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10AE72

# Seventh Semester B.E. Degree Examination, Dec.2018/Jan.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. With neat sketch explain flight envelop? **(04 Marks)**

b. Explain different types of loads acting on major components of aircraft. **(06 Marks)**

c. An aircraft having total load 45 kN lands on the deck of an a/c carrier and is brought to rest by means of cable engaged by arrester hook, as shown in Fig.Q1(c). If the deceleration induced by the cable '3g' determine the tension 'T' in the cable, the load on an undercarriage strut and the shear and axial loads in the fuselage at a section AA, the weight of an a/c aft of AA is 4.5 kN. Calculate also length of the deck covered by the a/c before it is brought to rest, if the touch down speed is 25 m/s. **(10 Marks)**

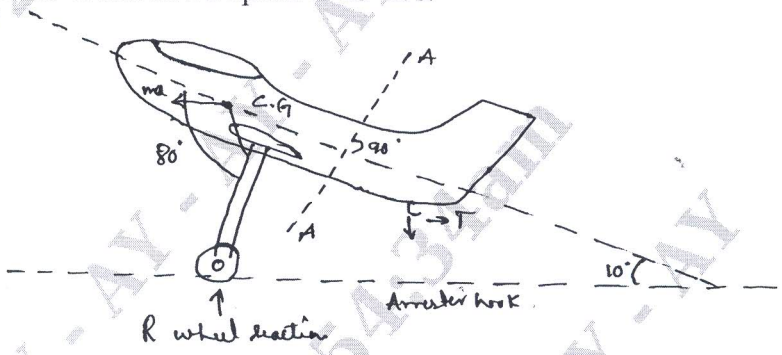


Fig.Q1(c) : Force of an a/c

2 a. A beam having the cross-section shown in Fig.Q2(a) is subjected to a bending moment of 1500 Nm in a vertical plane. Calculate the maximum direct stress due to bending stating the point at which it acts. **(10 Marks)**

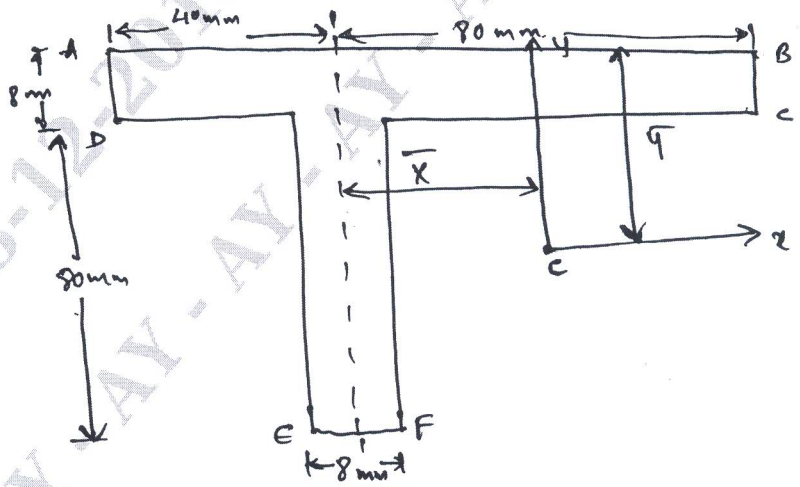


Fig.Q2(a)

b. The cross section of the beam has the dimension shown in Fig.Q2(b). If the beam is subjected to a negative bending moment of 100 kNm applied in a vertical plane. Determine the distribution of direct stress through the depth of the section. **(10 Marks)**

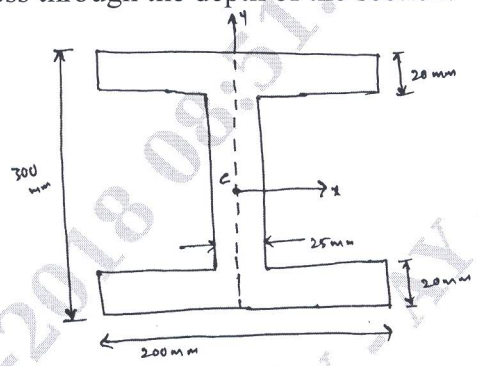


Fig.Q2(b)

3 a. Explain the concept of shear flow, shear centre and derive bending equation of thin section. **(08 Marks)**

b. Find the shear flow distribution and shear centre location for the cross-section shown in Fig.Q3(b). **(12 Marks)**

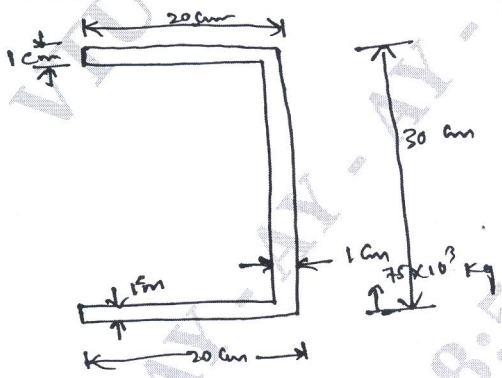


Fig.Q3(b)

Note : Hear shear flow distribution is asked for vertical load of $75 \times 10^3$ kg $\approx 75000$ kg.

