Hall Ticket No | | | | | | | | | | |

Question Paper Code:ACEC07

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
(Dundigal-500043, Hyderabad)

B.Tech IV SEMESTER END EXAMINATIONS (REGULAR) - JULY 2022
Regulation:UG20
THEORY OF STRUCTURES
(CIVIL ENGINEERING)

Time: 3 Hours **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
(NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Find the fixed end moments of a fixed beam AB of length 'L' carrying a UDL 'w' over the entire length. Also draw SFD and BMD. [BL: Understand| CO: 1|Marks: 7]

   (b) A simply supported beam with a triangularly distributed downward load is shown in Figure 1. Calculate reactions and draw shear force diagram. find location of V=0; calculate maximum moment, and draw the moment diagram.

   [BL: Apply| CO: 1|Marks: 7]

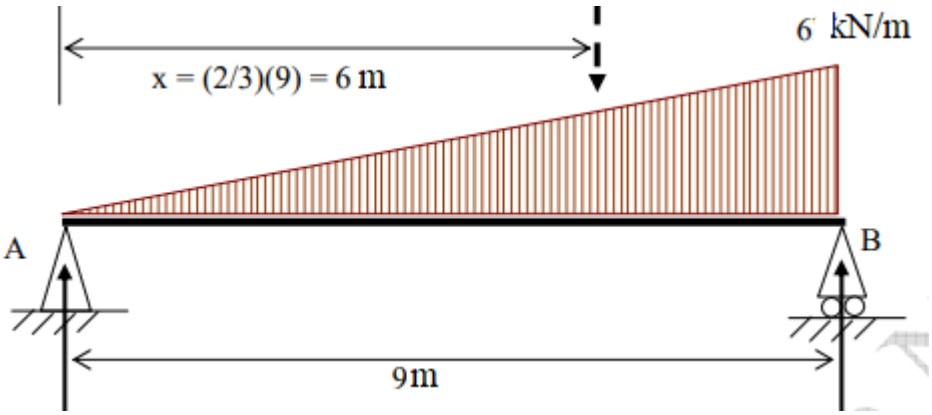

Figure 1

MODULE – II

2. (a) A continuous beam ABCD of length 15 m rests on four simple supports covering 3 equal spans and carries a uniformly distributed load of 1.5 kN/m length. Calculate the moments and reactions at the supports. Draw the SFD and BMD. [BL: Understand| CO: 2|Marks: 7]

   (b) A continuous beam ABCD is carrying a uniformly distributed load of 1 kN/m over span ABC in addition to concentrated loads as shown in Figure 2. Calculate support reactions. Also, draw bending moment and shear force diagram. Assume EI to be constant for all members.

   [BL: Apply| CO: 2|Marks: 7]

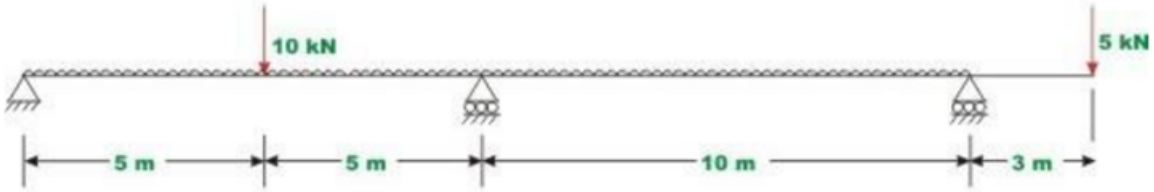

Figure 2

MODULE – III

3. (a) Derive the expression for central deflection of a simply supported beam of length L and carrying a point load at the centre. [BL: Understand| CO: 3|Marks: 7]

   (b) A cantilever of length 3 m is carrying a point load of 25 kN at the free end, if the moment of inertia of the beam = 10^8 mm^4 and value of E = 2.1 x 10^5 N/mm^2, find
   i) Slope of the cantilever at the free end
   ii) Deflection at the free end. [BL: Apply| CO: 3|Marks: 7]

