Hall Ticket Number:

Code No. : 8134

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

M.E. (Mech. Engg. : CBCS) I-Semester Main Examinations, Jan./Feb.-2017

(Advanced Design & Manufacturing)

Finite Element Techniques

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Discuss various boundary conditions used in Finite element method and their significance.
2. Define shape function. How it is useful in analysis?
3. Differentiate truss, frame and beam elements.
4. Explain the field variables and number of shape functions required in case of beam element.
5. What is an axisymmetric element? Give any two applications.
6. Discuss about convergence requirements with examples.
7. Explain method of approach required in case of general heat transfer problem.
8. Explain briefly how to determine natural frequency of a bar element.
9. What are the advantage & disadvantages of 3D elements over 2D elements in FEM?
10. List out various types of non-linear problems in FET.

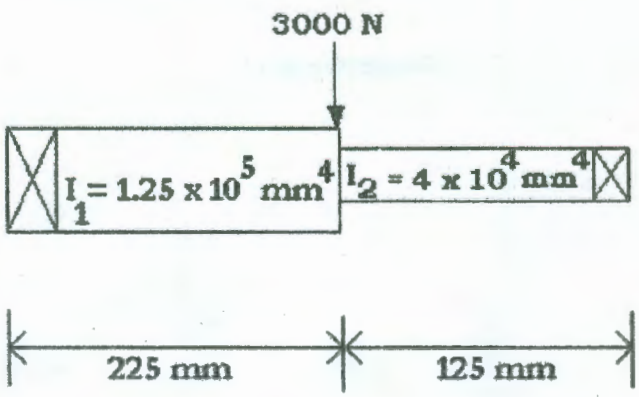
Part-B (5 × 10 = 50 Marks)

11. a) List the advantages and disadvantages of FEM over other traditional variational Methods. [4]

    b) Derive the general stiffness matrix in terms of stress-strain relation matrix and strain displacement relation matrix using any one method. [6]

12. a) Derive the expression for an element stiffness matrix in case of plane truss element. [4]

    b) Find the deflection at the point of the load of the steel shaft as shown in figure, take E = 200 Gpa. [6]



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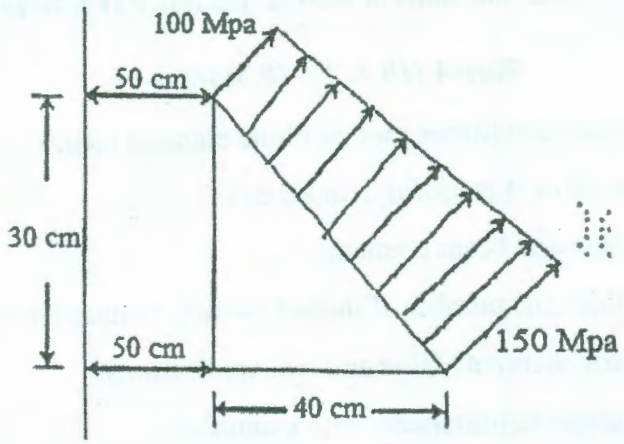
13. a) Evaluate the integral [5]

$$f(r) = \int_{-1}^{1}(r^2 - 3r + 7)dr$$

using Gaussian Quadrature and show that the result is exact.

b) An axisymmetric triangular element is subjected to the loading as shown in fig. The load is distributed throughout the circumference and normal to the boundary. Determine the nodal point loads. [5]



14. a) Explain how to solve a 1D heat transfer problem with suitable example. [5]

b) Compute the two longitudinal mode shapes and frequencies based on two element idealization for a stepped bar. [5]

15. a) Explain the procedure for analysing the circular shaft under the action of twisting moment using the finite element method. [6]

b) Find the shape functions of a brick element in terms of natural coordinates. [4]

16. a) Derive and explain Quadratic shape functions for a bar element. [4]

b) Deduce an expression for element stiffness matrix in case of beam element. [6]

17. Answer any ***two*** of the following:

a) Obtain the strain displacement relation matrix for the four noded quadrilateral element. [5]

b) Derive the conductance matrix for a 3 node plane triangular element. [5]

c) Differentiate between fluid stream function and Velocity potential. Give a brief FE based discussion. [5]