

## B.E. CIVIL ENGINEERING, THIRD YEAR FIRST SEMESTER EXAM 2024

## THEORY OF STRUCTURE – I

Time 3 hours

Full marks 100

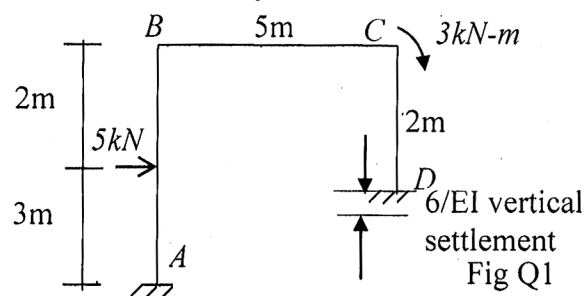
(50 Marks for each part)

Use separate answer scripts for each part

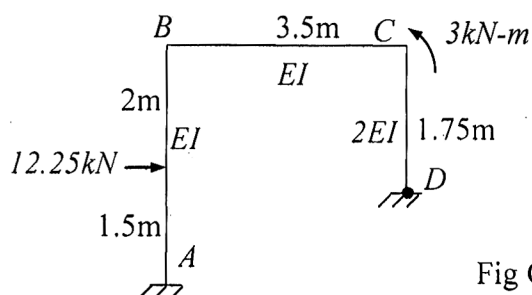
## Part-I

Answer ALL questions. Full marks 50

1. Solve the frame in Fig. Q 1 using **Slope-Deflection Method** for **Member End Moments**.  $EI$  is constant for all the members. Support D suffers a **vertical settlement of  $6/EI$  m**. The moment at C is a 'joint load'. (CO2- 20)



2. (a) Conduct only the **no-sway analysis** in Fig. Q 2a using **Moment distribution** problem to find the no-sway force. Note that support D is hinged. Find the no-sway force. Finally, draw the corresponding BMD on tension face. (CO1-15)  
 (b) Derive the expression for "rotation factor" used in **Kani's method**. (CO1-7)



3. **Derive and explain the shear strain energy density failure theory.** (CO3- 8)

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Part- II (Marks 50)

1. Find the 4<sup>th</sup> order differential equation for buckling problem of column and solve this differential equation for buckling load of a column with one end hinged and other end fixed. Use **Finite difference method**. Divide the column into **three equal** segments.  $EI$  is constant throughout its length. 20
2. A column has a rectangular cross section (400mm ×450mm) is supported as shown in Fig. 1. The end B has free movement in Z direction but movement along Y direction is prevented. The end A is fixed. Find the buckling load of the column.  $E=2 \times 10^5 \text{N/mm}^2$ . 10

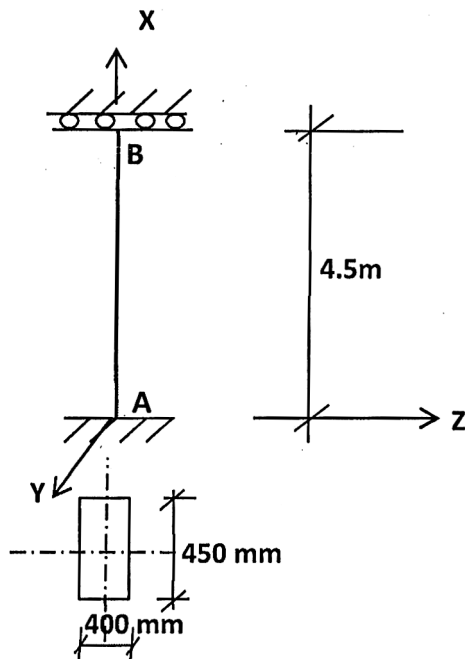


Fig. 1

3. A hollow cylindrical cast iron column is 5.0m long, both ends being fixed. Design the column to carry an axial compressive load of 325 kN. Use **Rankine's formula** and adopt factor of 4.0. The internal diameter may be takes as 0.8 times the external diameter. Take,  $\sigma_c=550\text{N/mm}^2$  and  $\alpha=1/1600$ . 10

4. Derive the Secant formula ,i.e.  $\sigma_{\max} = \frac{P}{A} \left[ 1 + \frac{ec}{r^2} \sec \left( \frac{l}{2r} \sqrt{\frac{P}{EA}} \right) \right]$  . The notations have their usual meaning. 10