4 a. Derive and explain the displacement associated with the Bredt – Batho shear flow. **(08 Marks)**

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

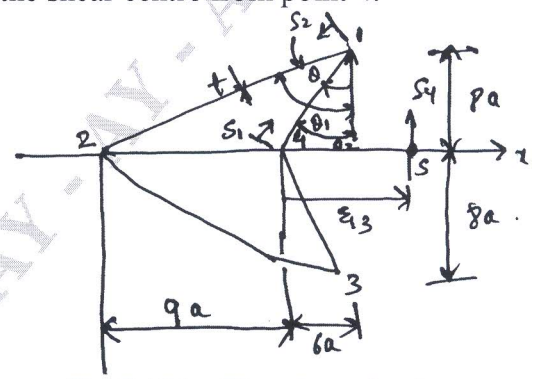


Fig.Q4(b) : Closed section beam

## PART – B

5 a. Explain Buckling and cripping stress? Bring out essential difference between them. **(08 Marks)**

b. A panel comprising flat sheet and uniformly spaced Z section stringers is subjected to a uniform compressive load is to be stabilized by frames & distance '*l*' apart '*l*' approx. greater than b. State the mode of failure y would consider & $h_0$ , y would find limiting stresses stringers shown in Fig.Q5(b). Assume skin thickness 't'.

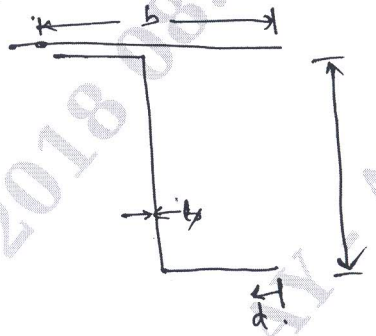


Fig.Q5(b) **(12 Marks)**

6 Determine the shear flow distribution in the singly symmetrical three-cell wing section shown in Fig.Q6. When it carries a shear load of 100 kN applied through its shear centre and hence find the distance of the shear centre form the spar web 34. Assume that all direct stresses are resisted by the booms while the skin is effective only in shear. The shear modulus G is constant throughout. **(20 Marks)**

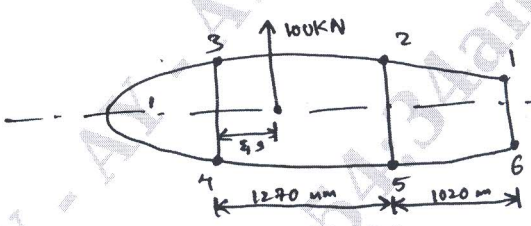


Fig.Q6

7 a. Explain Design life criteria principle and future airworthiness requirements. **(12 Marks)**

b. Explain i) Two-Bay crack criteria ii) Wide spread fatigue damage. **(08 Marks)**

8 a. Explain the general rules for using bolts in aerospace industry. **(06 Marks)**

b. The fitting shown in Fig.Q8(b) is made of a 1014 aluminium forging for which $\sigma_{at} = 65{,}000$ $\tau_{a_1} = 39{,}000$ and $\sigma_{ab_1} = 98{,}000$ lb/m$^2$. The bolt and bushing are made of steel for which $\sigma_{at} = 125{,}000$ ; $\tau_a = 75{,}000$ and $\sigma_{abr} = 175{,}000$ lb/m$^2$. The fitting resist limit or applied load of 15,000 lb compression and 12000 lb tension. A fitting factor of 1.2 and a bearing of 2.0 are used. Find the margin of safety for the fitting for various failures. **(14 Marks)**

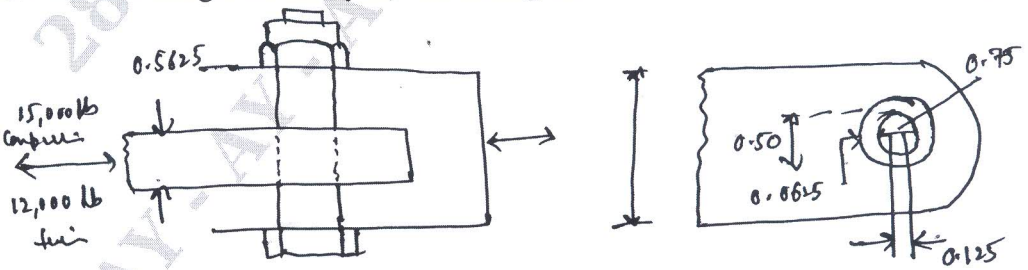


Fig.Q8(b)

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