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

Question Paper Code: 57702

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2019

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. In weighted residual technique, the methods adopted are CO1- R

   (a) point collocation method (b) least squares method

   (c) galerkin's method (d) all of the above

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. Example of 1-D Element CO2- R

   (a) Bar (b) Triangle (c) Square (d) Tetrahedron

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. When friction reduces mechanical energy of system as time passes, motion is said to be — CO4- R

(a) simple (b) damped

(c) random (d) linear

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. FEM equation for Fluid mechanics Element — CO5- R

(a) F=KT (b) F=KP (c) F=KU (d) F=KZ

PART – B (5 x 2= 10Marks)

11. List the methods are generally associated with the finite element analysis. — CO1- U

12. Mention the characteristic of shape function. — CO2- U

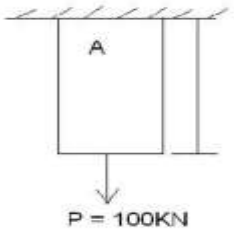
13. What is meant by local and global coordinate system? — CO3- U

14. Give the stiffness matrix of a triangular element. — CO4- U

15. Note down the convection boundary conditions using in FEA.. — CO5- U

PART – C (5 x 16= 80Marks)

16. (a) Using Rayleigh Ritz methods calculate the deflection at the middle and end for the following cantilever beam. — CO1-App — (16)

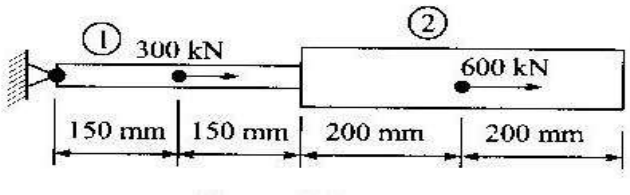


Or

(b) Briefly discusses the various methods in weighted residual method to solve a finite element problem. — CO1- App — (16)

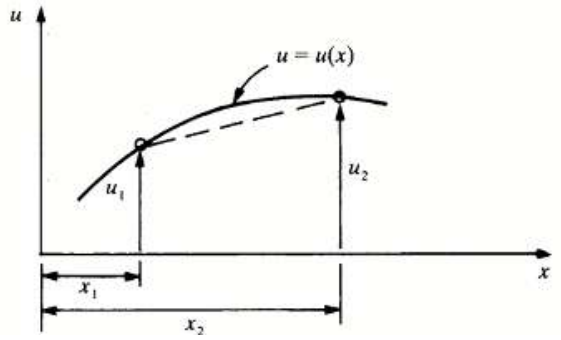
17. (a) A two step bar subjected to loading condition as shown in Figure..Draw the finite element model. Determine the Element stiffness matrices and assemble them into Global stiffness matrix — CO2- App — (16)

by using four elements. Also write the element equation.
Take Area A_1 =250mm^2,A_2 =400mm^2 Young's
Modulus = 200GPa.

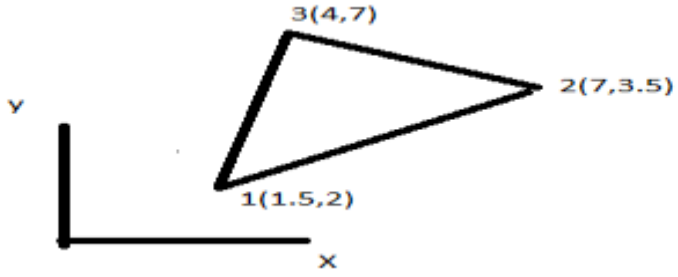


Or

(b) Derive a one dimensional linear interpolation formula for a function u = u(x) that is valid in the range u_1 through u_2 shown in figure — CO2- App — (16)

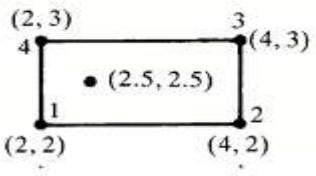


18. (a) Evaluate the shape function N_1, N_2 ,N_3 at the interior point 'P' for the triangular element shown in Figure — CO3- App — (16)



Or

(b) A quadrilateral element is shown in an x, y coordinate system in figure 1. The nodes are located at the coordinates point as mentioned and a temperature distribution has computed at each node as T_1 = 100 ℃, T_2 = 60 ℃, T_3 = 50 ℃ and T_4 = 90 ℃, Using the shape functions, compute the temperature at x = 2.5 and y = 2.5. — CO3- App — (16)



19. (a) Determine the smallest natural frequency of a beam with clamped ends, and of constant cross-sectional area A, moment of inertia I, and length L. solve the above problem with two reduced-integration Timoshenko beam (RIE) elements in the half-beam. CO4 -Ana (16)

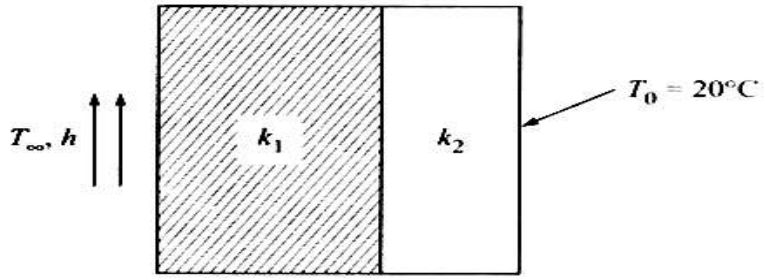
Or

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

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

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 CO5-App (16)



Or

(b) In the problem of the flow of a viscous fluid through a circular cylinder assume that the fluid slips at the cylinder wall; i.e. instead of assuming that w =0 at r = R0, use the boundary condition that CO5-App (16)

$$k\omega = -\mu \frac{dw}{dr}, r = R_o$$

in which k is the "coefficient of sliding friction." Solve the problem with two linear elements.