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10AE72

Seventh Semester B.E. Degree Examination, June/July 2019
Aircraft Structures – II

Time: 3 hrs.   Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Sketch and explain V-n diagram of a typical aircraft with all important structural design limits. **(08 Marks)**

b. An aircraft of 45 kN lands on a deck of an aircraft carrier and is brought to rest by means of arrestor hook, if the deceleration included by the cable is 3g. Determine the tension T in the cable, the load on the under carriage strut and shear and axial loads in the fuselage aft at the section A-A is 4.5 kN. Also calculate the length of the deck covered by the aircraft before it is brought to rest if touchdown speed is 25 ms^{-1}. [Refer Fig.Q1(b)] **(12 Marks)**

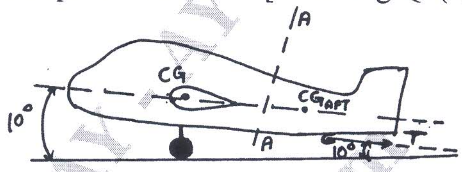

Fig.Q1(b)

2 a. Derive an expression for direct stress for a unsymmetrical cross-sectional-beam bending condition, when M_x and M_y are acting on the beam. **(08 Marks)**

b. A beam having a cross-section as shown in the Fig.Q2(b) is subjected to a bending moment of 1500 N-m in a vertical plane. Calculate the point at which the direct stress acts. **(12 Marks)**

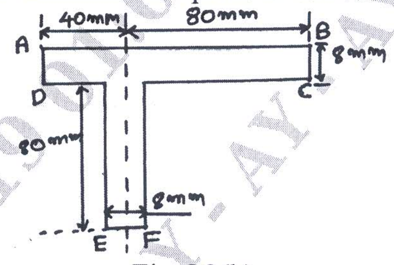

Fig.Q2(b)

3 a. Derive an expression for shear flow acting on open section beam. **(10 Marks)**

b. Consider a C section beam as shown in Fig.Q3(b), find the shear center for the same cross-section, if h = 10mm and b = 15mm and S_y = 1200 N by deriving an expression for shear center. **(10 Marks)**

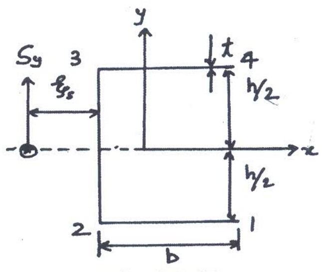

Fig.Q3(b)

4 a. Deduce an expression for shear flow in closed section beams. **(08 Marks)**

b. A thin walled closed section beam has a symmetrical cross-section as shown in Fig.Q4(b). Each wall of section is flat, thickness (t) and shear modulus (G). Calculate the shear center from point 4. **(12 Marks)**

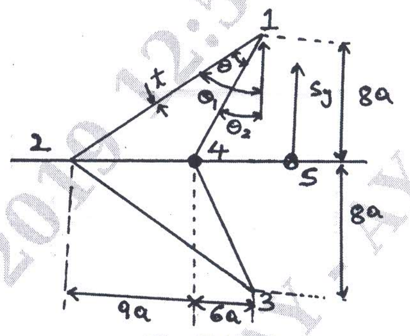

Fig.Q4(b)

PART – B

5 a. Derive an expression for thin plate bukling to find direct critical stress. **(10 Marks)**

b. A beam as shown in the Fig.Q5(b) is assumed to have complete tension field web. If the cross-sectional areas of the flanges and stiffners are 350 mm^2 and 300mm^2 respectively. Elastic modulus of each flange is 750 mm^3, determine the maximum stress in a flange and find whether the stiffners will buckle. The thickness of the web is 2 mm and second moment of Area of the stiffner about an axis in the plane of the web is 2000 mm^4. E = 70000 N/mm^2. **(10 Marks)**

