Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 50024

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Fourth Semester
Aeronautical Engineering
AE 6403 – AIRCRAFT STRUCTURES – I
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. Define deficient, perfect and redundant plane truss.
2. Define stiffness factor, distribution factor and carry over moment used in moment distribution method.
3. Write the strain energy expressions for axial loading, bending and shear.
4. Explain the difference between dummy load and unit load methods.
5. Define slenderness ratio and its used in the classification of column.
6. The cross section of a column is rectangle of width 15 cm and depth 6 cm. What value of second moment of area is used for determination of buckling load ?
7. Explain why method of superposition is not used in the analysis of beam column.
8. What failure theories used for ductile and brittle materials ?
9. A bar of length 2 m is fixed at its ends and its temperature is raised by 30°C. Given E = 200 GPa and $\alpha = 12 \times 10^{-6}$/°C determine the stress developed in the bar.
10. A bar of uniform section is fixed at its top end and a collar is attached at its bottom end. A block of weight W is allowed to slide along its length from height h and strike the collar. Derive the expression for stress developed in the bar.

PART – B (5×13=65 Marks)

11. a) Determine thin forces in the members of the truss shown in the Fig. 11(a).

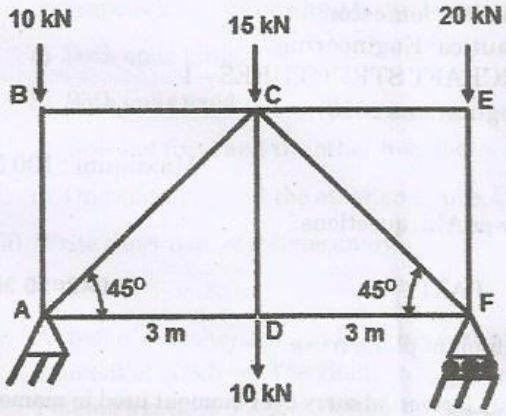

Fig. 11 (a)

(OR)

b) A beam of uniform section and length L is fixed at its ends and subjected to uniformly distributed load of intensity w throughout its length. It is also subjected to a load P, acting downward at its midpoint. Using method of superpositions determine the support reactions.

12. a) A two span beam is subjected to loads as shown in Fig. 12 (a). Using Clapeyron's three moment equations determine the support reactions.

(OR)

b) Determine the support reactions of the beam shown in Fig. 12 (b) by applying moment distribution method.

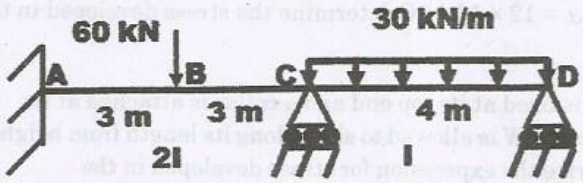

Fig. 12 (a) and (b)

13. a) A beam ABC of length 2L and uniform section is subjected to uniformly distributed load of intensity w over the entire length of the beam. Length of AB and BC are same. It is simply supported at A and on roller supports at B and C. Determine the support reactions using energy method.

(OR)

b) A beam of length L and uniform section is simply supported at its ends and subjected to uniformly distributed load of intensity w over the entire length of the beam. Determine the slope at the left support and deflection at the midpoint using dummy load method or unit load method.

14. a) A beam of length L and of uniform section is simply supported at its ends and subjected to uniformly distributed load over the entire length of the beam. Also it is subjected to axial compressive load P at its ends. Derive the expressions for beam-column displacement and its maximum stress. **(13)**

(OR)

b) A thin walled circular cylindrical tube of mean radius 500 mm is subjected to an internal pressure of 10 MPa. The yield stress of the tube material is 375 MPa and Poisson's ratio is 0.3. Determine the required wall thickness using maximum stress theory, maximum shear stress theory and strain energy theory. Consider factor of safety as 3. **(13)**

15. a) A compound cylinder consists of solid brass rod surrounded by steel tube and lengths of both materials are same. Diameter of brass rod is 50 mm. Its modulus of elasticity is 100 GPa and coefficient of thermal expansion is 20×10^{-6}/°C. The outer diameter of steel tube is 80 mm and its inner diameter is 60 mm. Modulus of elasticity and coefficient of thermal expansion are respectively 200 GPa and 120×10^{-6}/°C. The ends of the compound cylinder are held together by rigid plates and a tensile load of 100 kN is applied at the center of the plate. Also the temperature of the compound cylinder is increased by 40°C. Determine the stresses developed in steel and brass.

(OR)

b) Explain the following : **(7)**

i) Stress developed due to impact loading

ii) Analysis of structure for creep. **(6)**

PART – C (1×15=15 Marks)

16. a) i) A column of length 3 m has its cross section in the form rectangle of width 100 mm and depth 50 mm. Its modulus of elasticity is 210 GPa. Determine its slenderness ratio. Also determine the critical buckling load and the corresponding stress using a factor of safety of 2.5 for the column with

a) Both ends hinged,

b) Both ends fixed,

c) One end fixed and the other free and

d) One end fixed and the other end hinged. (10)

ii) Write short note of fatigue analysis. (5)

(OR)

b) i) A shaft of diameter 180 mm is subjected to a torque of 70 kN-m and a bending moment of 50 kN-m. The yield stress of the material is 250 MPa and Poisson's ratio is 0.3. Check whether the material will fail or not using :

i) Maximum shear stress theory

ii) Maximum strain energy theory and

iii) Maximum shear strain energy/distortion energy theory. If does not fail determine the factor of safety. (10)

ii) Explain about the stress relaxation. (5)