**CBCS SCHEME**

USN | | | | | | | | | | |

**15AE64**

## Sixth Semester B.E. Degree Examination, Aug./Sept.2020
## Aircraft Structures – II

Time: 3 hrs. Max. Marks: 80

***Note: Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

### Module-1

1 a. Derive an equation for direct stress due to bending in an unsymmetrical section. **(08 Marks)**

b. A thin walled cantilever beam of unsymmetrical cross-section supports shear loads at its free end as shown in Fig.Q1(b). calculate the value of direct stress at the extremity of the lower flange (Point A) at a section half way along the beam if the position of the shear loads is such that no twisting of the beam occurs.

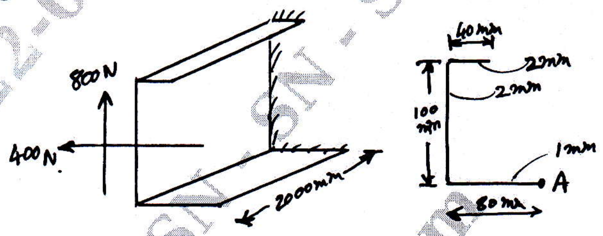


Fig.Q1(b) **(08 Marks)**

**OR**

2 a. Define : Shear flow, shear center, elastic air and Bredt-Batho theory. **(08 Marks)**

b. Calculate the position of the shear center of the thin walled section shown in Fig.Q2(b).

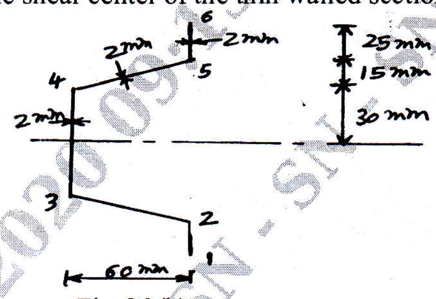


Fig.Q2(b) **(08 Marks)**

### Module-2

3 a. Find the angle of twist per unit length in the wing whose cross-section is shown in Fig.Q3(a) when it is subjected to a torque of 10 kNm. Find also the maximum shear stress in the section. G = 25 GPa. Wall 12(outer) = 900 mm. Nose cell area = 20,000 mm$^2$.

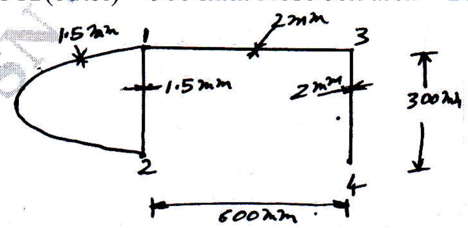


Fig.Q3(a) **(08 Marks)**

b. If the wing box as shown in Fig.Q3(b) is subjected to a torque of 100 kNm, calculate the rate of twist of the section and the maximum shear stress G = 25 GPa.

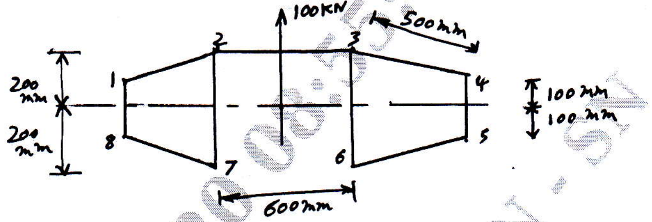


Fig.Q3(b) **(08 Marks)**

**OR**

4 a. Obtain the equation for shear flow in open section idealized beam. **(08 Marks)**

b. Fig.Q4(b) shows Two-cell box type wing section with vertical spars connected to the wing skin through angle sections having cross sectional area of 300 $mm^2$. Idealize the section into direct stress carrying booms and shear stress only carrying panels suitable for resisting bending moments in virtual plane.

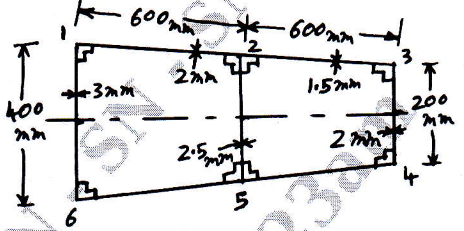


Fig.Q4(b) **(08 Marks)**

## Module-3

5 a. Derive an equation for critical stress for uniform rectangular plate. **(08 Marks)**

b. The sheet stringer panel shown in Fig.Q5(b) is loaded in compression. The sheet is assumed to be simply supported at the loaded ends and free at the sides. Each stringer has an area of 65 $mm^2$. Assume $E = 7.1\times10^4$ MPa, K = 3.62 and 0.385 for the sheet between stringers and edge of the sheet respectively. Find the total compressive load (i) when the sheet first buckles (ii) when the stringer stress is 69 MPa.

