CBCS SCHEME

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15AE64

Sixth Semester B.E. Degree Examination, Jan./Feb.2021
Aircraft Structures – II

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the concept of allowable and margin of safety based on different failure modes. **(08 Marks)**

b. A Beam having the cross section shown in Fig.Q1 (b) is subjected to pure bending moment of 1600 Nm. Calculate the maxi direct stress and the point where it acts. **(08 Marks)**

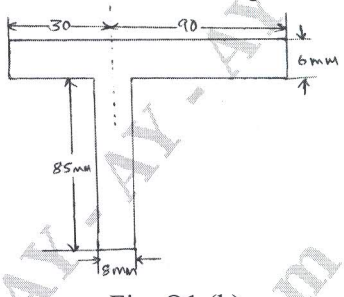


Fig. Q1 (b)

OR

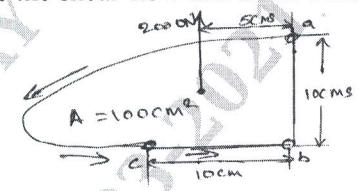
2 a. Derive expression for direct stress for the case of Unsymmetrical bending. **(08 Marks)**

b. Write the equilibrium equations for a thin walled beam and derive an expression for shear in open section beam. **(08 Marks)**

Module-2

3 a. Derive Soderberg relation when a specimen is subjected to axial cyclic stress. **(08 Marks)**

b. Calculate the shear flow and shear centre for a three stringer section. **(08 Marks)**



$t_{ab} = 0.08$ cms $S_{ab} = 10$ cms

$t_{bc} = 0.06$ cms $S_{bc} = 10$ cms

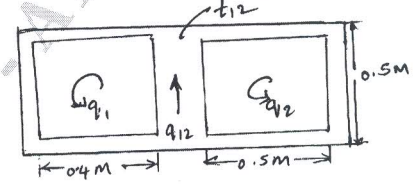
$t_{ac} = 0.04$ cms $S_{ac} = 25$ cms

Fig. Q3 (b)

OR

4 a. Explain Bredth-Batho theory and derive Breadth-batto formula. **(08 Marks)**

b. A 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. **(08 Marks)**



$t_1 = 0.02$ cm

$t_2 = 0.4$ cm

$t_{12} = 0.3$ cm

Fig. Q4 (b)

Module-3

5 a. Discuss the solution of a rectangular plate compressed uniformly by an inplane force N_x° along the edge x = 0 and x = a. **(08 Marks)**

b. Analyse the efficiency of the bolt and lug joint given for the loading:
Bolt diameter = 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
(08 Marks)

OR

6 a. A panel comprising flat sheet and uniformly spaced 'Z' section stringers is subjected to a uniform compressive load is to be stablised by frames a distance L apart. ℓ being appreciably greater than b. State the mode of failure Y would consider b and find limiting stresses. **(08 Marks)**

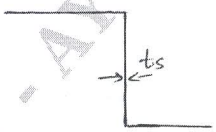


Fig. Q6 (a)

b. Find the distance 'e' in the shown Fig. Q6 (b), if the maximum shearing stress on most heavily loaded rivet is to be 80 MPa. Diameter of rivets is 18 mm. **(08 Marks)**

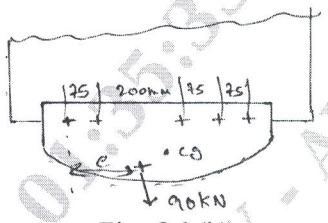


Fig. Q6 (b)

Module-4

7 a. What are complete tension field beams [Wagner's beam]. Explain and derive an expression for tension stress and normal stress in web of Wagner beams. **(08 Marks)**

b. 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 = 2.5 mm, Flange area = 375 mm^2, Depth of flange at AA = 300 mm.
(08 Marks)

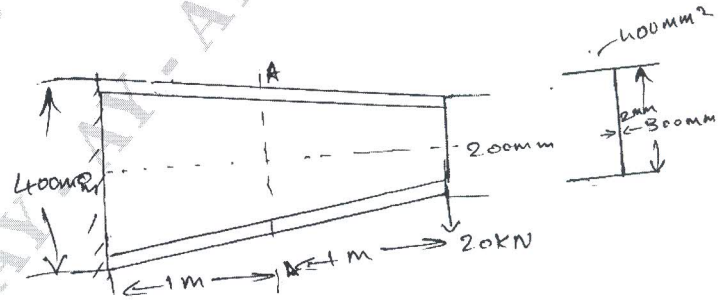


Fig. Q7 (b)

OR

8 a. Briefly explain the function and geometrical arrangement of wing. **(08 Marks)**

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 spar web effective in shear only, determine the flange loads and shear flows in the web at Section 1 and 2 from the free end. **(08 Marks)**

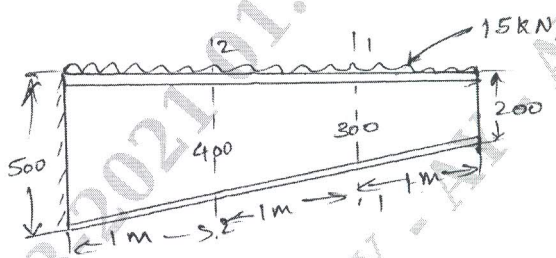


Fig. Q8 (b)

Module-5

9 At a section of a fuselage the bending moment due to self weight was 9.8 kNm and due to symmetrical pull out tail load is 45.1 kNm down. The tail load may be assumed to be acting at 2 m away from the section. If the stringers are 16 in number and placed as shown, with areas of stringers placed symmetrical about YY axis, calculate the stresses in stringers. (Refer Fig. Q9) **(16 Marks)**

Sl. No.	1	2	3	4	5	6	7	8	9
Area	640	600	600	600	620	640	640	850	640
x	0	100	200	300	500	450	300	150	0
y	660	600	420	228	25	-204	-396	-502	-540

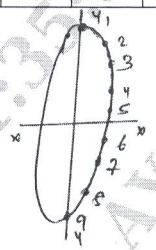


Fig. Q9

OR

10 The beam shown in Fig. Q10 is assumed to have a complete Tension field web. If the cross sectional area of flanges and stiffeners are 350 mm^2 and 300 mm^2 and elastic section modulus of each flange is 750 mm^3, determine maxi stress in flange and also find whether the stiffness will buckle. Thickness of web 2 mm. Second M.I of stiffener about an axis in the plane of web is 2000 mm^4. E = 70,000 N/mm^2. **(16 Marks)**

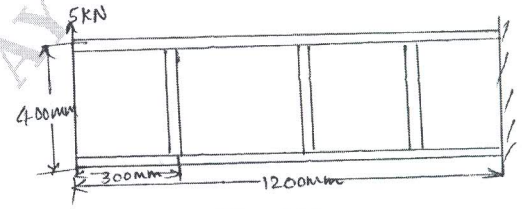


Fig. Q10

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