

--	--	--	--	--	--	--	--	--	--

Fifth Semester B.E. Degree Examination, June/July 2016
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. In a symmetrical flight maneuvers, what are the conditions for highest load in any part of the airplane? Explain. (10 Marks)
 - b. What is a V-n diagram of an airplane? Explain with a neat sketch. (05 Marks)
 - c. Derive an expression for increment in gust load factor. (05 Marks)
2.
 - a. What are the different aluminium alloys used in airplane construction. Explain their properties. (10 Marks)
 - b. What is maraging steel and what are the main advantages over conventional low alloy steels? (06 Marks)
 - c. What are the titanium parts on an aircraft? Comment on their properties. (04 Marks)
3.
 - a. What are the important mechanical properties of materials used in airplane fabrication? Explain those properties. (10 Marks)
 - b. Derive an equation to prove the deflection of a bar of uniform section under its own weight is equal to half the deflection of the bar under the axial load equal to its weight. (06 Marks)
 - c. A conical bar tapers uniformly from a diameter of 15 mm to a diameter of 40 mm in a length of 400 mm. Determine the elongation of the bar under an axial tensile force of 100 kN. Take $E = 2 \times 10^5 \text{ N/mm}^2$. (04 Marks)
4.
 - a. Explain with a neat sketch statically determinate and indeterminate beams. (06 Marks)
 - b. Using Clapeyron's theorem, find the fixing moment for a fixed beam subjected to a Uniform Distributed Load (UDL) throughout the span. Refer Fig.Q4(b). (06 Marks)

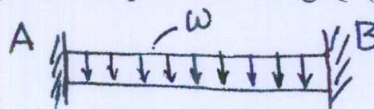


Fig. Q4(b)

- c. Determine the forces in the members P_{BC} and P_{BD} of the frame shown in Fig.Q4(c). (08 Marks)

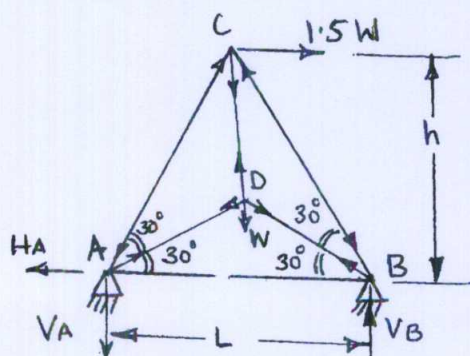


Fig. Q4(c)

PART – B

- 5 a. Explain Castigliano's 1st theorem. (10 Marks)
b. Calculate the deflection at the free end of a cantilever of length 'L' loaded with a point load 'W' at a distance of L_1 from the support using unit load method. (10 Marks)
- 6 a. What is meant by Buckling? Derive the expression for the critical load. (10 Marks)
b. A hollow cast iron cylinder, 4 meter long with both ends firmly fixed carries an axial load of 200 kN. The internal diameter of the column is 0.8 times the external diameter. Determine the section of the column, take $f_c = 600 \text{ N/mm}^2$, Rankine's constant $a = 1/1600$ and factor of safety of 6. (10 Marks)
- 7 a. Derive the equation for stress equilibrium. (10 Marks)
b. What is understood by Airy's stress function? (10 Marks)
- 8 a. What are the common five theories of elastic failures? (04 Marks)
b. Explain maximum shear stress theory and maximum strain energy theory and their limitations. (10 Marks)
c. The load on a bolt consists of an axial pull of 15 kN together with a transverse shear of 7.5 kN. Determine the diameter of the bolt according to the maximum principal shear stress theory. (06 Marks)
