U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 20AE6DCAST **Max Marks: 100**
Course: Aerospace Structures

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Explain the various loads acting on structural components. Also discuss the functions of structural members in aircraft structures. **10**

b) The cross-section of a beam has the dimensions shown in Fig.1. If the beam is subjected to a negative bending moment of 100 kN m applied in a vertical plane, determine the distribution of direct stress through the depth of the section. **10**

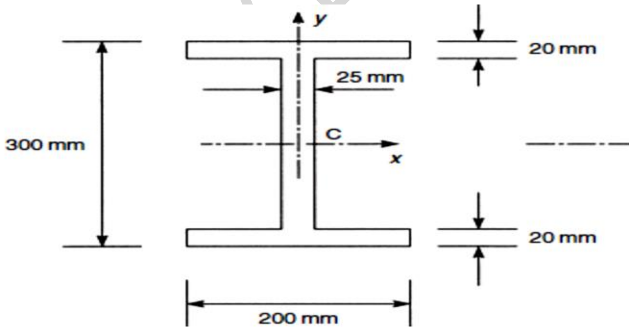

Fig.1

UNIT - II

2 a) A beam has the singly symmetrical, thin-walled cross-section shown in Figure below. Each wall of the section is flat and has the same length a and thickness t. Calculate the distance of the shear centre from the point 3. **10**

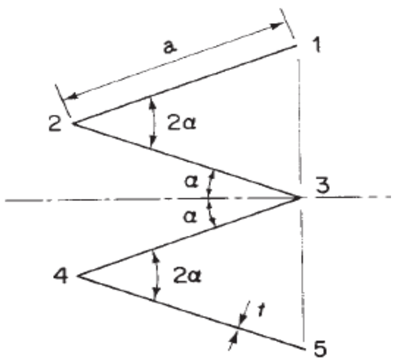

Fig.2

b) Derive the expression for shear loading of open section beam with the appropriate sketch. **10**

UNIT - III

3 A thin-walled closed section beam has the singly symmetrical cross-section shown in Fig.3. Each wall of the section is flat and has the same thickness t and shear modulus G. Calculate the distance of the shear center from point 4. **20**

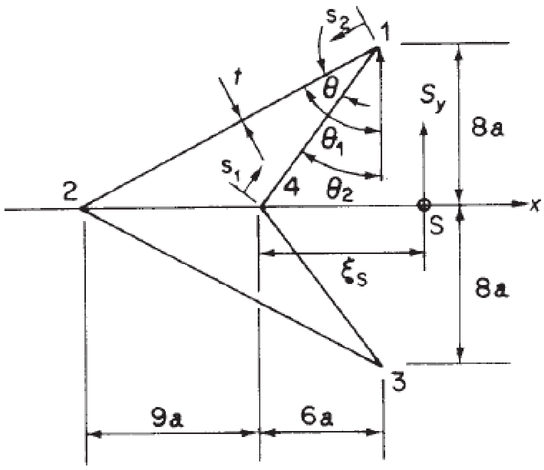

Fig.3

UNIT - IV

4 A thin rectangular plate of side a and b (parallel to x & y -axis respectively) and thickness "t" is simply supported opposite edges and unload edges are free, and has a slight initial curvature giving an initial deflected shape. **20**

$$w = \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} A_{mn} \sin\frac{m\pi x}{a} \sin\frac{n\pi y}{b}$$

If the plate is subjected to a uniform compressive stress σ in the x and y -direction, find an approximate expression for the magnitude of the stress σ which causes the plate to buckle.

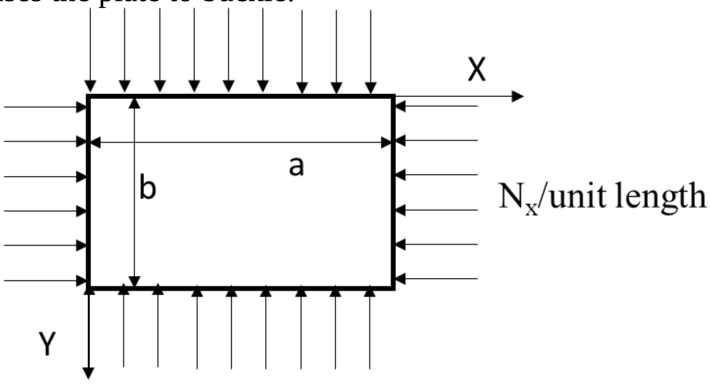

Fig.4

OR

5 a) Derive the expressions for failure stress in plates and stiffened panels. **10**

b) The beam shown in Fig.5 is assumed to have a complete tension field web. If the cross-sectional areas of the flanges and stiffeners are, respectively, 350 mm^2 and 300 mm^2 and the elastic section modulus of each flange is 750 mm^3, determine the maximum stress in a flange and also whether or not the stiffeners buckle. The thickness of the web is 2 mm and the second moment of area of a stiffener about an axis in the plane of the web is 2,000 mm^4; E = 70,000 N/mm^2. **10**

