Hall Ticket No | | | | | | | | | | |　　Question Paper Code:AAEC15

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Dundigal-500043, Hyderabad)

B.Tech V SEMESTER END EXAMINATIONS (REGULAR) - DECEMBER 2022

Regulation:UG20

ANALYSIS OF AIRCRAFT STRUCTURES

Time: 3 Hours　　**(AERONAUTICAL ENGINEERING)**　　**Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) What are the assumptions made in thin plate theory? Determine the governing differential equation for plate bending. [BL: Understand| CO: 1|Marks: 7]

   (b) The beam shown in Figure 1 is assumed to have a complete tension field web. If the cross-sectional areas of the flanges and stiffeners are, respectively, $350mm^2$ and $300mm^2$ and the elastic section modulus of each flange is $750mm^3$, determine the maximum stress in a flange and also whether or not the stiffeners buckle. The thickness of the web is 2 mm and the second moment of area of a stiffener about an axis in the plane of the web is $2000mm^4$; $E = 70,000N/mm^2$.
   [BL: Apply| CO: 1|Marks: 7]

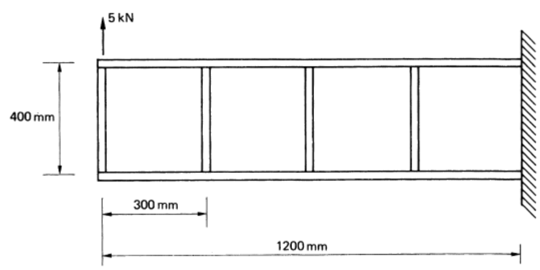

Figure 1

MODULE – II

2. (a) Find the Bredt-Batho formula related to torsion. What are the assumptions made? Explain the salient features of the equation. [BL: Understand| CO: 2|Marks: 7]

   (b) A horizontal cantilever 2 m long is constructed from the Z-section. A load of 10 KN is applied to the end of the cantilever at an angle of 60^0 to the horizontal as shown in Figure 2. Assuming that no twisting moment is applied to the section, determine the stresses at points A and B. ($I_{xx} = 48.3 \times 10^{-6} m^4$, $I_{yy} = 4.4 \times 10^{-6} m^4$) [BL: Apply| CO: 2|Marks: 7]

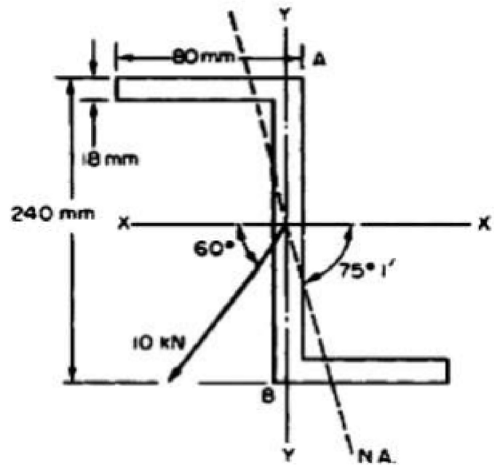

Figure 2

MODULE – III

3. (a) With the help of neat sketches explain 'Pultrusion' and 'Pulforming'. Illustrate filament winding process. [BL: Understand| CO: 3|Marks: 7]

   (b) State generalized Hooke's law. Show the reduction of the monoclinic stress–strain relationships to those of an orthotropic material. [BL: Apply| CO: 3|Marks: 7]

4. (a) Classify different reinforcement materials used in metal matrix composites with examples. Explain the characteristics of reinforcement materials. [BL: Understand| CO: 4|Marks: 7]

   (b) Choosing any 3 types of fibers, compare their important mechanical properties. List the importance of netting analysis in composites? [BL: Understand| CO: 4|Marks: 7]

MODULE – IV

5. (a) Develop the equation for shear stress distribution at a built-in end of a thin-walled closed section beam. [BL: Understand| CO: 5|Marks: 7]

   (b) A thin-walled circular section beam has a diameter of 200mm and is 2m long; it is firmly restrained against rotation at each end. A concentrated torque of 30 kNm is applied to the beam at its mid-span point. If the maximum shear stress in the beam is limited to $200N/mm^2$ and the maximum angle of twist to 2^0, calculate the minimum thickness of the beam walls. Take $G = 25000N/mm^2$.
   [BL: Apply| CO: 5|Marks: 7]

6. (a) Explain the procedure for finding shear flow in symmetric closed section, and the location of shear centre for both single and multi cell sections subjected to torsion.
   [BL: Understand| CO: 5|Marks: 7]

   (b) Compare between Bredt's formula and the exact theory when used to evaluate the angle of twist of thin-walled circular tube in Figure 3 . $TakeD_0 = 40mm$, t = 2mm, G = 80GPa, L = 1m, and T = 200 Nm. [BL: Apply| CO: 5|Marks: 7]

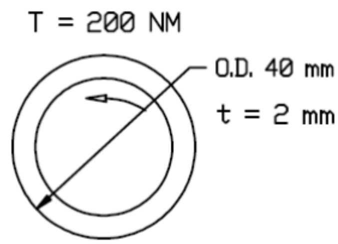

Figure 3

MODULE – V

7. (a) Obtain the expression for total torque produced on an open I-section beam with suitable diagram. [BL: Understand| CO: 6|Marks: 7]

   (b) The cold-formed section shown in Figure 4 is subjected to a torque of 50Nm. Calculate the maximum shear stress in the section and its rate of twist. $G = 25000N/mm^2$. [BL: Apply| CO: 6|Marks: 7]

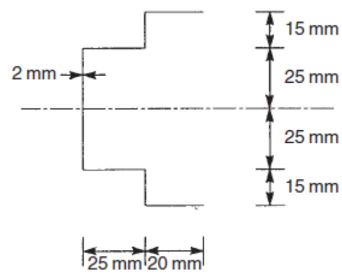

Figure 4

8. (a) What is the basic theory of torsion in open sections? Discuss the limitations of that theory. [BL: Understand| CO: 6|Marks: 7]

   (b) Determine the maximum shear stress in the beam section shown in Figure 5 stating clearly the point at which it occurs. Also find the rate of twist of the beam section if the shear modulus G is $25000N/mm^2$. [BL: Apply| CO: 6|Marks: 7]

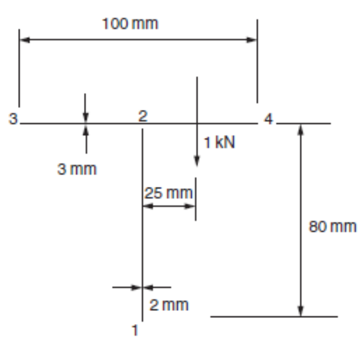

Figure 5

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