

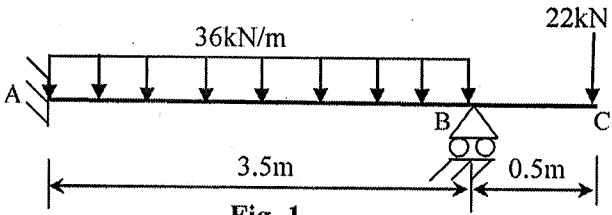
M. E. CIVIL ENGINEERING 1ST YEAR 1ST SEMESTER ... EXAMINATION, 2025

SUBJECT ... COMPUTER METHODS AND FINITE ELEMENT ANALYSIS ...

Full Marks 100
(60 marks for this part)

Time: Three hours

Use a separate Answer-Script for each part

No. of Questions	PART I	Marks
	<p style="text-align: center;"><u>Answer any THREE questions</u></p> <p>1. Analyse the beam ABC as shown in Fig.1 by 'Stiffness Method'. Also calculate the support reactions and draw BMD and SFD. Given, $E = 200 \times 10^6 \text{ kN/m}^2$, $I = 450 \times 10^{-6} \text{ m}^4$.</p> <div style="text-align: center;">  <p>Fig. 1</p> </div> <p>2. a) Derive the shape functions for a two-noded one dimensional element of length 'L' in Cartesian coordinate system. [2+5+13 = 20] b) Using these shape functions, derive the stiffness matrix of an one dimensional two-noded element of length 'L' if it is used in 'uniaxial problem'. Assume relevant data. c) A bar of length 'L', cross-sectional area 'A' is suspended from the top and subjected to its self-weight only. Determine the end deformation, strain and stress developed in the bar considering its self-weight only. Discretize the bar using a single two-noded one dimensional element. Assume any other data, if required.</p>	

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No. of Questions	PART I	Marks
	<p><i>(Contd. from page 1)</i></p> <p>3. a) Derive the shape functions for a three-noded triangular element having the coordinates of the vertices as (18,8), (24,8) and (24,16). All values are in mm. b) Using these shape functions, form the strain-displacement matrix for the above element having two degrees of freedom (u,v) per node in 'plane-stress condition'. c) Form the constitutive relationship matrix of this element if it is used in 'plane-stress condition'. Consider $E = 2.0 \times 10^5 \text{ N/mm}^2$ and $\nu = 0.3$. Assume any other relevant data, if required. d) Write the expression to find the stiffness matrix of this three-noded triangular element based on the above matrices. What will be size of this stiffness matrix?</p> <p>4. a) What is difference between stiffness method and flexibility method? b) Find the shape functions of three noded triangular element following 'area coordinate system'. c) Write the difference among isoparametric, sub-parametric and super-parametric finite element formulation. d) Using the basic properties of the shape functions, derive the shape functions of four-noded rectangular element in 'natural coordinate system'. e) Using the shape functions of above-mentioned four-noded element, calculate the elements of the 'Jacobian matrix' of a four-noded 'quadrilateral element' having the nodal coordinates (3,6), (10,5), (8,11), and (2,9) [All values are in mm] to be used in plane stress condition.</p> <p>===== END =====</p>	<p>[10+5 +2+3 = 20]</p> <p>[2+3+ 3+4+8 = 20]</p>

Form A: Paper –Setting Blank

Ref No. –**Ex/PG/CE/T/115A/2025**M.C.E. 1ST YEAR 1ST SEMESTER EXAM 2019(1st/ 2nd Semester/ Repeat / Supplementary / Annual / Bilingual)

SUBJECT: Computer Methods and Finite Element Analysis

Full Marks 100

Time: ~~Two hours~~/Three hours/~~Four hours~~/~~Six hours~~(40 marks for this part)

Use a separate Answer-Script for each part

No. of Question	PART – II	No.
<u>ANSWER Q 1. AND ANY TWO FROM REST</u>		
1.	Write short note (ANY TWO): a. Weighted Residual Method b. Collocation Method c. Boundary Element Method	5*2=10
2.	Solve the following Boundary Value problem using Galerkin Method. Use a quadratic trial solution. Compare and show percentage error with exact solution. $d^2u/dx^2 = 3x + x^4 \quad 0 < x < 1$ Given boundary conditions, $u(0)=0, u(1)=0$	15
3.	Obtain approximate solution of the following problem using Rayleigh-Ritz method. Use quadratic trial solution. $d^2u/dx^2 + x^2 = 0, \quad 0 < x < 1$ Given boundary conditions, $u(0)=1, du(1)/dx + 2u(1) = 1$	15
4. a.	Derive the governing differential equation for a steady state heat conduction problem.	3
b.	The inside of a 1.2 m thick wall is maintained at a constant temperature 300° C, while the outside is insulated. There is a uniform heat source inside generating 400W/m ³ . The thermal conductivity K=28.5W/m-°C. Find the temperature distribution at 1/4 th points in the wall.	12