Question Paper Code : 71028

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fifth Semester

Aeronautical Engineering

AE 2302/AE 52/AE 1302/10122 AE 502 — AIRCRAFT STRUCTURES — II

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between symmetric and unsymmetric bending.

2. Draw bending stress variation across the depth for

   (a) Rectangular section

   (b) I-section.

3. Explain briefly the Euler-Bernoulli hypothesis in bending of beams.

4. Define shear center and elastic axis.

5. What is mean by distribution factor?

6. Define proof resilience and modulus of resilience.

7. What is linearly elastic structure?

8. Define buckling and crippling?

9. Define stiffness factor and moment distribution factor in moment distribution method.

10. Write the Clapeyron's three moment equation in general form and write the terms of it.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive and obtain an expression for the bending stress in an unsymmetrical section subjected to bending, using the generalized 'k' method. (12)

(ii) What do you mean by shear center? Explain with the help of neat Sketch. (4)

Or

(b) (i) Find the maximum bending stress in a c-section having 20×4 mm web and 10×4 mm flange subjected to a bending moment of 10 kN-m about x-axis. (8)

(ii) Determine the bending stresses in the stringer of the section shown in fig. Q 11 b (ii) $E_1 = 70$ GPa, $E_2 = 210$ GPa and $E_3 = 100$ GPa. Stringer areas are 2 cm². (8)

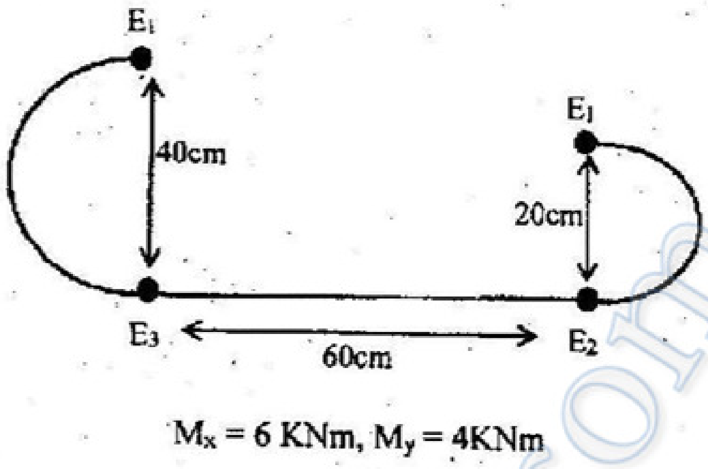

Figure – Q 11 b (ii)

12. (a) Derive the equation to find out the shear center of Figure Q 12 (a) shown. (16)

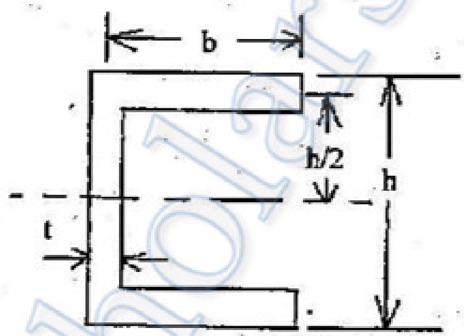

Figure – Q 12 (a)

Or

(b) Determine the shear flow distribution in the thin-walled Z-section shown in Figure Q 12 (b) due to a shear load S_y applied through the shear center of the section. (16)

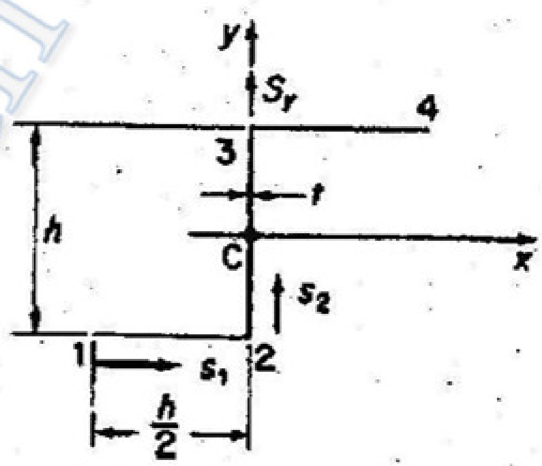

Figure – Q 12 (b)

13. (a) The thin-walled single cell beam shown in Figure has been idealized into a combination of direct stress-carrying booms and shear-stress-only-carrying walls. If the section supports a vertical shear load of 10 kN acting in a vertical plane through booms 3 and 6, calculate the distribution of shear flow around the section. Boom areas: $B_1 = B_8 = 200\,mm^2$, $B_2 = B_7 = 250\,mm^2$ $B_3 = B_6 = 400\,mm^2$, $B_4 = B_5 = 100\,mm^2$. (16)

