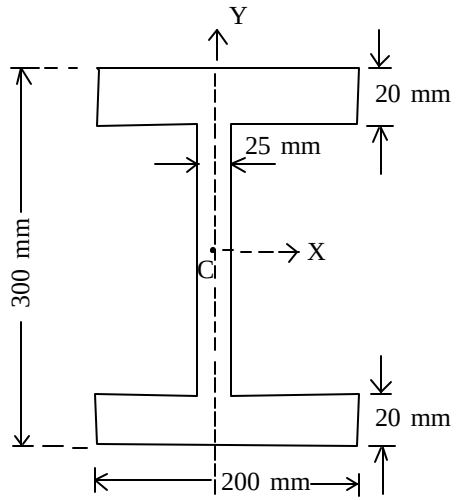


OR

10. Find the position of the shear centre of the rectangular four boom beam section shown in fig. below. The booms carry only direct stresses. The area of each boom is 100 mm^2. 13



(b) The cross-section of the beam has dimensions shown in fig. If the beam is subjected to the moments M_X = –100 kNm and M_Y = 100 kNm. Find the bending stress distribution over the section and sketch it. 7



3. Prove that, the general stress equations for thin walled beams are given by,

$$\frac{\partial q}{\partial s} + t \cdot \frac{\partial \sigma_z}{\partial z} = 0; \text{ and } \frac{\partial q}{\partial s} + t \cdot \frac{\partial \sigma_s}{\partial s} = 0.$$

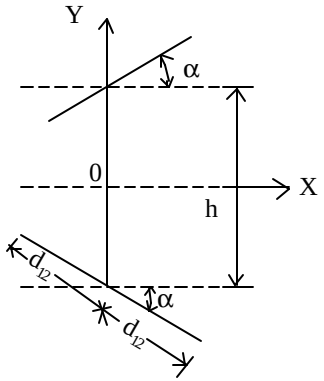
Using these equations, derive the equation of shear flow for thin walled beams sections in general case. 13

OR

4. A beam has singly symmetrical, thin walled cross section as shown in fig. below. The thickness 't' of the walls is constant throughout. Show that, the distance of the shear centre from the web is given by,

$$e_x = -d \cdot \frac{\rho^2 \cdot \sin\alpha \cdot \cos\alpha}{1 + 6\rho + 2\rho^3 \sin^2\alpha}$$

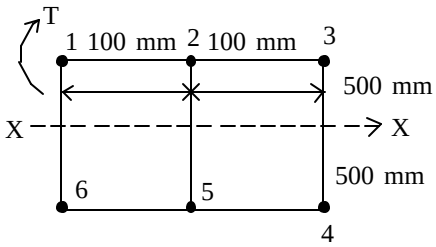
where, ρ = d/h. 13



5. A thin walled circular section beam has a diameter of 200 mm and is 2 m long, it is firmly restrained against rotation at each end. A concentrated torque of 30 kNm is applied to the beam at its midpoint of span. If the maximum shear stress in the beam is limited to 200 N/mm^2 and the maximum angle of twist to 2°, calculate the minimum thickness of the beam walls. G = 25000 N/mm^2 14

OR

6. Find the shear flow distribution in a 2-celled singly symmetric idealized section as shown in fig., due to clockwise torque of 100 kNm. All booms have same cross sectional area of 100 mm^2. All walls have same thickness of 2 mm shear modulus is same for both cells. 14



7. Consider a thin rectangular plate of dimensions a × b, simply supported along its edges. It is subjected to the uniaxial compressive load of N_x/length along edges x = 0 and x = a. Find the critical buckling stress for this plate, assuming elasticity. What will be critical buckling stress if inelastic buckling is assumed ? 13

OR

8. (a) Write a short note on Tension field beams. 4

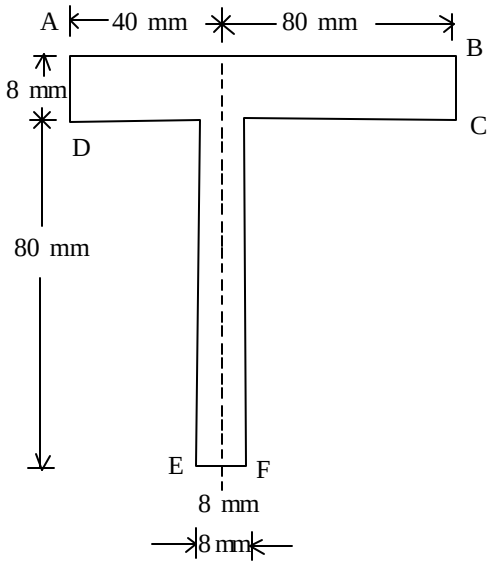
(b) For tension field beams, prove the following equation :

$$\tan^4 a = \frac{1 + (td/2A_F)}{1 + (tb/A_S)}$$

where symbols carry their usual meaning. 9

1. (a) State and explain, parallel and perpendicular axis theorems. 5

(b) A beam having the cross-section as shown in fig. below, is subjected to a bending moment of 1500 Nm in a vertical plane. Find the bending stresses at points A to F. At which point maximum bending stress acts ? 8



OR

2. (a) Derive the relationship between load intensity, shear force and bending moment in a general case. 6

11. (a) Give the conditions used for analysis of multicell structures under the action of Sy and torque 'T' simultaneously. 4

(b) What do you mean by shear flow ? How will you calculate shear stress from it ? What is its structural design significance ? 5

(c) Give the various conditions used for the analysis of open and closed section (combined) to find shear flow. 5

OR

12. The doubly symmetric fuselage section is shown in fig. below. It has been idealized. All boom areas are 150 mm^2. Find the shear flow distribution and sketch it, due to shear load of 50 kN. 14