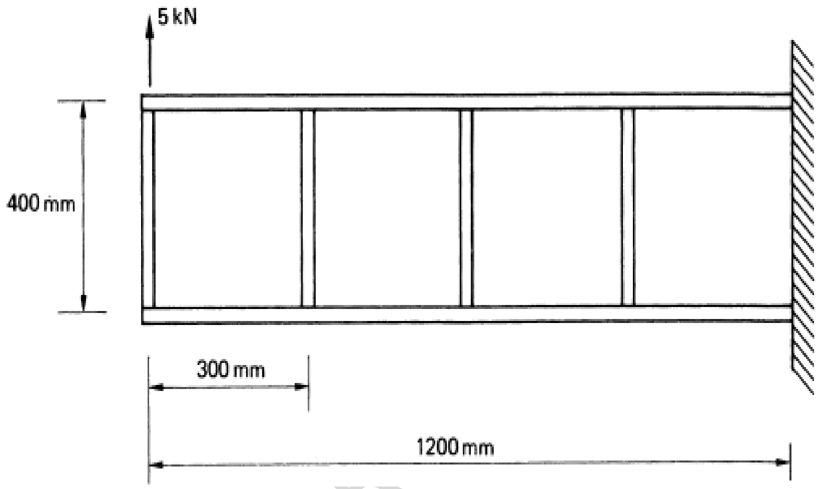

Fig.5

UNIT - V

6 a) Determine the shear flow distribution in the web of the tapered beam shown in Fig.6 at a section midway along its length. The web of the beam has a thickness of 2 mm and is fully effective in resisting direct stress. The beam tapers symmetrically about its horizontal centroidal axis and the cross-sectional area of each flange is 400 mm^2. The internal bending moment and shear load at the section AA produced by the externally applied load are, respectively, M_x 20 x 1 = 20 kNm; S_y=20 kN **10**

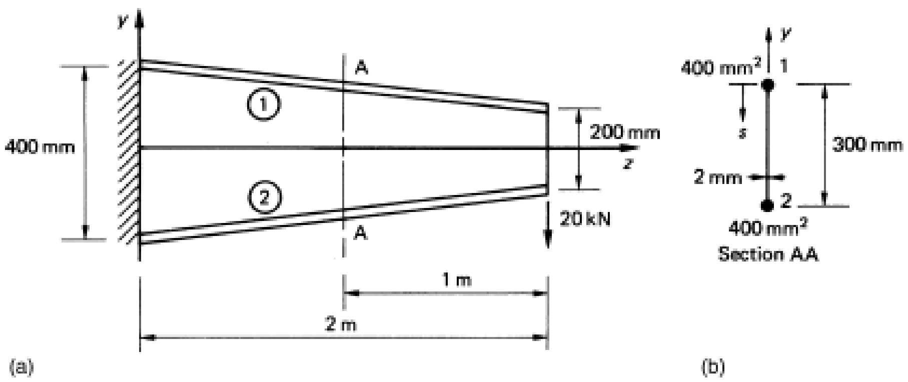

Fig.6

b) The wing section shown in Fig.7 has been idealized such that the booms carry all the direct stresses. If the wing section is subjected to a bending moment of 300 kNm applied in a vertical plane, calculate the direct stresses in the booms: **10**

Boom areas: B1 =B6 =2580 mm^2, B2 =B5= 3880 mm^2 , B3 =B4= 3230 mm^2

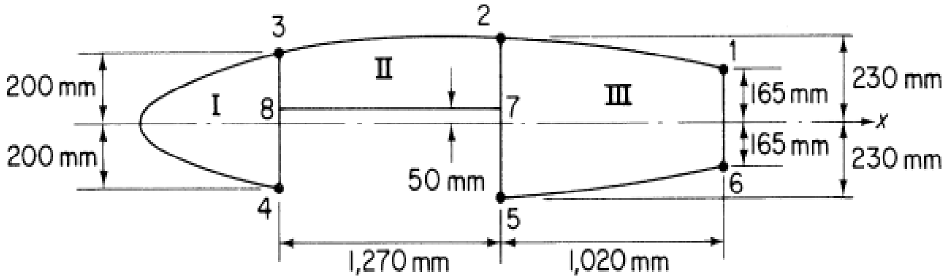

Fig.7

OR

7 The fuselage of a light passenger carrying aircraft has the circular cross-section shown in Fig.8 below. The cross-sectional area of each stringer is 100mm^2 and the vertical distances given in Figure below are to the mid-line of the section wall at the corresponding stringer position. If the fuselage is subjected to vertical shear load of 100 kN applied at a distance of 150mm from the vertical axis of symmetry. Calculate the distribution of shear flow in the section. **20**

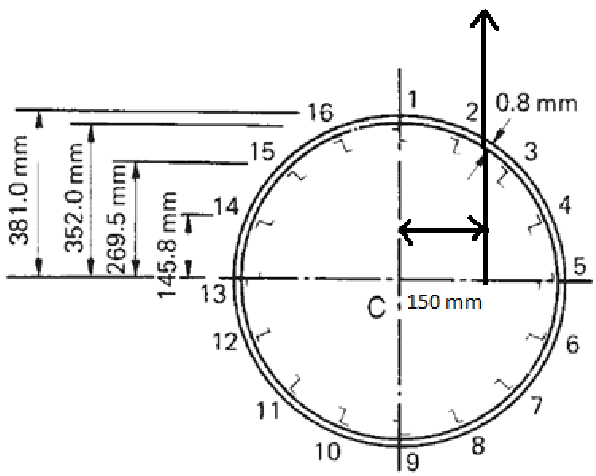

Fig.8

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