Ref. No. : Ex/CE/PC/B/T/413/2025

Name of the Examinations: B.E. CIVIL ENGINEERING FOURTH YEAR FIRST SEMESTER - 2025

Subject : THEORY OF STRUCTURES-III **Time : 3 hours** **Full Marks : 100**

Part I (50 Marks)

Instructions: Use Separate Answer scripts for each part.

Question 1. Analyse the portal frame using Stiffness Matrix Approach shown in Figure 1 and plot the BMD and SFD. (20 + 6) CO3

Question 2 (a) Derive the expression for impulse response for a single degree of freedom system. CO4

(b) Using the concept of Duhamell Integral find the response of a SDOF system subjected to a load given in Figure 2. (3 + 7)

Question 3 (a) Obtain the expression for transmissibility for a base excited system. (5 + 9) CO4

(b) A 82 kg machine tool is mounted on an elastic foundation. An experiment is run to determine the stiffness and damping properties of the foundation. When the tool is excited with a harmonic force of magnitude 8000 N at a variety of frequency the maximum amplitude obtained is 4.1 mm at a frequency of 40 Hz. Calculate the stiffness and damping of the foundation. Note: Peak amplitude always occur for damping ratio < $1/\sqrt{2}$

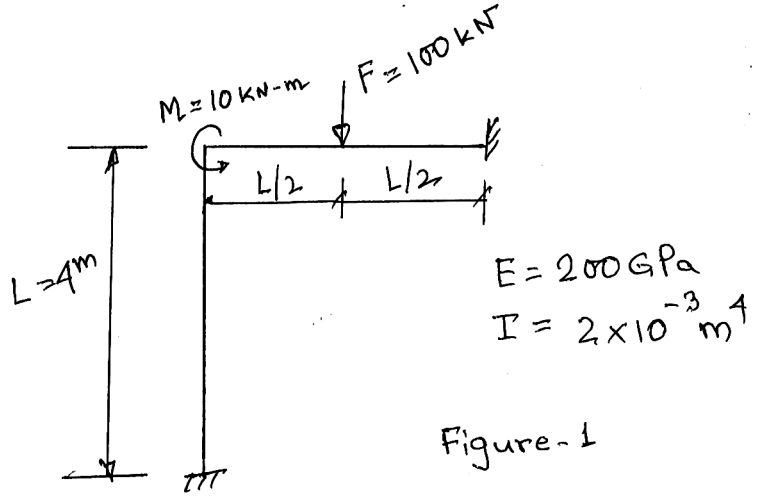

Figure-1

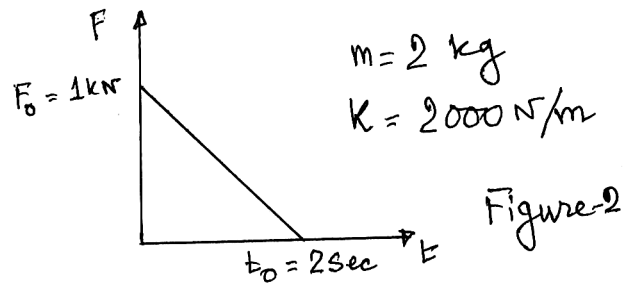

Figure-2

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B.E. CIVIL ENGINEERING FOURTH YEAR FIRST SEMESTER EXAM 2025

Subject: THEORY OF STRUCTURES -III PART –II TIME:3HRS Full Marks: 100

(50 marks for each part)

Use Separate Answer scripts for each Group / part
Assume necessary data if required

1.	**CO1** a) A two hinged semicircular arch of radius R=15 m. It carries a point load 100 kN at the crown. Find the horizontal thrust at each support. Assume uniform flexural rigidity (EI). (Prove the necessary formula). b) A two hinged parabolic arch of span 60 m and rise 10.5 m carries a point load 90 kN at a distance of 12 m from the left support. Find the horizontal thrust at each support. Find also the maximum bending moment. (Formula need not to be proved). c) A two hinged parabolic arch of span 50 m and rise 8.5 m is subjected to increase of temperature of 25° C. Find the maximum bending stress at the crown due to temperature rise. The rib section is 900 mm deep. Take E = $2x10^5$ N/mm^2 and α = $12x\ 10^{-6}$ per degree centigrade. (Formula need not to be proved).	**10+10+6=26**

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(50 marks for each part)

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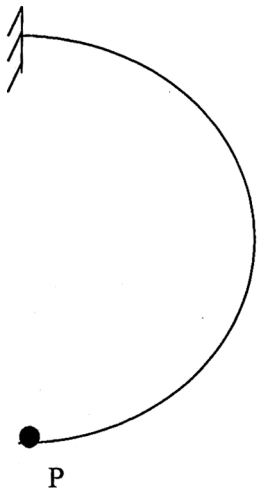
Assume necessary data if required

2.	**CO1** Draw the SFD, BMD and TMD of a cantilever curved beam (Half circle) shown as below. The load 'P' is applied downward at the tip of the beam.  	8
3.	**CO2** A three-hinge stiffening girder of a suspension bridge of span 115 meter is subjected to two-point loads of 210 kN and 310 kN at a distance 25 meter and 75 meter from the left end. Find the shear force and bending moment for the girder at a distance of 42 meter from the left end. The supporting cable has a central dip of 11.5 meter. Find also the maximum tension in the cable and draw the bending moment diagram.	16