4. (a) Derive the expression for maximum deflection of a cantilever beam of length L and carrying a point load at the free end. [BL: Understand| CO: 3|Marks: 7]

   (b) A simply supported beam of span 6 meters carries a central point load of 20 kN. Find the maximum slope and deflection by moment area method. Given EI = 4000 kN-m^2.
   [BL: Apply| CO: 3|Marks: 7]

MODULE – IV

5. (a) What is Castigliano's first theorem? Provide the mathematical formulation.
   [BL: Understand| CO: 4|Marks: 7]

   (b) Using strain energy method, determine the vertical deflection at "O" in the Figure 3 (Take $E = 2 * 10^5 N/mm^2$, Area of wire, $A = 100mm^2$) [BL: Apply| CO: 4|Marks: 7]

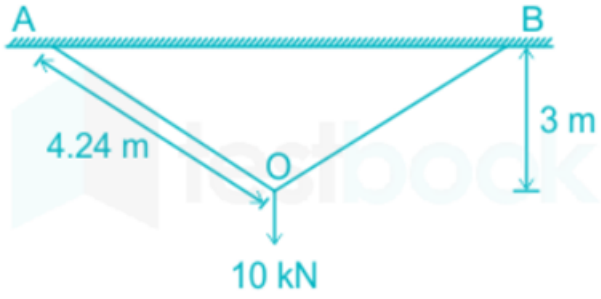

Figure 3

6. (a) Derive an expression for strain energy in a member subjected to an axial load.
   [BL: Understand| CO: 5|Marks: 7]

   (b) A truss is loaded as shown in Figure 4. Compute the vertical deflection at point C due to the externally applied load (Consider AE=constant). [BL: Apply| CO: 5|Marks: 7]

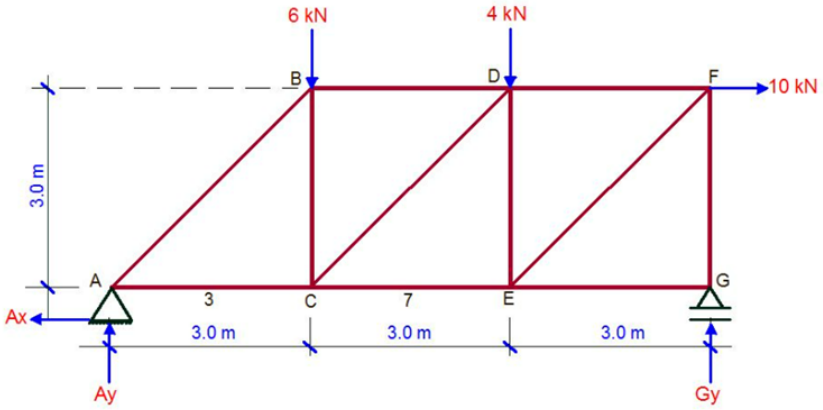

Figure 4

MODULE – V

7. (a) Derive the crippling load of a column when both the ends of a column are hinged using Euler's theory [BL: Understand| CO: 6|Marks: 7]

   (b) A solid round bar 3 m long and 5cm in diameter is used as a strut with both the ends hinged. Determine the crippling load. Take $E = 2x10^5 N/mm^2$. [BL: Apply| CO: 6|Marks: 7]

8. (a) How will you justify that Rankine's formula is applicable for all the lengths of columns, ranging from short to long columns. Differentiate short column and long column.
   [BL: Understand| CO: 5|Marks: 7]

   (b) Find the Euler's crushing load for a hollow cylindrical cast iron column, 200 mm external diameter and 250 mm thick, if it is 6 m long and hinged at both ends. E=1.2 x 10 N/mm^2. Compare this load with that obtained by the Rankine's formula using constants σ_c =560 N/mm^2 and $\alpha = 1/1600$; For what length of the column would these two formulae give the same crushing load?
   [BL: Apply| CO: 5|Marks: 7]

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