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10AE72

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
Aircraft Structures – II

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the concept of allowable and margin of safety based on different failure modes. **(04 Marks)**

b. Explain four basic flight loading conditions that are likely to result in maximum loads in flight. **(08 Marks)**

c. Explain functions of various aircraft structural components. **(08 Marks)**

2 a. Derive expression for direct stress for the case of unsymmetrical bending. **(10 Marks)**

b. A beam having the cross section shown is subjected to bending moment of 1600 Nm. Calculate the maxi direct stress and the point where it acts. **(10 Marks)**

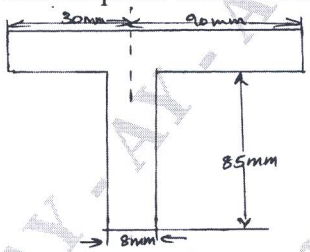


Fig. Q2 (b)

3 a. Derive Soderberg relation when a specimen is subjected to axial cyclic stress. **(10 Marks)**

b. If torque at the section is 3×10^3 Nm. Obtain the shear flow q, maxi shear stress element and its value rotation θ of the section. Given $G = 26.3\times10^3$ Pa, $t_1 = 0.005$ m, $t_2 = t_3 = 0.007$ m. **(10 Marks)**

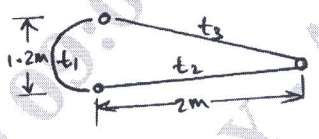


Fig. Q3 (b)

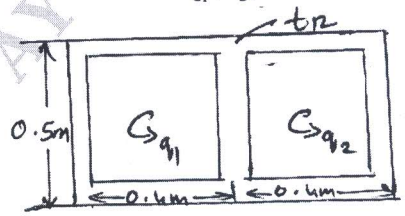
4 a. Explain Bredt-Batho theory and derive Bredt-Batho formula. **(10 Marks)**

b. Explain buckling and crippling stress? Bring out the essential difference between them. **(10 Marks)**

PART – B

5 a. Discuss the solution of a rectangular plate compressed uniformly by an inplane force $\dot{N}_x$ along the edge $x = 0$ and $x = a$. **(10 Marks)**

b. 2 cell thin walled box beam is subjected to a torque T that causes a twist angle $\theta = 5^\circ/m$. Assume G = 27 GPa, find shear flow q_1, q_2 and J. **(10 Marks)**



$t_1 = 0.2$ cm
$t_2 = 0.4$ cm
$t_{12} = 0.3$ cm

Fig. Q5 (b)

6 a. Determine the flange axial load, shear load distribution in the web of tapered beam at section AA for a single spar wing construction where web thickness is 2.5 mm, flange area is 375 mm? Depth of flange at AA = 300 mm. **(10 Marks)**

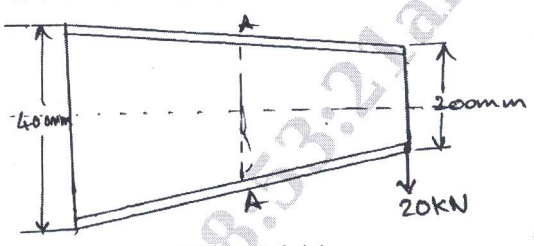


Fig. Q6 (a)

b. A wing spar has dimensions shown and carries a uniformly distributed load of 15 kN/m along its complete length. Each flange has a cross section area of 500 mm^2 with top flange being horizontal. If the flanges are assumed to resist all direct loads with the spur web effective in shear only, determine the flange loads and shear flows in the web at section 1 and 2 from the free end. **(10 Marks)**

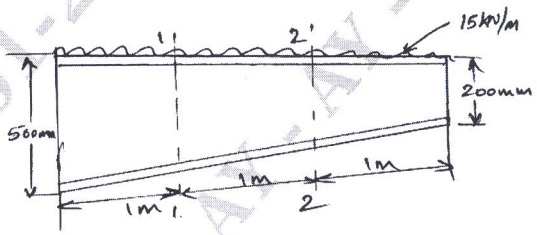


Fig. Q6 (b)

7 a. Derive the equation for cycle to failure N_f for a crack, when it grows from initial length $2a_o$. **(10 Marks)**

b. List the design criteria specifying the associated mode of failure and data to be considered for the same. **(10 Marks)**

8 a. Analyse the efficiency of the bolt and lug joint given for the loading:
Bolt dia = 12.5 mm, Bush thickness = 1.6 mm, Applied load = 60 kN,
Thickness of plate = 14.5 mm, Width = 35 mm, R = 20 mm.
Material properties, lug :
$F_t = 445$ N/mm^2.
$F_s = 265$ N/mm^2
$F_{br} = 675$ N/mm^2
Bolt bush
$F_s = 515$ N/mm^2
$F_{br} = 1205$ N/mm^2
F.O.S = 1.5, Fitting factor 1.2, Bearing factor = 2. **(10 Marks)**

b. A Bracket is supported by means of 4 Rivets of same size as shown. Determine the diameter of the rivet if the maximum shear stress is 140 N/mm^2. **(10 Marks)**

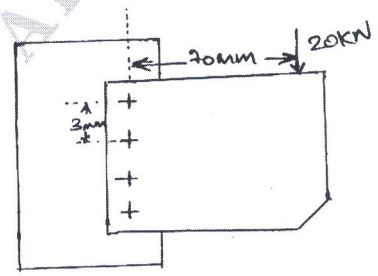


Fig. Q8 (b)

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