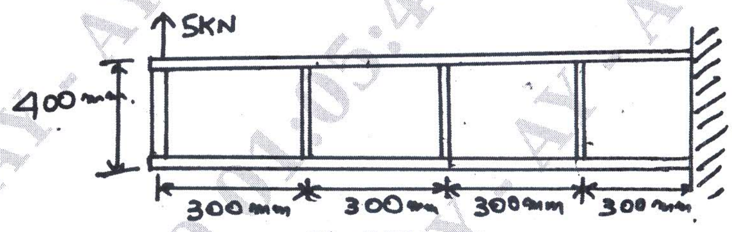

Fig.Q5(b)

6 a. The wing section shown in Fig.Q6(a) 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 stress in the booms. [Boom Areas : $B_1 = B_6 = 2580$ mm^2, $B_2 = B_5 = 3880$ mm^2, $B_3 = B_4 = 3230$ mm^2] **(10 Marks)**

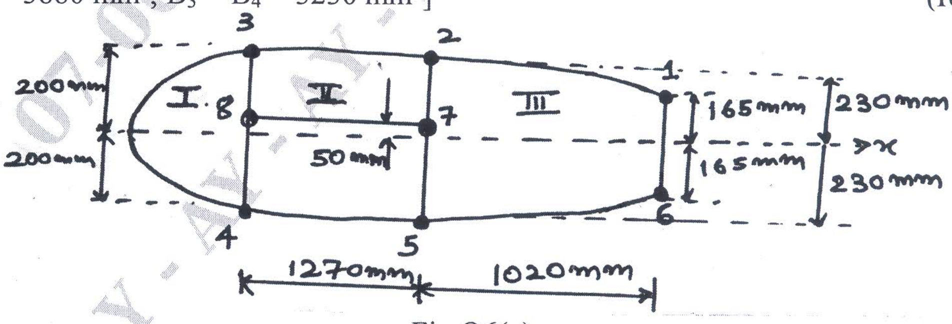

Fig.Q6(a)

b. A light passenger carrying aircraft fuselage has the circular cross-section shown in Fig.Q6(b). The cross-sectional area of each stringer is 100 mm^2 and vertical distance is also given in Fig.Q6(b) with respect to each stringer from the mid line of the fuselage section. If the fuselage is subjected to a bending moment 200 kNm applied in the vertical plane of symmetry. Calculate the direct stress distribution. **(10 Marks)**

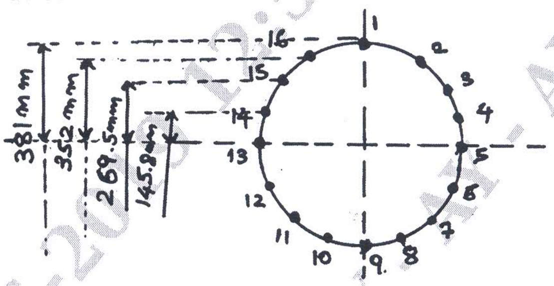

Fig.Q6(b)

7 a. Explain in brief 3 design principles used in aircraft structural analysis. **(10 Marks)**
b. Write short note on aircraft (i) Design criteria (ii) Fatigue Damage. **(10 Marks)**

8 a. Enlist the advantages of rivets over welded and bolted joints. **(05 Marks)**
b. A 200mm × 150mm × 10mm angle, carrying a load of 200 kN is to be welded to a steel plate by fillet welds as shown in Fig.Q8(b). Find the lengths of the weld at the top and bottom if allowable shear stress in the weld is 102.5 N/mm^2. The distance between the neutral axis and the edges of the angle section are 144.7mm and 55.3mm respectively. **(15 Marks)**

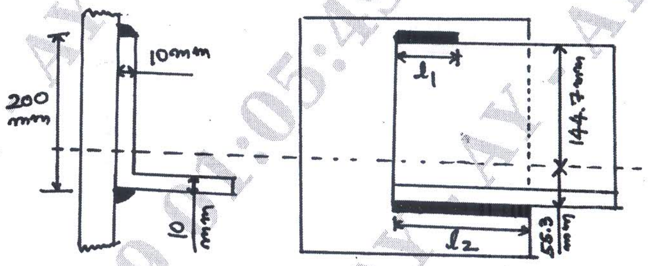

Fig.Q8(b)

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