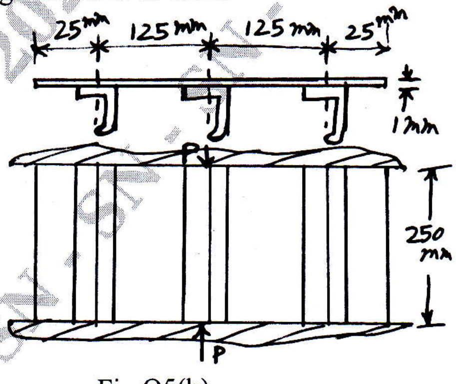


Fig.Q5(b) **(08 Marks)**

**OR**

6 a. Explain the design parameters involved in Rivet joints. **(12 Marks)**

b. Write a note on effective skin width. **(04 Marks)**

## Module-4

7 a. Determine the shear flow distribution in the web of the tapered beam shown in Fig.Q7(a) at a section midway along its length. The web of the beam has a thickness of 2mm and is fully effective in resisting direct stress. Each flange area is 400 $mm^2$.

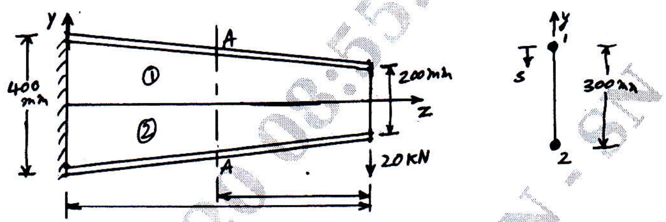


Fig.Q7(a) **(12 Marks)**

b. Write a note on wing strength requirements. **(04 Marks)**

**OR**

8 The structural portion of a wing consists of a three-bay rectangular section box which may be assumed to be firmly fixed at all points around its periphery. The wing is having a cut-out on the under surface of the central bay and is subjected to a torque of 10 kNm at its tip as shown in Fig.Q8. Calculate the shear flows in the skin panels, spar webs, loads in the corner flanges and the forces in the ribs on each ride of cut-out.

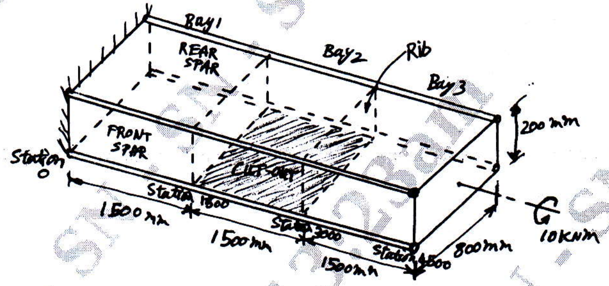


Fig.Q8 **(16 Marks)**

## Module-5

9 The fuselage as shown in Fig.Q9 is subjected to a vertical shear load of 100 kN applied at a distance of 150mm from the vertical axis of symmetry as shown for the idealized section. Calculate the distribution of shear flow in the section.

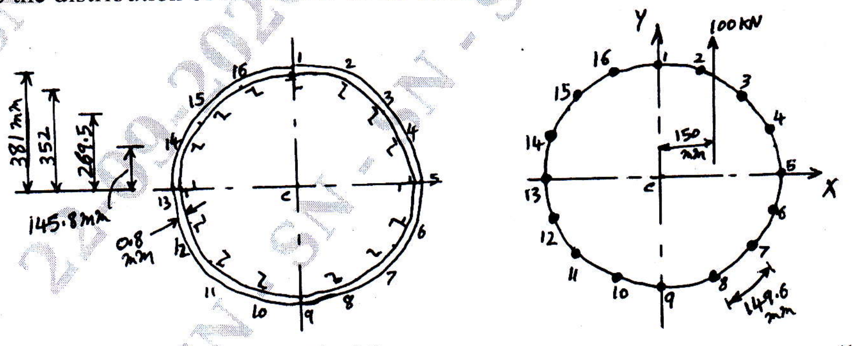


Fig.Q9 **(16 Marks)**

**OR**

10 a. Explain with a neat sketch, how shear flow is calculated in fuselage panel with cutouts for windows. **(08 Marks)**

b. Explain with a neat sketch, how shear flow distribution around the periphery of the frame is determined. **(08 Marks)**

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