Ref. No. : Ex/CE/PC/H/T/424/2022

Name of the Examinations: B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER - 2022

Subject : THEORY OF STRUCTURES IV(HONS.) Time : Full Marks : 70

Part 1

Instructions : Use Separate Answer scripts for each Part

1. A cylindrical concrete pier of 0.5 m diameter is subjected to a load of 20 kN/m^2 and is fixed at the base. The concrete weighs 25 kN/m^3 and the modulus of elasticity E = 28 x $10^6 kN/m^2$. Find the displacement and stresses in the pier using a FE procedure. Use at least two number of linear element to obtain the results. The governing differential equation of the problem is

$$-\frac{d}{dx}\left(EA\frac{du}{dx}\right) = f(x)$$

(15)

2. Develop the weighted residual form in the weak variational sense of a Bernoulli-Euler beam finite element and explain the significance of the various boundary conditions. (10)

Or,

Obtain the finite element equation in the weak variational form for a 2-dimensional element whose physical behaviour is governed by the Poisson's Equation. (10)

3. a) Develop the Lagrangian interpolation function for a 4-node one-dimensional finite element in the natural coordinate system.
b) For the problem defined in Question 1 obtain the value of K_{12} of any one element in the natural coordinate system (using 2-node element) and hence deduce the actual stiffness in the global coordinate. (3 + 7)

P.T.O

B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEM. EXAM. -2022

Subject: THEORY OF STRUCTURES IV (HONS.) **Time: 4 hours** **Full Marks 70**

PART-II (MARKS-35)

Use a separate Answer-Script for each part

No. of questions	Answer all questions	Marks 15+12+8=35
1.	Deduce the differential equations of plate bending with neat sketch.	15
2.	Show that the maximum deflection at the center of a simply supported rectangular plate subjected to a single concentrated load 'P' at center point is $$w_{max} = \frac{4P}{\pi^4 abD} \sum_{m=1}^{\infty} \sum_{n=1}^{\infty} \frac{1}{\left(\frac{m^2}{a^2} + \frac{n^2}{b^2}\right)^2}$$ Use Navier Solution. 'a' is the length of plate and 'b' is the width of plate. D is the flexural rigidity. 'm' and 'n' are no. of terms.	12
3.	Find the membrane forces in a cylindrical shell roof subjected to self-weight only.	8