Or

(b) Derive the equations to find out the primary and secondary warping of an open cross section subjected to Torsion. (16)

14. (a) A cantilever beam shown in Figure Q 14 (a) carries concentrated loads as shown. Calculate the distribution of stiffener loads and the shear flow distribution in the web panels assuming that the latter are effective only in shear. (16)

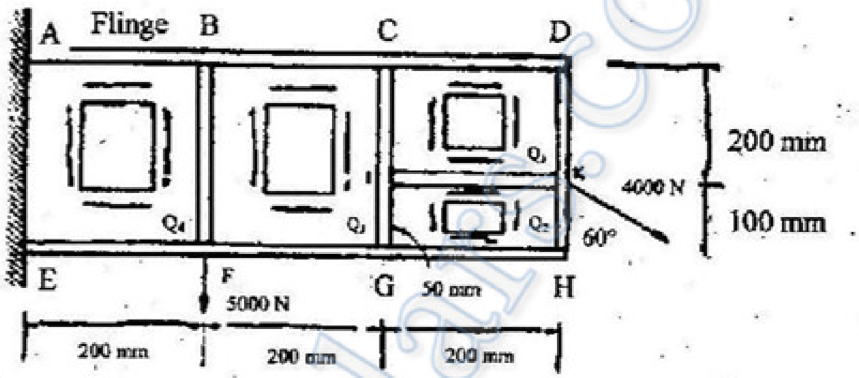

Figure – Q 14 (a)

Or

(b) Derive the equation to find out Failure stress in plates and stiffened panels. (16)

15. (a) (i) Draw and explain the construction of Fuselage and derive the equations to carry out the analysis.

(ii) The beam shown in Figure Q 15 (a) (ii) is simply supported at each end and carries a load of 6000 N. If all direct stresses are resisted by the flanges and stiffeners and the web panels are effective only in shear, calculate the distribution of axial load in the flange ABC and the stiffener BE and the shear flows in the panels. (8+8)

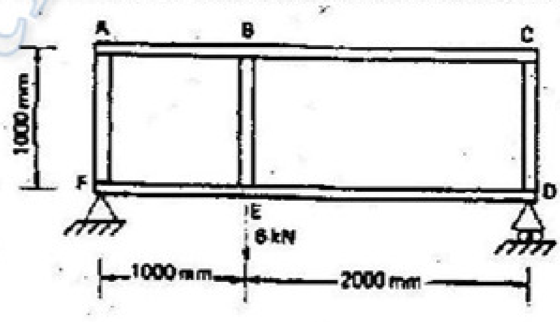

Figure – Q 15 (a) (ii)

Or

(b) Calculate the shear flows in the web panels and the axial loads in the flanges of the wing rib shown in Figure Q 15 (b). Assume that the web of the rib is effective only in shear while the resistance of the wing to bending moments is provided entirely by the three flanges, 1, 2 and 3. (16)

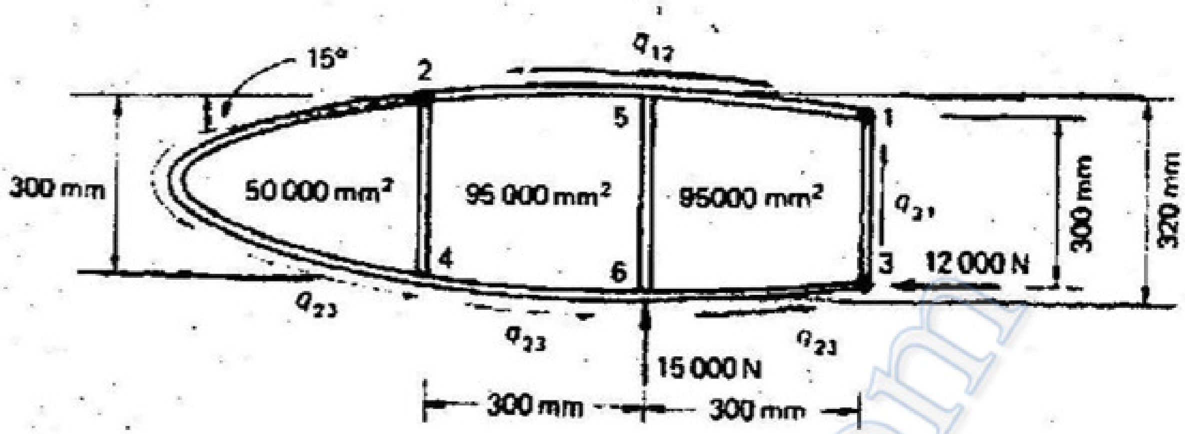

Figure – Q 15 (b)
