CBCS SCHEME

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15AE54

Fifth Semester B.E. Degree Examination, Aug./Sept. 2020
Aircraft Structures – I

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define factor of safety. Discuss the factors influencing for the selection of appropriate value of Factor of Safety. **(05 Marks)**

b. Explain Bi-axial and Tri-axial state of stresses. **(06 Marks)**

c. A point in a structural member subjected to plane stress as shown in below Fig. Q1 (c). Determine the Principal stresses. **(05 Marks)**

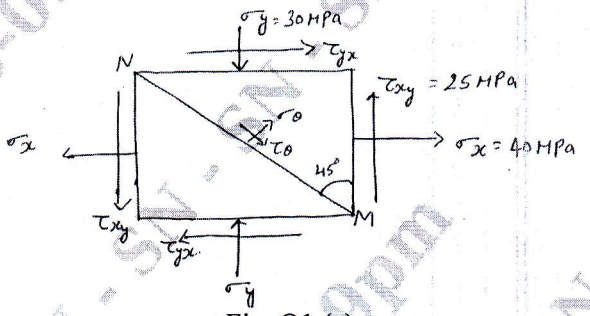

Fig. Q1 (c)

OR

2 a. Explain the following failure theories:
(i) Maximum normal stress theory.
(ii) Maximum shear stress theory.
(iii) Maximum distortion energy theory. **(09 Marks)**

b. A plate of C45 steel $\sigma_{yt} = 353$ MPa is subjected to the following stresses $\sigma_x = 150\,N/mm^2$, $\sigma_y = 100\,N/mm^2$ and $\tau_{xy} = 50\,N/mm^2$, find the Factor of Safety by,
(i) Maximum principal stress theory.
(ii) Maximum shear stress theory.
(iii) Hencky Mises theory. **(07 Marks)**

Module-2

3 a. Derive an expression for impact stresses due to axial loading. **(08 Marks)**

b. Explain S-N diagram and Endurance limit. **(08 Marks)**

OR

4 a. Explain Soderberg criterion and derive the relationship. **(08 Marks)**

b. Determine the maximum load for the simply supported beam, cyclically loaded at the middle of beam as W minimum load and 3 W maximum load. The diameter of beam is 50 mm, length 400 mm. The ultimate strength is 700 MPa. The yield point in tension is 520 MPa and endurance limit in reversed bending is 320 MPa. Use FoS as 1.25. The load size and surface correction factors are 1, 0.75 and 0.9 respectively. **(08 Marks)**

Module-3

5 a. Name the types of loads acting on Aircraft and explain all the loads acting on Aircraft. **(08 Marks)**

b. An Aircraft having a total weight of 45 kN lands on the deck of an Aircraft carrier and is brought to rest by means of a cable engaged by an arrester hook as shown in Fig. Q5 (b) . If the deceleration induced by the cable is 3 g determine the tension T in the Cable. The load on the under carriage strut and the shear and axial loads in the fuselage at section AA; The weight of the aircraft aft of AA is 4.5 kN. Calculate also the length of deck covered by the aircraft before it is bought to rest if the touch down speed is 25 m/S. **(08 Marks)**

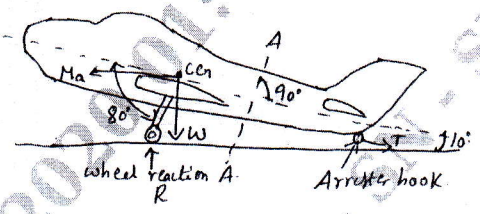

Fig. Q5 (b)

OR

6 a. Explain the use of following materials in Aircraft:
(i) Alluminium alloy (ii) Titanium alloy.
(iii) Stainless steel alloy. (iv) Composite material **(08 Marks)**

b. Derive the equation for crack growth rate. **(08 Marks)**

Module-4

7 a. Derive the dimensional equilibrium equation. **(10 Marks)**

b. Explain plane stress and plane strain problems in 2D elasticity. **(06 Marks)**

OR

8 a. Differentiate between determinate and indeterminate structures. **(04 Marks)**

b. Compute the forces in each member of a given truss as shown in Fig. Q8 (b), by the method of joints. **(12 Marks)**

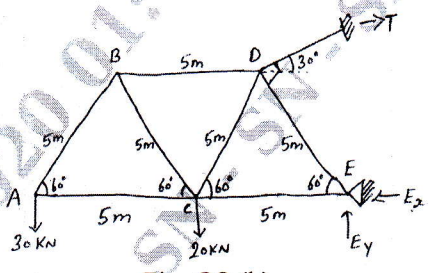

Fig. Q8 (b)

Module-5

9 a. Derive Maxwell's reciprocal theorem. **(08 Marks)**

b. Explain the concept of strain energy due to axial bending and torsion. **(08 Marks)**

OR

10 a. Derive Rankine formula for columns. **(08 Marks)**

b. A 2 m long pin ended column of square cross section is to be made of wood. Assume E = 12 GPa and allowable stress being limited to 12 MPa. Determine the size of the column to support the following loads safety. (i) 95 kN (ii) 200 kN. Use factor of safety 3 and Euler's crippling load for buckling. **(08 Marks)**

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