A **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 57702

B.E./B.Tech. DEGREE EXAMINATION, NOV 2018

Seventh Semester

Mechanical Engineering

15UME702 – FINITE ELEMENT ANALYSIS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Finite element method formulation of problem results in a system of CO1- R

   (a) Algebraic equations (b) R = 0 (c) R = w (d) R = y

2. FEM gives accurate representation of CO1- R

   (a) Non – Structural Problems (b) Complex geomentry

   (c) Discretization of Structure (d) None of the above

3. To solve FEM problem, it subdivides a large problem into smaller, simpler parts that are called CO2- R

   (a) Traction Force (b) Body Force (c) Finite element (d) None of the above

4. _____ is a defined as a structure, made up of several bars, riveted or welded together? CO2- R

   (a) Truss (b) Bar Element (c) Total Potential Energy (d) All of the above

5. Three noded triangular element is known as CO3- R

   (a) Constant Strain Triangular (CST) (b) Linear Strain Triangular (LST)

   (c) Quadratic Strain Triangular (QST) (d) None of these

6. _____is defined o be a state of stress in which the normal stress and shear stress directed perpendicular to the plane are assumed to be zero. CO3- R

(a) Plain Stress Analysis (b) Plain Strain Analysis

(c) Both a & b (d) None of these

7. _____as the ratio of actual damping coefficient (C) to the critical damping coefficient (C_c). CO4- R

(a) Frequency of Vibration (b) Damping Ratio

(c) Longitudinal Vibration (d) Transverse Vibration

8. When the particles of the shaft or disc move approximately perpendicular to the axis of the shaft, then the vibrations_____ CO4- R

(a) Frequency of Vibration (b) Damping Ratio

(c) Longitudinal Vibration (d) Transverse Vibration

9. _____can be defined a the transmission of energy from one region to another region due to temperature difference. CO5- R

(a) Mass Transfer (b) Longitudinal Vibrations (c) Heat Transfer (d) None of these

10. _____is defined as locus of points through which a fluid particle of fixed identity passes as it moves in space. CO5- R

(a) Stream Line (b) Viscous Flow (c) Inviscid Flow (d) Path Line

PART – B (5 x 2= 10Marks)

11. State the application of FEA. CO1- U
12. State the different steps involved in FEM.. CO2- U
13. What is meant by local and global coordinate system? CO3- U
14. Give the stiffness matrix of a triangular element. CO4- U
15. Explain the applications of dynamic analysis. CO5- U

PART – C (5 x 16= 80Marks)

16. (a) Explain briefly about the variational approach of approximation. CO1-App (16)

Or

(b) Solve the differential equation for a physical problem expressed as $\frac{d^2y}{dx^2} + 50 = 0$, $0 \leq x \leq 10$ and the trial function is $y = a_1x(10-x)$ with boundary conditions as $y(0) = 0$ and $y(10) = 0$ using: CO1- App (16)

(i) Point Collocation Method

(ii) Sub-domain Collocation Method

(iii) Least Squares Method

(iv) Galerkin's Method

17. (a) A two step bar subjected to loading condition as shown in Figure. 1.Draw the finite element model. Determine the Element stiffness matrices and assemble them into Global stiffness matrix by using four elements. Also write the element equation. Take Area A_1 =250mm^2,A_2 =400mm^2 Young's Modulus = 200GPa. CO2- App (16)

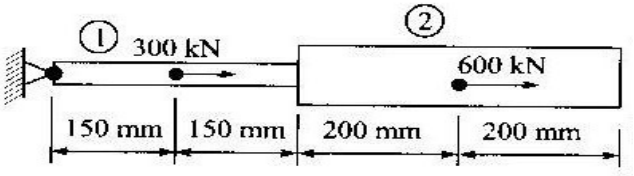

Figure. 1

Or

(b) The bar element is shown in Figure2.is to have an axial displacement field u that is linear in x and depends on nodal degrees of freedom u_1 ,u_2 . CO2- App (16)

(i) Evaluate ξ ,N_1 and N_2.

(ii) If u_1 = 0.5 mm and u_2 = 0.7 mm, determine the nodal displacement at the point P.

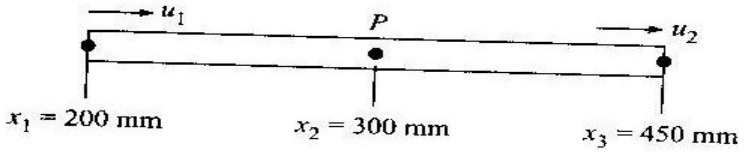

Figure. 2

18. (a) Evaluate the shape function N_1, N_2 ,N_3 at the interior point 'P' for the triangular element shown in Figure.3 CO3- App (16)

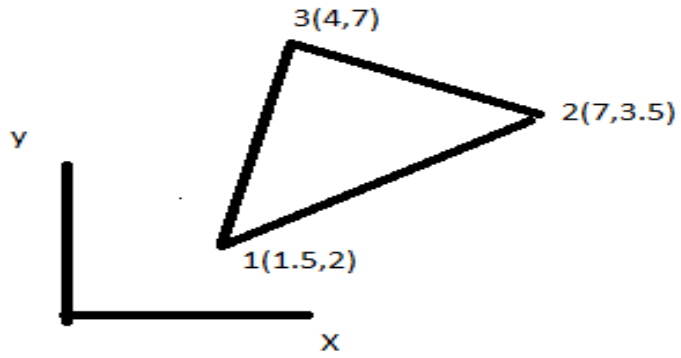

Figure.3

Or

(b) Determine the x and y coordinates of point P for the triangular element shown in Figure.4.The shape functions N_1, N_2 are 0.2 and 0.3 respectively CO3- App (16)

