Total No. of Questions :12]

SEAT No. :

P1704

[Total No. of Pages :4

[4859]-45
B.E (Mechanical)
b:FINITE ELEMENT METHOD
(2008 Course) (Elective - III) (Semester - II)

Time : 3 Hours] *[Max. Marks :100*

Instructions to the candidates:

1) ***Answer any 3 questions from each section.***
2) ***Answer to the two sections should be written in separate answer book.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of calculator is allowed.***
6) ***Additional data sheet is attached for the reference.***

SECTION - I

Q1) a) Explain general FEM procedure for one dimensional structural linear Element. **[8]**

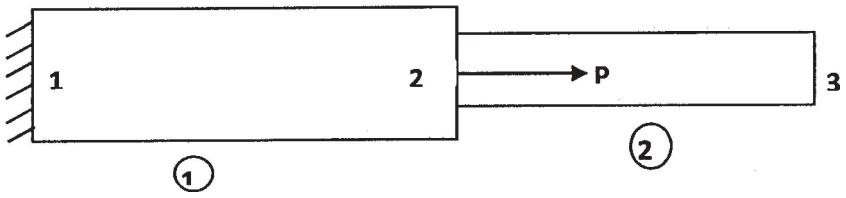
b) Explain in brief concept of Cholesky"s decomposition of matrix and banded skyline solution to solve the simultaneous equation in matrix form. **[8]**

OR

Q2) a) Explain in brief the concept plane stress, plain strain and Axi-symmetric. **[12]**

b) Write a short note on Ritz method. **[4]**

Q3) a) Determine the nodal displacement at node 2, stresses in each material and support reactions in the bar shown in fig, due to applied force $P=400 \times 10^3$ N **[10]**



$A_1 = 2400\ mm^2$, $A_2 = 1200\ mm^2$, $l_1 = 300$ mm, $l_2 = 400$mm

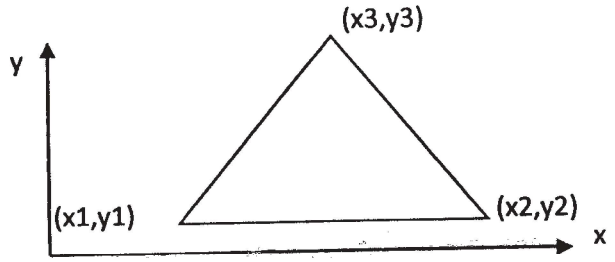
$E_1 = 0.7 \times 10^5\ N/mm^2$, $E_2 = 2 \times 10^5\ N/mm^2$

P.T.O.

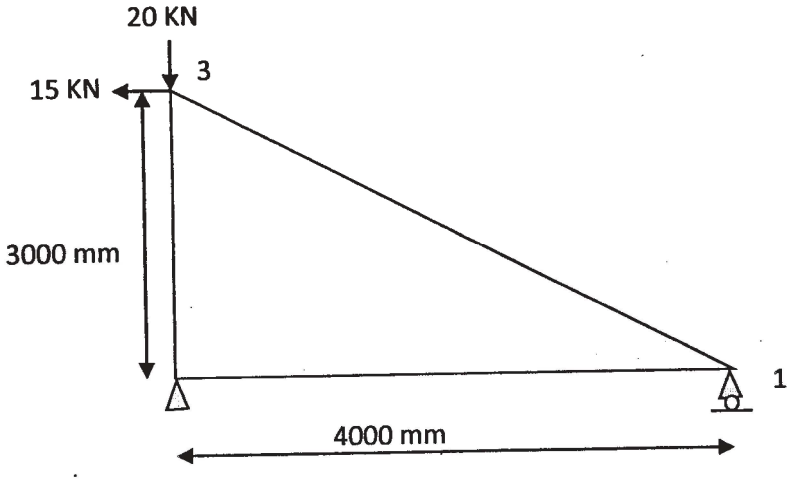
b) State and explain principle of minimum potential approach to formulate FEM equation. **[6]**

OR

Q4) a) For the CST element shown in fig. Derive the shape function for 3 noded simple triangular elements. **[4]**



b) Obtain the forces in the plane truss shown in fig. 1 and determine the support reactions also. Use finite element method. Take E=200Gpa and A=2000 mm^2. **[12]**



