CBCS SCHEME

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17AE54

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Aircraft Structures – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the following : i) Stress ii) Factor of safety iii) Stress tensor. **(08 Marks)**

b. Explain atleast three different types of failure. **(12 Marks)**

OR

2 a. A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kNm and a torsional moment of 30kN-m. Determine the diameter of the shaft using different theories of failure, assuming a factor of safety of 2. Take E = 210 GPa and Poisson's ratio = 0.25. **(14 Marks)**

b. Define stress concentration factor and explain how to determine the same. **(06 Marks)**

Module-2

3 a. Define fatigue. With neat sketch explain S-N diagram. **(10 Marks)**

b. What is endurance limit? Explain the Goodmann and Soderberg relationship. **(10 Marks)**

OR

4 a. What are the important modifying factors effects the endurance limit. **(12 Marks)**

b. Define impact strength. Write the equations for impact stresses due to axial, bending and torsional loads. **(08 Marks)**

Module-3

5 a. Explain load factor and different types of loads that acts on the aircraft. **(04 Marks)**

b. Explain V-n diagram. **(06 Marks)**

c. An aircraft having a weight of 250kN and a tricycle under carriage lands at a vertical velocity of 3.7m/s, such that the vertical and horizontal reactions on the main wheels are 1200kN and 400kN, respectively : at this instant, the nose wheel is 1.0m form the ground, as shown in the Fig.Q5(c). If the moment of inertia of the aircraft about its CG is 5.65×10^8 NS^2mm, determine the inertia forces of the aircraft, the time taken for its vertical velocity to become zero and its angular velocity at his instant. **(10 Marks)**

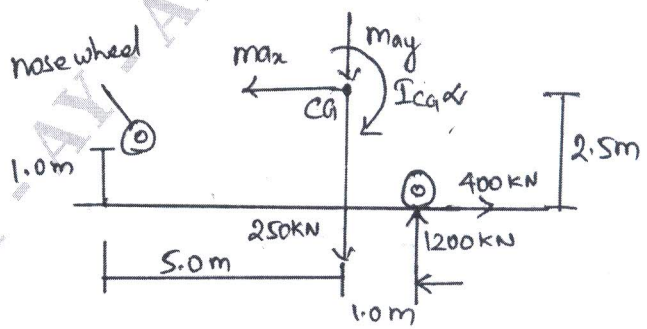

Fig.Q5(c)

OR

6 a. What are the desirable properties materials for aircraft application? **(06 Marks)**

b. Describe the uses of aluminum alloy, titanium alloy stainless steel and composite materials with merits and demerits. **(10 Marks)**

c. Define fracture and fatigue. **(04 Marks)**

Module-4

7 a. Derive the equilibrium equation for the state of stress in three dimensions. **(10 Marks)**

b. Define principal plane and principal stresses. **(04 Marks)**

c. For the state of stress shown in Fig.Q7(C), find the principal plane and principal stresses. **(06 Marks)**

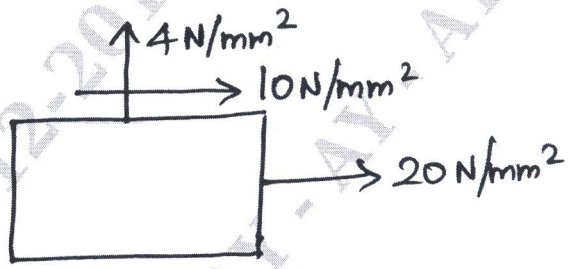

Fig.Q7(c)

OR

8 a. Derive Clapeyron's three moment equation. **(10 Marks)**

b. A truss of span 10m is loaded as shown in the Fig.Q8(b) find the forces in all the members.

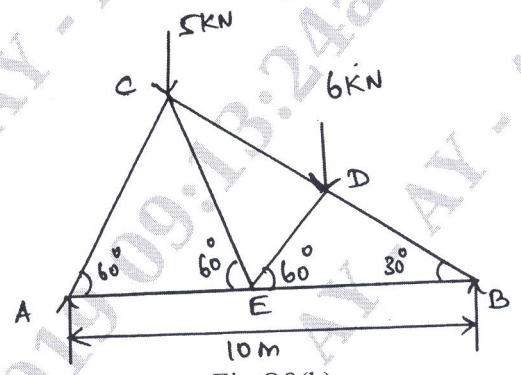

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. State and explain the method of least work. **(08 Marks)**

b. State and explain the "Maxwell's Reciprocal theorem". **(08 Marks)**

c. Define strain energy and write the equation for axial load and bending loads. **(04 Marks)**

OR

10 a. What are the assumptions made in Euler's column theory? Derive the Euler's crippling load for the column with one end fixed and one end free condition. **(10 Marks)**

b. A T-section 150mm × 120mm × 20mm is used as a strut of 4m long hinged at both the ends. Calculate the crippling load, if Young's modulus for the material of the section is 200kN/mm^2. **(06 Marks)**

c. Define slenderness ratio and give the limitations of Euler's formula. **(04 Marks)**

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