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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Supplementary) - June, 2018

**Regulation: IARE – R16**

**Strength of Materials - II**

**Time: 3 Hours**

**(CE)**

**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) Derive the basic differential equation for deflection curve of a simply supported beam using double integration method. [7M]
- (b) A beam ABC of length  $(l+a)$  has one support at the left end and the other support at a distance 'l' from the left end. The beam carries a point load W at the right end. Find the slopes over each support and at the right end. Find also the deflection at the right end and the maximum deflection between supports. [7M]
2. (a) Derive the expression for finding out deflection for a cantilever beam subjected to UDL over whole span using Mohr's theorems. [7M]
- (b) Using conjugate beam method find slopes at ends and central deflection for a simply supported beam shown in Figure 1. Plot SFD and BMD. [7M]

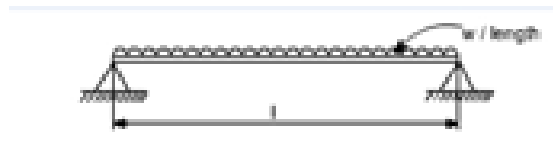


Figure 1

## UNIT – II

3. (a) Determine the rotation at supports and deflection at mid span of the simply supported beam as shown in the Figure 3. Use moment area method. [7M]

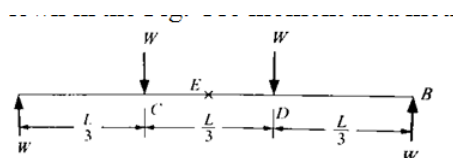


Figure 2

- (b) Determine the horizontal displacement and rotation at roller support in the frame shown in Figure 2. by unit load method. Flexural rigidity  $EI$  is constant throughout. [7M]

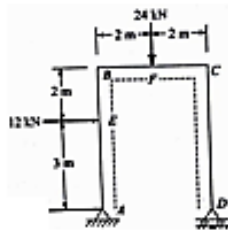


Figure 3

4. (a) Calculate the central deflection and slope at the ends of a simply supported beam carrying UDL 'W' per unit length over the whole span. Use unit load method. [7M]
- (b) Determine the vertical and horizontal displacement at the free end D in the frame shown in the Figure 4. Take  $EI = 12 \times 10^3 \text{ N mm}^2$ . Use Castigliano's theorem. [7M]

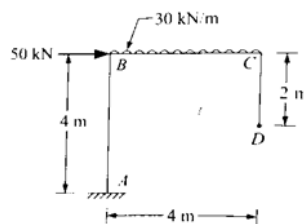


Figure 4

### UNIT – III

5. (a) A shell 3.25m long, 1m in diameter is subjected to an internal pressure of  $1 \text{ N/mm}^2$ . If the thickness of the shell is 10mm, find the circumferential and longitudinal stresses. Find also the maximum shear stress and the changes in the dimensions of the shell. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $\nu = 0.3$ . [7M]
- (b) A cylindrical shell 1 meter long, 180mm internal diameter, thickness of metal 8mm is filled with a fluid at atmospheric pressure. If an additional  $20000 \text{ mm}^3$  of the fluid is pumped into the cylinder, find the pressure exerted by the fluid on the wall of the cylinder. Find also the hoop stress induced. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $\nu = 0.3$ . [7M]
6. (a) Derive the Lamé's equation for radial pressure 'P' and circumferential stress c. [7M]
- (b) A pipe of 400 mm internal diameter and 100mm thickness contains a fluid at a pressure of  $8 \text{ N/mm}^2$ . Find the maximum and minimum hoop stress across the section. Also, sketch the radial pressure distribution and hoop stress distribution across the section. [7M]

## UNIT – IV

7. (a) Analyze a cantilever beam propped at end and subjected to UDL of  $w$ /unit length covering entire span of length  $L$ . Draw S.F.D and B.M.D. [7M]
- (b) Two cantilever beams 1 and 2 respectively are propped by a hinge as shown in Figure 5. Beam 1 carries a central concentrated load of 30 kN. Draw the SFD and BMD.  $EI$  is constant for both cantilevers. [7M]

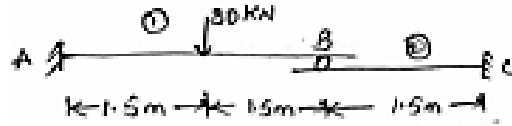


Figure 5

8. (a) A fixed beam of 6m span is subjected to a clockwise concentrated couple of 150 KN.m applied at a section 4m from the left end. Find the end moments. Draw SFD and BMD. [7M]
- (b) A propped cantilever beam AB is subjected to a uniformly distributed load of 15 kN/m throughout the length of 10 m. Draw bending moment diagram and shear force diagram by consistent deformation method. Assume that flexural rigidity of beam is constant throughout its length. [7M]

## UNIT – V

9. (a) Derive the clapeyorn's equation of three moment for a continuous beam carrying UDL. [7M]
- (b) A continuous beam ABCD covers three spans  $AB= 1.5L$ ,  $BC= 3L$  and  $CD=L$ . It carries UDL of  $2W$ ,  $W$  and  $3W$  per meter run on AB, BC and CD respectively. If the beam is of same cross section throughout, Find B.M at supports B & C and pressure on each support. Also plot the BMD and SFD. [7M]
10. (a) Derive the three moment equation for a continuous beam which is fixed at both the end. Consider the beam carries a uniformly distributed load of  $w$  per unit length. [7M]
- (b) A three span continuous beam ABCD has different moment of inertia and is loaded as shown in figure. Find reactions and support moments and draw the S.F.D and B.M.D. [7M]

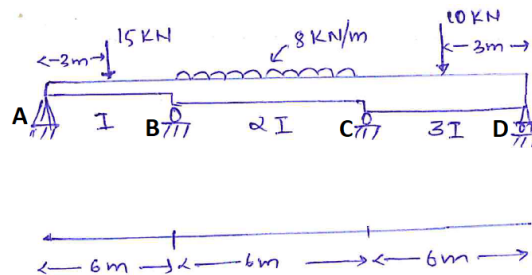


Figure 6

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