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BAS-014

**B. Tech. AEROSPACE ENGINEERING
(BTAE)**

Term-End Examination

December, 2015

BAS-014 : AIRCRAFT STRUCTURES

Time : 3 hours

Maximum Marks : 70

Note : Answer any *five* questions. All questions carry equal marks. Use of non-programmable calculator is permitted.

1. (a) Define the term 'shear'. 3
- (b) What are the different types of aircraft monocoque designs ? 4
- (c) Explain the construction of an aircraft wing. 7

2. (a) Explain the Flight envelope diagram, clearly indicating corner velocity, positive and negative load factors. 6

- (b) Find the slope and deflection at point B for the cantilever beam shown in Figure 1, using unit load method. Take $EI = 20000 \text{ kNm}^2$.

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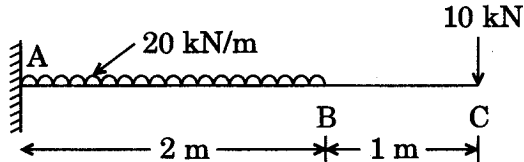


Figure 1

3. (a) A quadrant ring beam of radius 'r' supports a concentrated load 'P' at the free end. Calculate the vertical and horizontal deflection at the free end.
- (b) What do you understand by unsymmetrical bending? Explain the torsion of thin walled closed sections.
- (c) Explain the limit load for load factor determination.
4. (a) What is torsional stiffness? How does it affect flight?
- (b) A relatively thin walled tube and a solid circular shaft have the same cross-sectional area. Compare the torsional stiffness of one to the other.

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5. (a) The beam ABCD shown in Figure 2 has overhangs at each end and carries uniform load of intensity q . For what ratio b/L will the bending moment at the mid-point of the beam be zero ?

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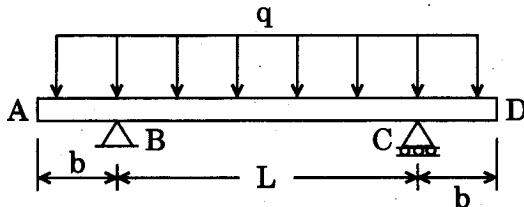


Figure 2

- (b) Define shear centre. Explain its practical significance.
6. (a) The vertical shear action on a channel section is 150 kN. Find the shear flow and shear centre of the section as shown in Figure 3. Assume thickness in flange as 9.7 mm and thickness of web 6.7 mm. $I = 71.97 \times 10^6 \text{ mm}^4$.

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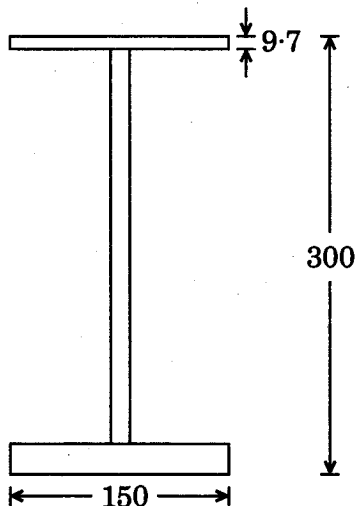


Figure 3

- (b) Differentiate between flexibility and stiffness. 4
7. (a) Explain how the Brittle Lacquer test is used to identify areas of concentrated stress. 4
- (b) A hollow cylindrical steel shaft is 1.5 m long and has inner and outer diameters of 40 mm and 60 mm respectively. What torque should be applied to the end of the shaft to produce a twist of 2° ? Use the value $G = 80$ GPa for the modulus of rigidity of steel. 10
8. (a) What is a load cell? How does a pneumatic load cell work? 5
- (b) Derive the equation of shearing stress in terms of torque and polar moment of inertia. 9
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