INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Code No:**BST005**

MODEL QUESTION PAPER - II

M.Tech II Semester Regular Examinations, APRIL 2017

FINITE ELEMENT METHOD

(STRUCTURAL ENGINEERING)

Time: 3 hours Max. Marks: 70

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

1.(a) Explaintheterms 'Plane stress'and'Planestrain'problems.Giveconstitutivelawsforthesecases. Specify stress and strain tensors for plane stress case. Give suitable examples for plane stress problems. [7]

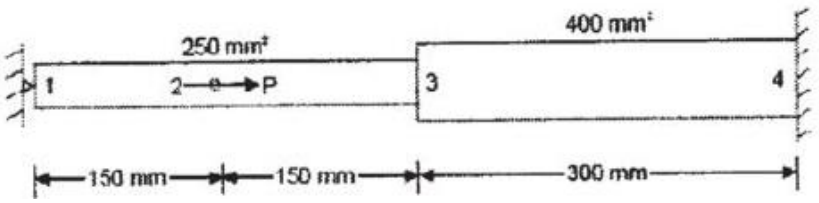
(b) What is meant by 'discretization'?List and describe the general steps of the finite element method. [7]

(or)

2.(a) Write the potential energy for beam of span 'L' simply supported at ends, subjected to a concentrated 'P' at midspan. Assume EI constant. [7]

(b) For a simply supported Beam of uniformly distributed load of Intensity Po per unit length and a concentrated load P at center, Find the Transverse deflection using Raleigh-Ritz method of Functional Evaluation and compare the result with exact Analytical solution. [7]

3.(a) Determine nodal displacement , element stresses and support reactions of the axially loaded bar as shown in fig

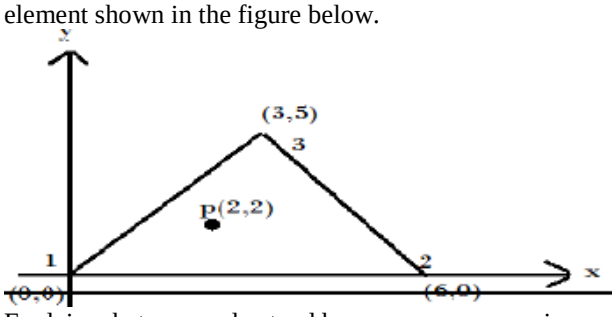


[6]

(b) Derive shape functions and their derivatives for a line element with quadratic interpolation function. [8]

(or)

4.(a) Evaluate the shape functions N1, N2 and N3 at the interior point P for the triangular element shown in the figure below.



[7]

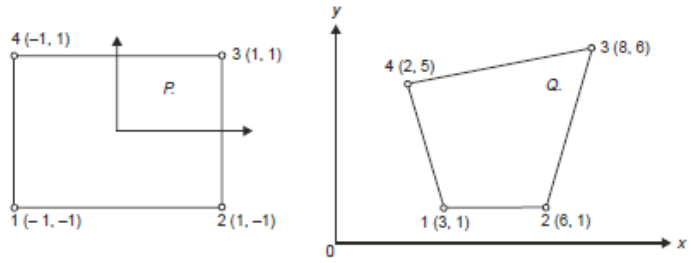
(b) Explain what you understand by convergence requirements; and conditions to be satisfied by the assumed displacement function. What are compatibility requirements and geometric isotropy? [7]

5.(a) Write a note on isoparametric formulations and how the geometric as well as field variables are taken into account? [8]

(b) Using the Lagrange interpolation formula construct the shape function in natural coordinate for one dimensional axial element with 4 nodes. Sketch the shape function [6]

(or)

6.(a) For the isoparametric quadrilateral element shown in fig, determine
a) Cartesian coordinate of the point P which has local coordinate ζ =0.57335 and η=0.57735.
b) Local coordinate of the point Q which has Cartesian coordinate (7,4)

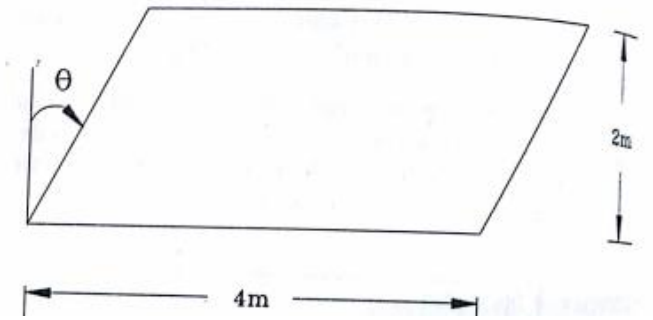


[7]

(b) Explain finite element formulation for 8-noded isoperimetric solid element. Explain step by step procedure and elaborate all the steps. [7]

7.(a) What are the assumptions made in thin plates with small deflections? Give the relation between forces and stresses action on a thin plate [5]

(b) Figure show the simply supported skew plate and it is subjected to uniformly distributed load of 4 KN/m^2. Analyze the plate and compare the result with theoretical solution, h= 200 mm, E=2 X 10^4 n/mm^2, μ=0.3,θ=30^o.



[9]

(or)

8.(a) i)Discuss Love-Kirchhoff 's and Mindlin's plate bending theories in detail
ii)Explain the different classification of shells with neat sketches [8]

(b) Explain finite elements for plate analysis. Write notes on numerical integration and stress smoothening in the case of four noded quadrilateral plateelement. [6]

9.(a) What are the types of non-linearity in structural analysis? Give two examples of geometric nonlinear problems? [6]

(b) Discuss about Material and Geometric nonlinearity.Explain incremental procedure to handle material non – linear problems. [8]

(or)

10.(a) Explain iterative procedure and modified iterative procedure for the analysis of material Non-linearity problems. [6]

(b) How is geometry nonlinearity taken care in finite element analysis?Explain the solution methods for nonlinear algebraic equations. [8]