Hall Ticket No | | | | | | | | | | | Question Paper Code: AAE002

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Four Year B.Tech III Semester End Examinations (Supplementary) - January, 2019
Regulation: IARE – R16
THEORY OF STRUCTURES
Time: 3 Hours   **(AE)**   **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) State Hooke's law. Write the relationship between bulk modulus, rigidity modulus and Poisson's ratio. **[7M]**

   (b) Draw the shear force and bending moment diagram for a simply supported beam of length 9m and carrying a uniformly distributed load of 10kN/m for a distance of 6m from the left end. Also calculate the maximum B.M. on the section. **[7M]**

2. (a) Define bending moment, shear force and the applied load. Write the relation between them. Explain lateral strain with a neat sketch. **[7M]**

   (b) Draw SFD and BMD for a cantilever beam of length 6 m carries a gradually varying load, zero at the free end to 2 kN/m at the fixed end. **[7M]**

UNIT – II

3. (a) Define section modulus. Write and deduce an expression for section modulus for rectangular, circular and hollow circular sections. **[7M]**

   (b) A beam is of T-section, flange 120 mm x 10 mm, web 100 mm x 10 mm. What percentage of the shearing force is carried by the web. **[7M]**

4. (a) The shear stress is maximum at the neutral axis in case of a rectangular section. Justify the statement with proof. **[7M]**

   (b) Two wooden planks 150 mm x 150 mm each are connected to form a T-section of a beam. If a moment of 3.4 kNm is applied around the horizontal neutral axis, inducing tension below the neutral axis, find the stresses at the extreme fibres of the cross-section. **[7M]**

UNIT – III

5. (a) Determine the deflection at the free end of a cantilever carrying a point load at free end using double integration method. **[7M]**

   (b) A straight circular bar of steel 10 mm in diameter and 1.2 m long is mounted in testing machine and loaded axially in compression till it buckles. Assuming the Euler formula for pinned ends to apply, estimate the maximum central deflection before the material reaches its yield stress of 250 N/mm^2. Take E = 2.1 x 10^5 N/mm^2. **[7M]**

6. (a) Write Euler's formula for buckilng load. Write the assumptions made in Euler's Column Theory.
   [7M]

   (b) A 1.5 m long C.I. Column has a circular cross-section of 5cm diameter. One end of the column is fixed in direction and position and the other is free. Taking factor of safety as 3, calculate the safe load, using:
   (i) Rankine-Gordan formula; take yield stress $560MN/m^2$, and a $= 1/1600$ for pinned ends.
   (ii) Euler's formula. Young's Modulus for C.I.$=120GN/m^2$. **[7M]**

UNIT – IV

7. (a) State and explain the Clapeyron's theorem of three moments. **[7M]**

   (b) Analyze the axial forces in all the members of the plane truss carrying a horizontal load of 16 kN and a vertical load of 24 kN, as shown in Figure 1. **[7M]**
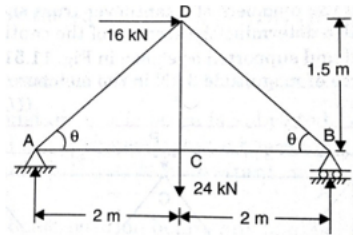

Figure 1

8. (a) Explain the various methods of analyzing a perfect frame. **[7M]**

   (b) A continuous beam ABC covers two consecutive span AB and BC of lengths 6 m and 8 m respectively, carrying uniformly distributed loads of 8 kN/m and 10 kN/m respectively. If the ends A and C are simply supported, find the support moments at A, B and C. Draw also BM and SF diagrams. **[7M]**

UNIT – V

9. (a) Explicate the constitutive law for 'Plane stain' problem. **[7M]**

   (b) A body is subjected to direct stresses in two mutually perpendicular directions accompanied by a simple shear stress. Draw the Mohr's circle of stresses and explain how you will obtain the normal, shear and resultant stresses on an oblique plane inclined at an angle with the plane of major direct stress. **[7M]**

10. (a) What are compatibility equations? Why are they required? **[7M]**

    (b) Draw the Mohr's stress circle for direct stresses of 65 MN/m^2 (tensile) and 35MN/m^2 (compressive) and estimate the magnitude and direction of the resultant stresses on planes making angles of 20^0 and 65^0 with the plane of the first principal stress. Find also the normal and tangential stress on these planes. **[7M]**

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