Q5) a) Write a short note on: **[12]**

i) Uniqueness of mapping in isoparametric elements.

ii) Jacobian matrix.

b) Explain the difference between p & h refinement. **[6]**

OR

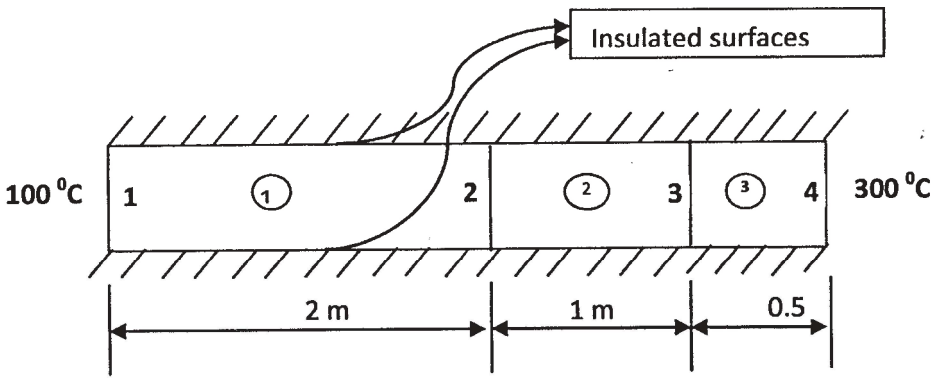
Q6) a) Explain the terms isoparametic, subparametric and superparametric elements and discuss the convergence criteria for isoparametric elements. **[12]**

b) Evaluate the integral using three point Gaussian quadratue method **[6]**

$$I = \int_{-1}^{1} (3^x - 4x)dx$$

SECTION - II

Q7) For the one dimensional composite bar shown in fig, determine the interface temperatures. for element 1 let Kxx = 200 W/m°C, for element 2, let Kxx = 100 W/m°C and for element 3, let Kxx=50 W/m°C. Let A = 0.1 m^2. The left has a constant temperature of 100°C and right end has a constant temperature of 300°C. **[16]**



OR

Q8) a) Derive the stiffness matrix of 1D steady state conducting thermal element. **[10]**

b) Write a short note on 2D element used for heat transfer problem. **[6]**

Q9) For the bar shown in fig. with length 2L, modulus of elasticity E, mass density p, and cross sectional area A, determine the first two natural frequencies. Divide the bar into two equal elements. **[16]**

OR

Q10)a) Derive the consistent mass matrix for a truss element. **[10]**

b) Explain the Eigen value problem for undamped-free vibration system. **[6]**

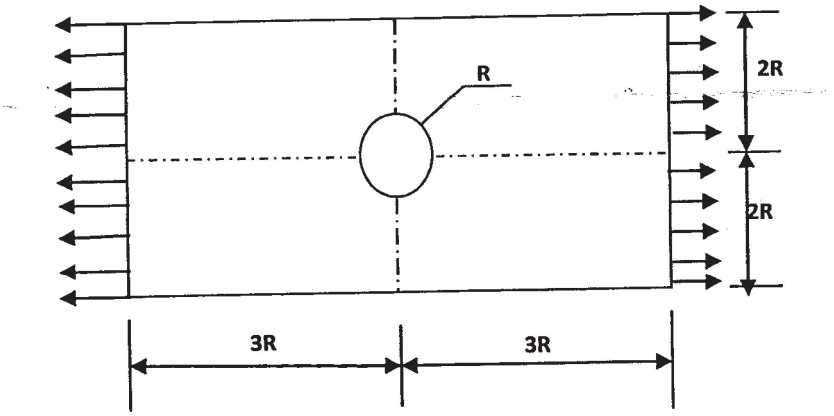
Q11)a) Explain the steps to be followed in pre-processing in FEM software. **[6]**

b) What is non linearity? Explain different types of non linearities. **[6]**

c) Explain aspect ratio and wrap angle. **[6]**

OR

Q12)Consider the problem given below of plate with center hole under plane stress. Answer the following questions.



a) For minimum calculation what type of model used for analysis? **[2]**

b) What type of meshing technique will you use between free Vs mapped meshing? Why? **[6]**

c) Which type of refinement will you use? Where? **[5]**

d) In post processing how will you interpret the result? And where will be the maximum stress location. **[5]**

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