B.E. CIVIL ENGINEERING, THIRD YEAR FIRST SEMESTER EXAM 2025

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. Derive the **equilibrium equations** for the frame in Fig. Q 1 by slope-deflection method. Note that the **hinged** support at D suffers a ***vertical settlement***. Use neat diagrams.

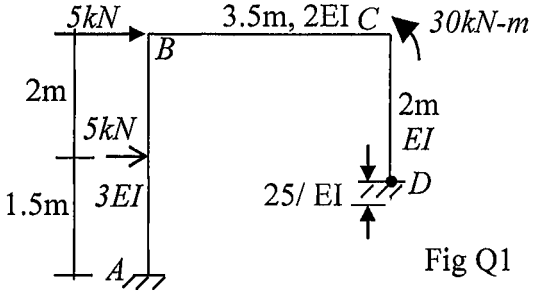

Fig Q1

(CO2, 15)

2. **Conduct only the no-sway analysis** for the frame in Fig Q1 using the *moment distribution method.* Compute the corresponding no-sway force. Finally, draw corresponding *BMD on the tension face* **for the no-sway moments you got.**

(CO1, 12+3 = 15)

3. Derive values of the terms ***m*** and ***n*** used in *Kani's method* to explain the *equivalence of a fixed-free column and a fixed-fixed column.*

(CO1, 10)

4. Derive the Mohr's modified shear stress failure theory for brittle materials with clean diagrams.

(CO3, 10)

Ref. No.: Ex/CE/PC/B/T/313/2025

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Subject: THEORY OF STRUCTURES I

Full Marks:100 **Time: 3hours**

(Use Separate Answer scripts for each Part)

Part- II (Marks 50)

1. Find the 4th 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 (300mm ×425mm) 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. $E=2\times10^5 N/mm^2$. **10**

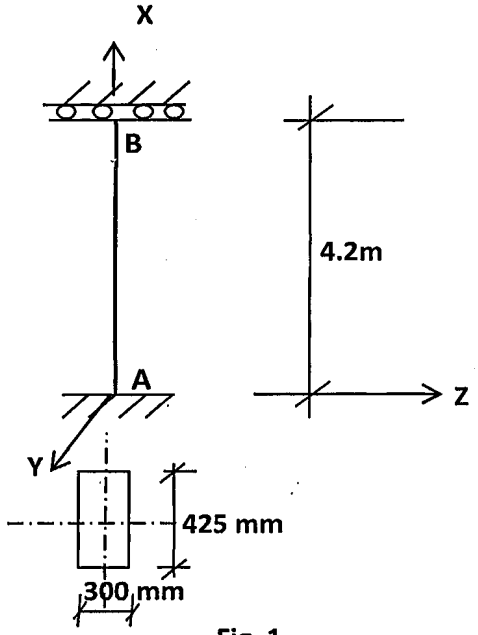

Fig. 1

3. A steel column of rectangular section 350mm×425mm hinged at one end and fixed at other end is subjected to axial compression. The column is 3.15m long. Determine the buckling load and the corresponding axial stress. Also determine the length for which Euler's theory may be used to determine the buckling load, if permissible stress is 180MPa. Take $E=2\times10^5\ N/mm^2$. **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**