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

## THEORY OF STRUCTURES– 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 for the member-end displacements of frame in Fig. Q1 by SLOPE-DEFLECTION method. *EI is constant for all members.* (20) CO1

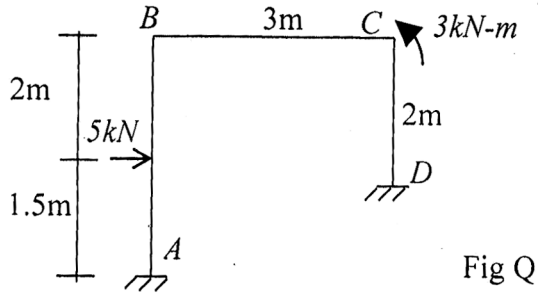


Fig Q1

2. Solve the frame shown in Fig Q2 using the MOMENT DISTRIBUTION METHOD. Draw the corresponding *BMD on the tension face.* (23) CO2

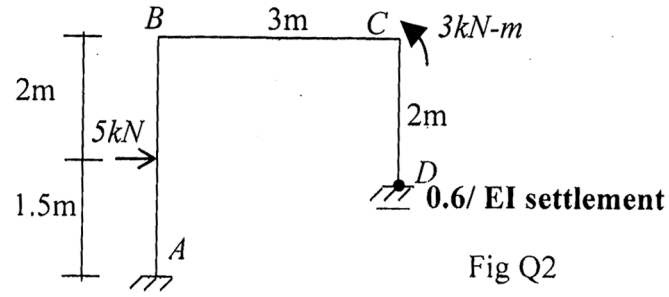


Fig Q2

3. Correlate von Mises' maximum shear strain energy theory of failure and octahedral shear stress failure theory. (7) CO3

**Ref. No.: Ex/CE/PC/B/T/313/2024 (S)**

**B.E. CIVIL ENGINEERING THIRD YEAR FIRST SEMESTER SUPPLEMENTARY EXAM 2024**

**Subject: THEORY OF STRUCTURES I**

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

**( Use Separate Answer scripts for each Part)**

**Part- II (Marks 50)**

1. Determine the buckling load of a column with both ends fixed. Use **Finite difference method**. Divide the column into **four equal** segments. *EI* is constant throughout its length. **20**

2. A steel column with pinned ends is 4.25m long. Its support an eccentrically applied load *P*=425 kN; the eccentric load acts on axis 2-2 at a distance 500 mm from centroid (**Fig.1**). Buckling occurs in plane 2-2. a) Using the **secant formula**, calculate maximum compressive stress in the column. b) if the yield stress for steel is 200MPa, what is the factor of safety with respect to initial yielding of the steel?
Given, $E=2\times10^5 N/mm^2$, area of column=$250cm^2$, radius of gyration about buckling axis=14.6cm. Section modulus about buckling axis=$1989cm^3$. **12**

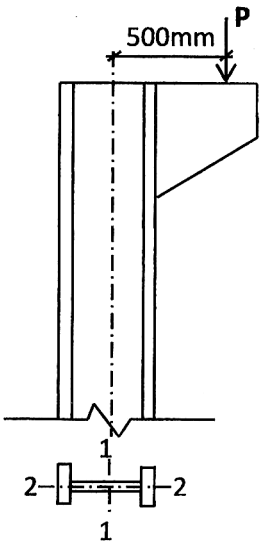


Fig. 1

3. A column has a rectangular cross section (325mm ×450mm) is supported as shown in **Fig. 2**. 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**

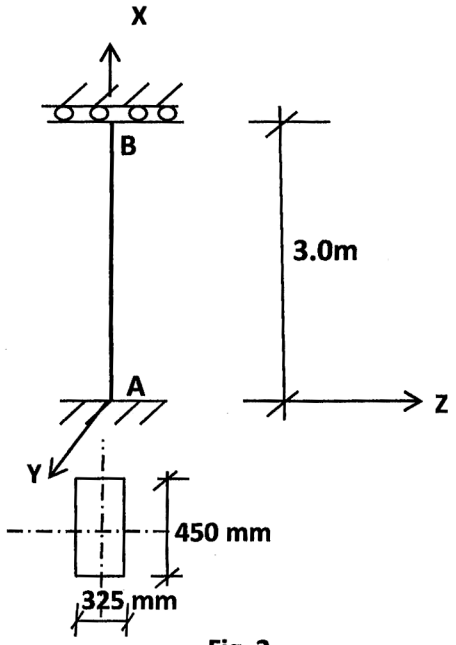


**Fig. 2**

4. A steel column of rectangular section 250mm×350mm hinged at one end and fixed at other end is subjected to axial compression. The column is 2.75m 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 250 MPa. Take $E=2\times10^5\ N/mm^2$. **8**