CBCS SCHEME

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18AE53

Fifth Semester B.E. Degree Examination, June/July 2023
Aircraft Structure – I

Time: 3 hrs. Max. Marks: 100

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 Draw the stress – strain curve for i) Ductile material ii) Brittle material and explain the salient features. **(10 Marks)**

b. Why failure theory is important for designing any components? Explain the types of failure theories in detail. **(10 Marks)**

OR

2 a. Explain the codes and standards used in design. **(10 Marks)**

b. The load on a bolt consists of an axial pull of 10kN together with a transverse shear force of 5kN. Find the diameter of bolt according to
i) Maximum principal stress Theory
ii) Maximum shear stress theory
iii) Maximum principal strain theory
iv) Maximum strain Energy theory **(10 Marks)**

Module-2

3 a. Define Fatigue. Draw S-N diagram and explain its features. **(10 Marks)**

b. Define Endurance limit. Explain the factors that effects the endurance limit. **(10 Marks)**

OR

4 a. Discuss the stresses due to combined loading. **(10 Marks)**

b. Derive the Goodmann and Soderberg relationship for combination of stresses. **(10 Marks)**

Module-3

5 a. What is Gust? Explain the Gust Envelope and its significance with suitable diagram. **(10 Marks)**

b. The aircraft shown in Fig Q5(b)-i) weighs 135kN and has landed such that, at the instant of impact, the grand reaction. On each main under carriage wheel is 200kN and its vertical velocity is 3.5m/s. If each under carriage wheel weighs 2.25kN and is attached to an also strut as shown in Fig Q5(b)-ii), calculate the axial load and bending moment in the strut, the strut may be assumed to be vertical. Determine also shortening of the strut when the vertical velocity of the aircraft is zero.

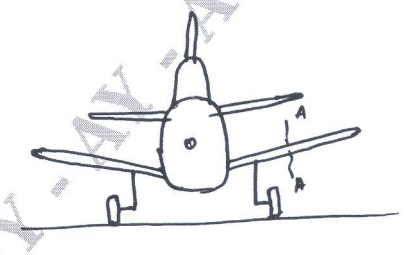

Fig Q5(b)-i)

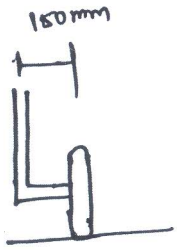

Fig Q5(b)-ii) **(10 Marks)**

OR

6 a. What is a composite material? Explain the types of composite materials based on its metrics and its uses. **(10 Marks)**

b. List out the desirable properties of a material to be considered in Aircraft applications. **(10 Marks)**

Module-4

7 a. A plane element in a boiler is subjected to tensile stresses of 40MPa on one plane and 150MPa on the other at right angles to the former. Each of the above stresses is accompanied by a shear stress of 100MPa such that when associated with the minor tensile stress tends to rotate the element in anticlockwise direction. Find :

i) Principal stress and their directions

ii) Maximum shearing stresses and the directions of the plane on which they act. **(10 Marks)**

b. Derive the equilibrium equations in 3-dimensions for the state of stress. **(10 Marks)**

OR

8 a. Differentiate between statically determinate and indeterminate structures. **(06 Marks)**

b. Determine the forces is all the members of a cantilever truss as shown in Fig Q8(b).

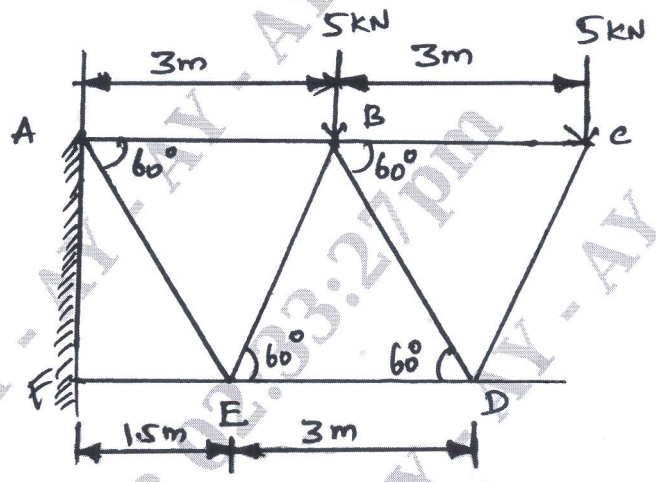

Fig Q8(b) **(14 Marks)**

Module-5

9 a. State and prove the method of least work. **(10 Marks)**

b. A steel rod of 50mm diameter is 4m long. Find the stress and stretch in the rod if a load of 50kN is applied i) Gradually ii) Suddenly. Also find the strain energy stored in the rod under the given conditions. Take $E = 200kN/mm^2$. **(10 Marks)**

OR

10 a. What are the assumptions made in Euler's column Theory? Derive the formula for clipping load for a column with both ends hinged condition. **(12 Marks)**

b. A hollow alloy tube 4m long with external and internal diameters of 40mm and 20mm respectively was found to extend 4.8mm under a tensile load of 60kN. Find the buckling load for the tube with both ends pinned. Also find the safe load on the tube, taking a factor of safety as 5. **(08 Marks)**

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