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

Question Paper Code: 57702

B.E./B.Tech. DEGREE EXAMINATION, NOV 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. The art of subdividing a structure into a convenient number of smaller components is Called CO1- R

   (a) Discretization (b) Numbering of nodes (c) Continumm (d) Both a &b

3. For 1-D bar elements if the structure is having 3 nodes then the stiffness matrix formed is having order of_____ CO2- R

   (a) 2*2 (b) 3*3 (c) 4*4 (d) 6*6

4. Sum of all shape functions will be equal to CO2- R

   (a) 0 (b) -1 (c) +1 (d) 2

5. A triangular plane stress element has _____degree's of freedom. CO3- R

   (a) 3 (b) 4 (c) 5 (d) 6

6. A three noded triangular element is called as CO3- R

   (a) Linear strain triangular element

   (b) Constant strain triangular element

   (c) Variable strain triangular element

   (d) Differable strain triangular element

7. Which type of vibrations are also known as transient vibrations? CO4- R

(a) Undamped vibrations (b) Damped vibrations

(c) Torsional vibrations (d) Transverse vibrations

8. _____is the reciprocal of period CO4- R

(a) Displacement (b) Frequency (c) Amplitude (d) None of the above

9. _____flow is a frictionless flow characterized by zero viscosity. CO5- R

(a) Viscous (b) Inviscid (c) Intermittent (d) None of the above

10. Each node in heat transfer problem has _____ degrees of freedom CO5- R

(a) 1 (b) 2 (c) 3 (d) 4

PART – B (5 x 2= 10 Marks)

11. List the various method of solving boundary value problems. CO1 R

12. Illustrate shape function of a two node line element. CO2 R

13. How will you modify a three-dimensional problem to a Two dimensional problem? CO3 R

14. Classify the three methods of representing the frequency response data. CO4 R

15. List the assumptions to be made in solving of 1-D fluid flow analysis. CO5 R

PART – C (5 x 16= 80 Marks)

16. (a) A tapered bar made of steel is suspended vertically with the larger end rigidly clamped and the smaller end acted on by a pull of 10 KN. The areas at the larger and smaller ends are 80 cm^2 and 20 cm^2 respectively. The length of the bar is 3m. The bar weighs 0.075 N/cc. Young's modulus of the bar material is E=2 x $10^7 N/cm^2$. Obtain an approximate expression for the deformation of the rod using Ritz technique. Determine the maximum displacement at the tip of the bar. CO1- App (16)

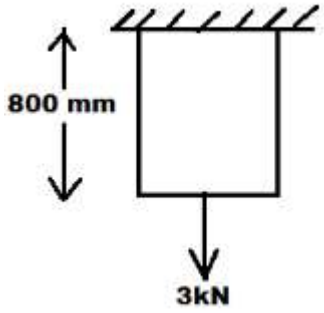
Or

(b) The following differential equation is available for a physical phenomenon, $d^2y/dx^2 - 10x^2 = 5$, $0 = x = 1$ with boundary conditions as $y(0) = 0$ and $y(1) = 0$. Find an approximate solution of the above differential equation by using Galerkin's method of weighted residuals and also compare with exact solution. CO1- App (16)

17. (a) Formulate the shape function for One-Dimensional Quadratic bar element. CO2- U (16)

Or

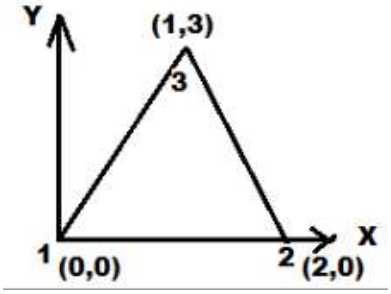
(b) A steel bar of length 800mm is subjected to an axial load of 3kN as shown in fig. estimate the nodal displacement of the bar and load Vectors. CO2- U (16)



18. (a) Derive the conductance matrix for a 3 noded triangular element whose nodal coordinates are known. The element is to be used for two dimensional heat transfer in a plate fin. CO3- Ana (16)

Or

(b) Calculate the element stiffness matrix and temperature force vector for the plane stress element shown in fig. The element experiences a 20ºC increase in temperature. Assume $\alpha = 6x10^{-6}C$. Take $E=2x10^5$ N/mm^2, v= 0.25, t= 5mm. CO3- Ana (16)



19. (a) (i) Formulate the expression of longitudinal vibration of the bar element. CO4- U (8)

(ii) Describe the use of frequency response function in modal analysis. CO4- U (8)

Or

(b) 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- U (16)

20. (a) A metallic fin 20 mm wide and 4 mm thick is attached to a furnace whose wall temperature is 180 °C. The length of the fin is 120 mm. if the thermal conductivity of the material of the fin is 350 W/m °C and convection coefficient is 9 W/°C, determine the temperature distribution assuming that the tip of the fin is open to the atmosphere and that the ambient temperature is 25 °C. CO5- U (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- U (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.