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10AE56

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Aircraft Structures - I

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. With neat sketch, explain velocity diagram. **(06 Marks)**

b. List the basic function of an aircraft structure. Define semi monologue and monologue **(07 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 from the ground as shown in Fig Q1(c). If the moment of inertia of the aircraft about its CG is $5.65\times10^8 NS^2mm$ determine the inertia forces on air craft, the time taken for its vertical velocity to become zero and its angular velocity at this instant. **(07 Marks)**

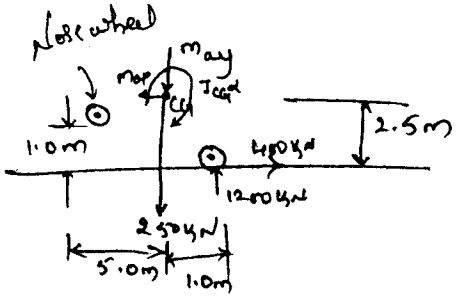

Fig Q1(c)

2 a. What are the advantages and disadvantages of titanium, stainless steel and composite materials? List the uses of each with respect to aircraft. **(10 Marks)**

b. List the various desirable properties of materials used in aircraft structure and explain each one of them in brief. **(10 Marks)**

3 a. Draw a neat diagram of stress – strain behaviour of low carbon steel. Discuss all salient points. **(08 Marks)**

b. Define the following :
   i) Yield point
   ii) Yield stress
   iii) Tensile strength
   iv) Resilience
   v) Toughness. **(05 Marks)**

c. Define fatigue. Explain in brief various stages in fatigue failure. **(07 Marks)**

4 a. Prove the Clapeyron's theorem of three moments. **(10 Marks)**

b. Explain briefly the importance of Hardy cross method. **(04 Marks)**

c. What is statically determinate structure and statically indeterminate structures? **(06 Marks)**

PART – B

5 a. State Castigliano's first theorem and the uses of Castigliano's first theorem. **(05 Marks)**

b. Calculate the instantaneous stress produced in a bar 1000mm^2 in area and 4 long by the sudden application of tensile load of unknown magnitude if the extension of the bar due to suddenly applied load is 1.35mm. Also determine the magnitude of the suddenly applied load. E = 2×10^5N/mm^2. **(08 Marks)**

c. A simply supported beam of span ℓ carries a point load F at mid span. Determine the strain energy stored by the beam. Also find the deflection at mid span. **(07 Marks)**

6 a. Explain Briefly the uses of south well plot. **(05 Marks)**

b. Differentiate short and long column. **(06 Marks)**

c. A bar of length 4 meters when used as a simply supported beam and subjected to a uniformly distributed load of 30kN/m. over whole span deflects 15mm at the centre. Determine the crippling loads when it is used as a column with the following conditions :

i) Both ends pin jointed
ii) One end fixed and the other hinged.
iii) Bothe ends fixed. **(09 Marks)**

7 a. What do you understand from Airy's stress function? Derive the relevant equation. **(08 Marks)**

b. Derive plane stress and plane strain in 2D elastic condition. **(12 Marks)**

8 a. Principal stresses in a M.S body are + 40MN/m^2 and – 100MN/m^2, the second principal stress being zero. Find the factor of safety based on the elastic limit if the criterion of failure for the material is the maximum principal stress theory. Take the elastic limit stress in simple tension as well as in simple compression to be equal to 210MN/m^2. **(10 Marks)**

b. A M.S. shaft 10cm diameter is subjected to a maximum torque of 15kNm and a maximum bending moment of 10kNm at particular section. Find F.O.S according to the maximum shear stress theory if the elastic limit in simple tension is 240 MN/m^2. **(10 Marks)**

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