Model Question Paper

(Pages: 3)

Reg. No. : ………………………….

Name :…………………………..

Seventh Semester B.Tech. Degree Examination, Dec. 2016

(2013 Scheme)

13.706.4 FINITE ELEMENT METHODS (MPU) (Elective III)

Time: 3 Hours Max. Marks: 100

Instructions:

Answer all questions in Part-A and any one full question from each module in Part-B.

PART – A

1. Discuss the advantages, disadvantages and applications of FEM.
2. Differentiate plane stress, plane strain axi-symmetric problems with examples.
3. Explain Rayleigh-Ritz method in finite element analysis.
4. What are the general characteristics of shape functions?
5. Explain quadratic shape functions. Write down the shape functions of a 3 noded line element.
6. Discuss the penalty method of incorporating specified boundary conditions.
7. Explain isoparametric formulation and isoparametric element.
8. Explain Hamilton's principle.
9. Write down the governing differential equation for a two dimensional steady state heat transfer problem.
10. Write down the finite element equation for one dimensional heat conduction with free end convection.

(10 x 2 = 20 marks)

PART B

MODULE – I

11. (i) Explain the principle of minimum potential energy. How is it related to FEM?
(ii) Explain Galerkin method of finite element formulation.
(iii)Explain Rayleigh-Ritz Procedure used in finite element analysis.

(20 marks)

OR

12. A simply supported beam is subjected to uniformly distributed load over the entire span. Determine the bending moment and deflection at mid span by using Rayleigh-Ritz method and compare with exact solutions. Use trial functions sin (πx / L) and sin ($3\pi x$ / L).

(20 marks)

MODULE – II

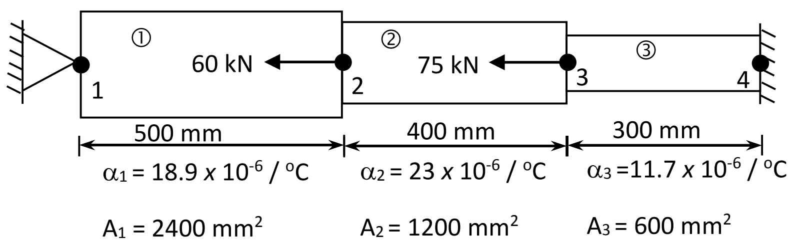
13. (i)Evaluate $I = \int_{-1}^{1}\left(3e^{x} + x^{2} + \frac{1}{x+2}\right)dx$ using one-point and two-point Gauss quadrature.

(ii) What are Largrangean and Serendipity elements.

(20 marks)

OR

14. Determine the displacements, strains, stresses and support reactions in the structure shown in the figure, which is subjected to an increase in temperature of 50°C. Use elimination method for handling boundary conditions.

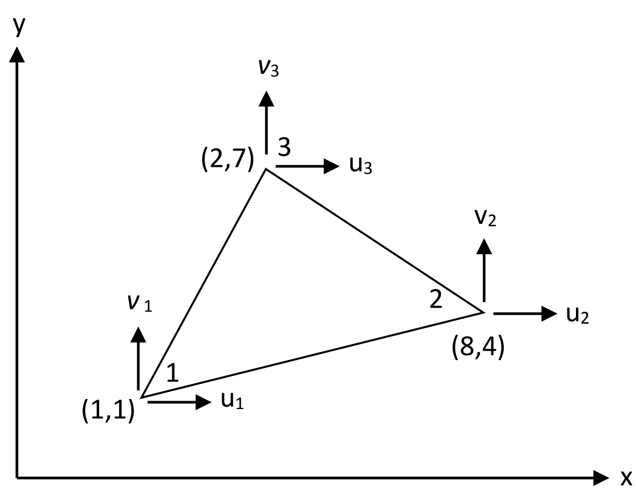


(20 marks)

MODULE – III

15. (i) Discuss the elimination method of incorporating specified boundary conditions.

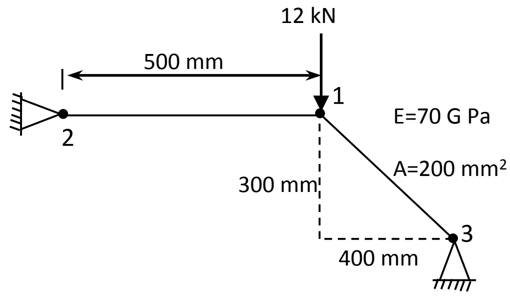
(ii) For the triangular element shown in the figure, evaluate the Jacobian for (x,y) - (ξ,η) transformation. Also obtain the strain displacement relation matrix **B** and determine the strains ε_x, ε_y and γ_{xy}. The nodal displacements are given as u_1=0.001, v_1=-0.004, u_2=0.003, v_2=0.002, u_3=-0.002 and v_3=0.005.



(20 marks)

OR

16. For a two bar truss element shown in the figure, determine the displacements of node 1 and the stress in the element 1-3.



(20 marks)

MODULE – IV

17. (i) Explain Hamilton's principle.
(ii) Explain consistent and lumped Mass Matrix formulations.
(iii) Explain the features of 3D problems in stress analysis.

(20 marks)

OR

18. A wall of 0.6 m thickness having thermal conductivity of 1.2 W/m K. The wall is to be insulated with a material of thickness 0.06 m having an average thermal conductivity of 0.3 W/mK. The inner surface temperature is 1000^{o}C and outside of the insulation is exposed to atmospheric air at 30^{o}C with heat transfer coefficient of 35 W/m^{2}K. Calculate the nodal temperatures.

(20 marks)

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