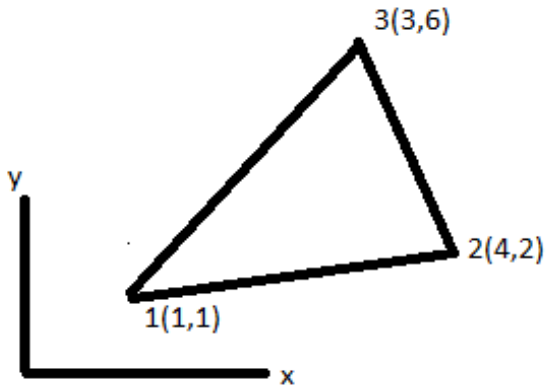

Figure.4

19. (a) Find the stiffness and mass matrices of longitudinal vibration of the unconstrained stepped bar shown in Figure.5. CO4 -Ana (16)

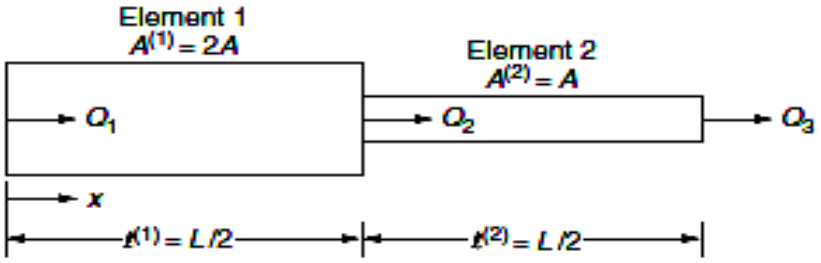

Figure.5

Or

(b) Evaluate the integral, CO4- App (16)

$$I = \int_{-1}^{1} \left(x^2 + \cos\left(\frac{x}{2}\right)\right) dx$$

using 2 points and 3 points Gaussian quadrature.

20. (a) Determine the temperature distribution through the composite wall shown in figure, when the convection heat loss occurs on the left surface. Assume unit area. Take wall thicknesses, t_1 = 4 cm and t_2 = 2 cm; Take properties k_1 = 0.5 W/cm^{o}C, k_2 = 0.05 W/cm^{o}C, h = 0.1W/cm^2 ^{o}C and Fluid temperature as T_∞ = -5^{o}C. shown in Figure.6 CO5-App (16)

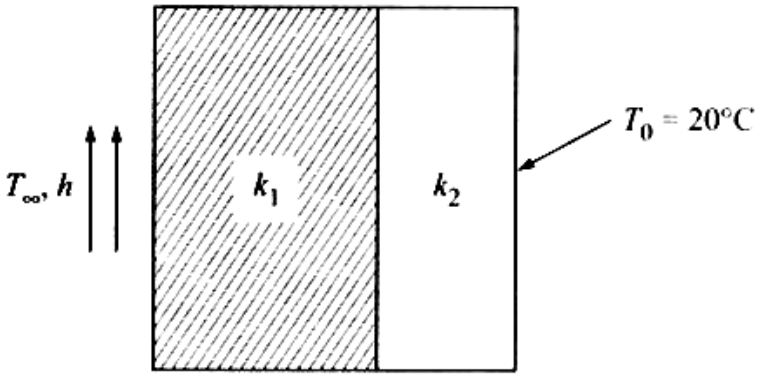

Figure.6

Or

(b) Determine the temperature distribution through the composite wall shown in Figure.7 when convection heat loss occurs on the left surface. Assume a unit area. CO5-App (16)

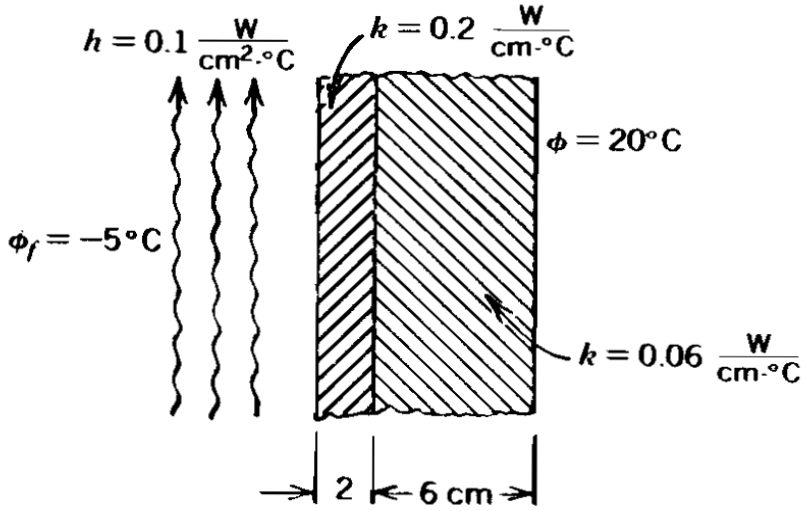

Figure.7