

Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Aircraft Structure – I

Time: 3 hrs.

Max. Marks:100

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

PART – A

- 1 a. Define airworthiness and explain v-n diagram for flight envelop and also draw gust envelope. (10 Marks)
- b. The wing of military aircraft has a maximum maneuver load factor is 6.0 if the weight of the aircraft is 50kN, determine the angle of bank required at speed of 180m/s. calculate also the radius of turn. Take $\rho = 1.223 \text{ kg/m}^3$. (10 Marks)
- 2 a. List and discuss the desirable properties of aircraft materials. (08 Marks)
- b. What are composites? Classify the composite materials? (06 Marks)
- c. Discuss the use of aluminum alloys in aircraft industry. (06 Marks)
- 3 a. Explain. (10 Marks)
 - i) Creep
 - ii) Fatigue failure
 - iii) Factor process.
- b. Discuss a neat diagram of stress – strain behaviour of low carbon steel. Discuss all salient points. (10 Marks)
- 4 a. Three identical wires support a load of 20kN as shown in Fig Q4(a). Determine the force in each wire and the vertical displacement of the load if diameter of each wire is 6mm and $E = 2 \times 10^5 \text{ N/mm}^2$ (10 Marks)

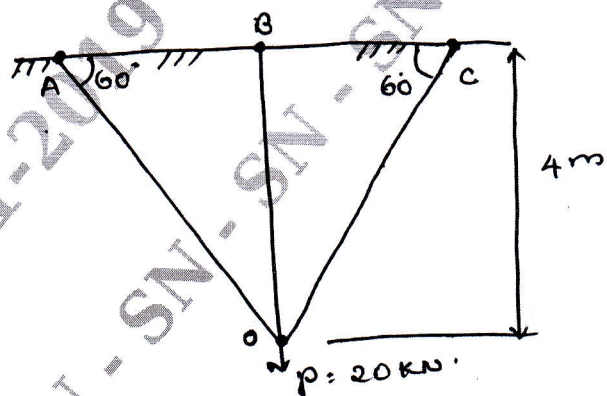


Fig Q4(a)

- b. Explain the different types of supports used in beams with the neat sketches. Also write the reactions at each supports. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART - B

- 5 a. State and prove Maxwell's reciprocal theorem (10 Marks)
b. Explain the following :
i) Strain energy
ii) Complementary energy
iii) Castiglione's theorem. (10 Marks)
- 6 a. Obtain an expression for the critical load for a long column subjected to bending when one end is fixed and other end is free. (10 Marks)
b. A built up I section has an overall depth of 400mm, width of flange 300mm, thickness of flange 50mm and web thickness 30mm. It is used as a beam with simply supported ends and it deflects 10mm at centre when subjected to a concentrated load of 320kN at centre. Find the safe load if this I section is used as a column with both ends fixed. Use Euler's formula. Assume F.O.S of 3 and $E = 2 \times 10^5 \text{ N/mm}^2$. (10 Marks)
- 7 a. Derive the 3D strain relation between strain and displacement functions. (10 Marks)
b. A rectangular element in linearly elastic, isotropic material is subjected to tensile stresses of 83 and 65N/mm² on mutually perpendicular planes. Determine the strain in the direction of each and in the direction perpendicular to both stresses. Find also the principal strain, maximum shear strain take $E = 2 \times 10^5 \text{ N/mm}^2$ and $\nu = 0.3$. (10 Marks)
- 8 Write a note on failure theories of materials. (20 Marks)
a. Maximum principal stress theory
b. Maximum principal strain theory
c. Maximum shear stress theory.
