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10AE56

Fifth Semester B.E. Degree Examination, May 2017
Aircraft Structure – I

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. List and discuss various loads acting on the structural components of aircraft. **(04 Marks)**

b. Define interia loads and derive the formula for minimum resultant inertial forces and total torque. **(08 Marks)**

c. Discuss the structural functions of various components with reference to wing with neat diagram. **(04 Marks)**

2 a. Sketch typical stress-strain curves for below mentioned material showing their important mechanical properties :
i) Aluminium ii) copper iii) brittle material iv) mild steel v) rubber. **(05 Marks)**

b. Briefly discuss aluminium alloys and steel as aircraft material with its area of applications. **(09 Marks)**

c. Discuss importance of non-metals as aircraft materials with applications. **(06 Marks)**

3 a. Discuss the tensile properties of mild steel. Clearly mention the linear and non-linear mechanical properties. **(10 Marks)**

b. What is fatigue? List and explain fatigue properties of material. **(06 Marks)**

c. Define creep and discuss creep properties. **(04 Marks)**

4 a. Distinguish statically determinate and indeterminate structure with example. **(06 Marks)**

b. A truss load as shown in Fig.Q4(b). Determine the forces in all the members of the truss. **(14 Marks)**

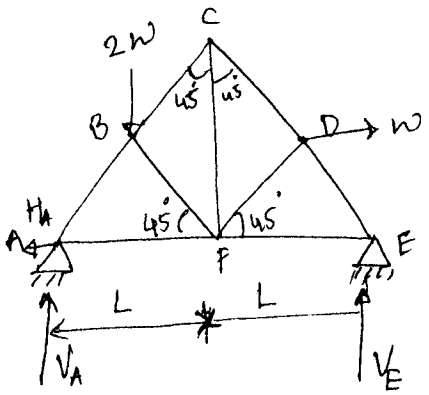

Fig.Q4(b)

PART – B

5 a. A continuous beam ABC of constant moment of inertia is simply supported at A, B, and C. The beam carries a central point load of 40 kN in span AB and a central clock wise couple of 300 kN-m in the span BC, as shown in Fig.Q5(a). Find the support moments and plot the shear force and bending moment diagram. **(10 Marks)**

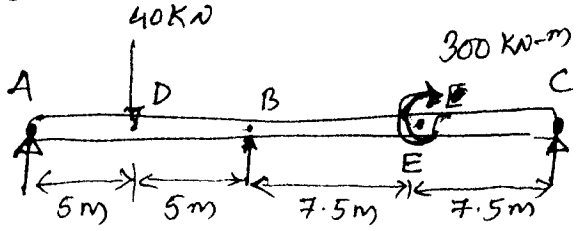

Fig.Q5(b)

b. State and prove Maxwell reciprocal theorem. **(10 Marks)**

6 a. Show that critical load for long column is given by :

$P = \frac{n^2\pi^2 EI}{L^2}$, where (n = 1, 2, 3 - - -). **(10 Marks)**

b. A cast iron hallow column, having 100 mm external diameter and 80 mm internal diameter is used as a column of 2.4m length. Using Rankines formulas, Determine the crippling load, when both the ends are fixed. Take $f_c = 600$ N/mm^2 and $a = \frac{1}{1600}$. **(10 Marks)**

7 a. Derive the equilibrium equation of 3-D elastic body, subjected to externally applied force system. Deduce the same to 2-D plane stress condition. **(14 Marks)**

b. Explain plane stress and plane strain conditions with example. **(06 Marks)**

8 a. Explain the need for failure theories and briefly describe maximum principal stress theory and distortion energy theory with their limitations and applicability. **(12 Marks)**

b. If the principal stress at point in an elastic material are 2f tensile, 1.5f tensile and f compressive. Calculate the value of f at failure according to any three failure theories. The elastic limit in simple tension is 210 N/mm^2 and $\mu = 0.3$. **(08 Marks)**

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