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10AE56

Fifth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Aircraft Structures – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Derive expression for incremental load factor due to gust, considering change in lift at both wing and tail plane? **(08 Marks)**

b. What are various loads experienced by aircraft? Explain in brief. **(06 Marks)**

c. The wing of a military aircraft has a maximum lift co-efficient of 1.25 and an area $16m^2$. The maximum maneuver load factor is 6.0. If the weight of the aircraft is 50kN, determine the angle of bank required at a speed of 180m/s. Also, calculate the radius of turn. (Take $\rho = 1.223\ kg/m^3$). **(06 Marks)**

2 a. Give a broad classification of materials and factors to be considered while choosing materials for aircraft application. **(06 Marks)**

b. Explain advantages and disadvantages of α and β titanium alloys. **(06 Marks)**

c. How composites are classified on the basis of matrix materials? Explain. **(08 Marks)**

3 a. Define fatigue. Explain in brief various stages in fatigue failure. **(08 Marks)**

b. What are elastic constants? Explain them. **(06 Marks)**

c. Explain the failure criteria based on soderberg line equation. **(06 Marks)**

4 a. The truss shown in part of an airplane's internal structure. Determine the axial forces in members BC, BD and BE. **(12 Marks)**

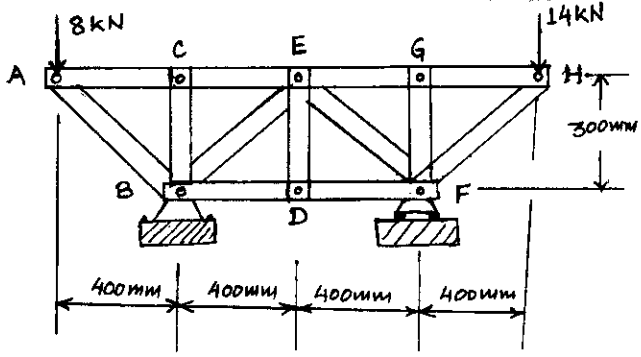

Fig.Q.4(a)

b. Derive three moment equation for a continuous beam. **(08 Marks)**

PART – B

5 a. Determine the deflection of a point on a frame-work by unit load method. **(12 Marks)**

b. Explain Maxwell's reciprocal theorem. **(08 Marks)**

6 a. Derive an expression for Euler's crippling load for a column with both ends fixed. **(10 Marks)**

b. Derive south well plot equation. **(10 Marks)**

7 a. Derive equations of equilibrium for the stress acting on a 3-dimensional element of an elastic material. **(10 Marks)**

b. The state of strain at a point is given by: $\epsilon_x = 0.001$, $\epsilon_y = -0.003$, $\epsilon_z = \gamma_{xy} = 0$, $\gamma_{xz} = -0.004$, $\gamma_{yz} = 0.001$. Determine the stress tensor at this point. (Take $E = 210 \times 10^6$ kN/m^2, Poisson's ratio = 0.28). Also find Lame's constant. **(10 Marks)**

8 a. Derive equation for failure condition based on maximum strain energy theory. Also explain its limitations. **(12 Marks)**

b. A mild steel shaft of 60mm diameter is subjected to a bending moment of 25×10^5 N-mm and Torque 'T'. If the yield point of steel in tension is 230 N/mm^2. Find maximum torque as per maximum stress theory. Take factor of safety as 1.5. **(08 Marks)**

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