Roll No. Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(ANE) (Sem.–4)

AIRCRAFT STRUCTURES – I

Subject Code : ANE-206

M.Code : 60514

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION–A

1. Write briefly :

a) What is Stress tensor? Why it is called tensor? Draw a typical three dimensional element and indicate state of stress in their positive senses.

b) What is St. Venant Principle?

c) Define factor of Safety w.r.t design of aircraft structures.

d) Define Shear Center. Show with the help of neat diagram, shear center of the channel section.

e) State Principle of Virtual work done.

f) Write the six equations of strain compatibility.

g) Write a short note on behavior of riveted joints.

h) Ground Loads during landing of an aircraft.

i) Investigate the relationship of stress and strain in a three-dimensional, linearly elastic, isotropic body.

j) State Maxwell's reciprocal theorem. State the difference between inverse and semi-inverse method.

SECTION-B

2. Explain load factor-velocity diagram with neat sketch. Also, briefly explain functions of structural components of an aircraft.

3. What do you understand by an Airy stress function in two dimensions? A beam of length I, with a thin rectangular cross-section, is built-in at the end x =0 and loaded at the tip by a vertical force P (Figure. 1). Show that the stress distribution, as calculated by simple beam theory, can be represented by the expression

$$\phi = Ay^3 + By^3x + Cyx$$

as an Airy stress function and determine the coefficients A, B and C.

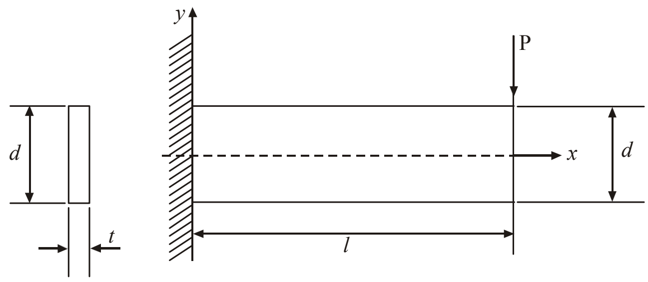

Fig. 1

4. Consider a thin-walled tube with the cross-section shown in Figure. 2. The wall thickness is t=0.005m and the average radius is 0.2025m. Also consider a same tube with cut open as shown in Figure 2(b). Compare the torsional rigidities of these two tubes. Comment on your answer.

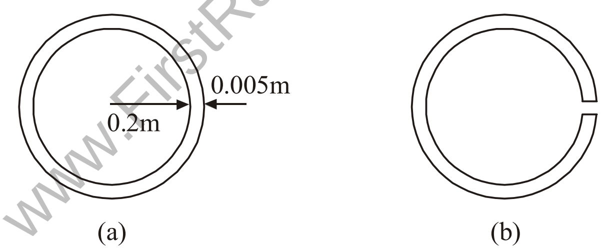

Fig. 2

5. Direct stresses of 160 N/mm^2 (tension) and 120 N/mm^2 (compression) are applied at a particular point in an elastic material on two mutually perpendicular planes. The shear stress, τ_{xy} is ±113N/mm^2. Determine also the value of the other principal stress and the maximum value of shear stress at the point using Mohr's circle. Also, evaluate the principal planes and planes of maximum and minimum shear stress. (**Graph Paper is required.**)

6. Determine the rate of twist and the stress distribution in a circular section bar of radius R which is subjected to equal and opposite torques T at each of its free ends. Assume if anything is required.

SECTION-C

7. State with neat diagram flexural formula of the beam. The cross-section of a beam has the dimensions shown in Figure. 3. If the beam is subjected to a negative bending moment of 100 kNm applied in a vertical plane, determine the distribution of direct stress through the depth of the section.

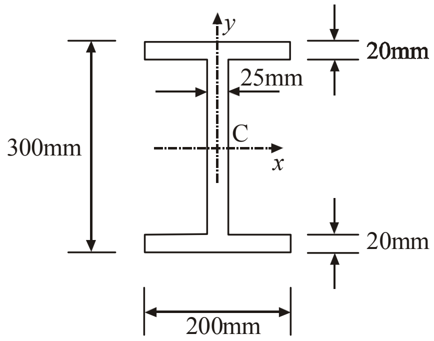

Fig. 3

8. Determine the deflection curve and the deflection of the free end of the cantilever shown in Figure. 4. The flexural rigidity of the cantilever is EI.

Fig. 4

9. What are statically indeterminate trusses? Analyze the truss shown in Figure. 5 using the method of virtual work.

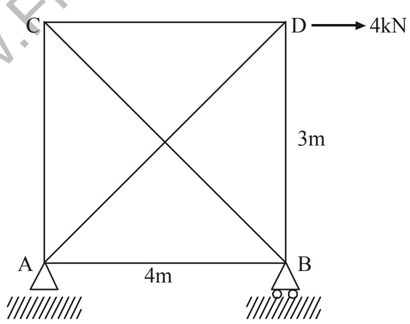

Fig.5

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.