KUMARAGURU
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Register Number:……..

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Seventh Semester

AERONAUTICAL ENGINEERING

AER131: Finite Element Method

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Rayleigh Ritz's method is a _____ method.
   a) Differentiation b) Integration
   c) Experimental d) Matrix
2. Finite difference method is not suitable for_____ boundaries.
   a) Inclined b) Square
   c) Curved d) Rectangular
3. The diagonal constants of a stiffness matrix always_____.
   a) Unity b) Positive
   c) Negative d) Either positive nor negative
4. The sum of the constants in any column of a truss element stiffness matrix is _____.
   a) Zero b) One
   c) Finite d) Infinite
5. An axisymmetric component has _____number of axis symmetry.
   a) Two b) Three
   c) Finite d) Infinite
6. Linear strain triangular element has_____ nodes and _____ Vertices.
   a) Three, Three b) Six, Three
   c) Six, Four d) Six, Six
7. Elements having number of nodes for defining the geometry is more than the number of nodes for defining displacement is called as_____.
   a) Subparametric element b) Super parametric element
   c) Isoparametric element d) Serendipity element
8. _____ Coordinate system used to define any point inside the element.
   a) Natural b) Global
   c) General d) Local
9. _____ Software package used for aircraft assembly level structural analysis.
   a) ANSYS b) ABACUS
   c) NASTRAN d) NISA
10. The degree of freedom for truss element is _____
    a) Two b) Three
    c) Four d) Six

PART B (10 x 2 = 20 Marks)

11. State the advantages of Ritz method.
12. What is Galerkin's method?
13. List the properties of shape function.
14. Write stiffness matrix for beam element.
15. State the required conditions for a problem to be axisymmetric.
16. What is LST? Graphically represent LST element.
17. What are the properties of a stiffness matrix?
18 What are isoparametric elements?
19. Write conduction stiffness matrix for bar element.
20. Name few FEM based software packages.

PART C (5 x 14 = 70 Marks)

21. a) Find the deflection at the center of a clamped beam subjected to uniformly distributed load through its length as shown in figure-1. Use Galerkin's method.

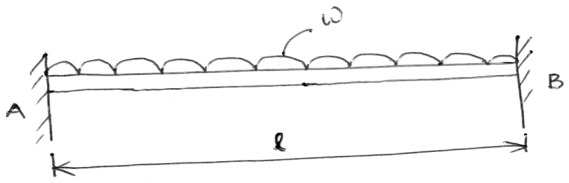

Figure-1

(OR)

b) A simply supported beam shown in figure-2. Subjected to UDL entire span and its subjected to a point load at the centre of the span. Determine deflection and slope at mid span by using Rayleigh Ritz method.

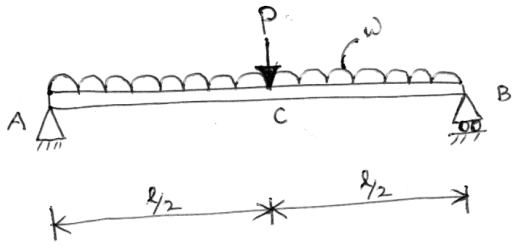

Figure-2

22. a) For a tapered plate of uniform thickness t= 10mm as shown in figure-3.Find the displacements at the nodes by forming into two element model. The bar has mass density ρ=7300 Kg/m^2, Young's Modulus E=2x10^{5}N/mm^2.In addition to self-weight, the plate is subjected to a point load P=10kN at its center. Also determine the reaction force at the support.

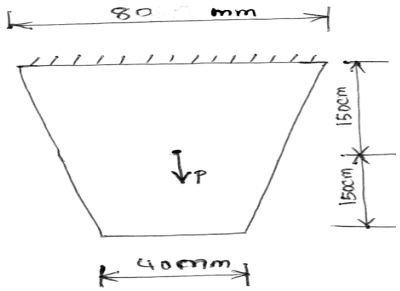

Figure-3

(OR)

b) For two bar truss shown in figure-4.determine the displacements of node 1 and the stress in element 2.

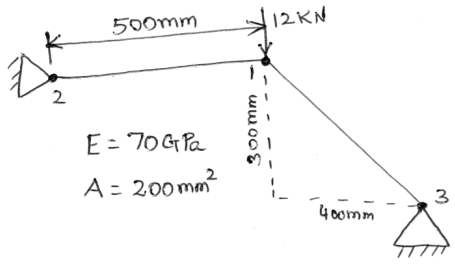

Figure-4

23. a) For the triangular element shown in figure-5 obtain the strain displacement relation matrix [B] and determine the strains ε_x, ε_y and γ_{xy}.

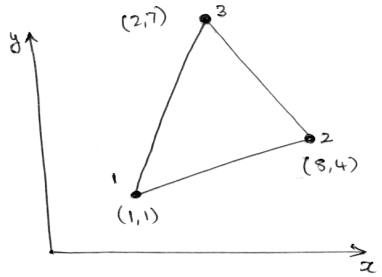

Figure-5

(OR)

b) For the axisymmetric element shown in figure-6, determine the stiffness matrix. Let Young's modulus E=2.1x10^5 N/mm^2 and poison's ratio μ=0.25. All dimensions are in mm.

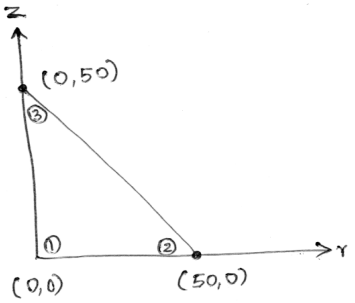

Figure-6

24. a) Evaluate the Cartesian co-ordinate of point p which has local co-ordinate ξ=0.8 and η=0.6 as shown in figure-7.

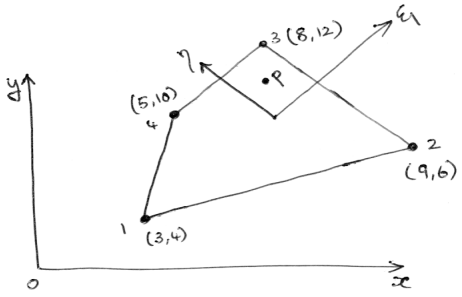

Figure-7

(OR)

b) For the element shown in figure-8. Determine the Jacobian matrix.

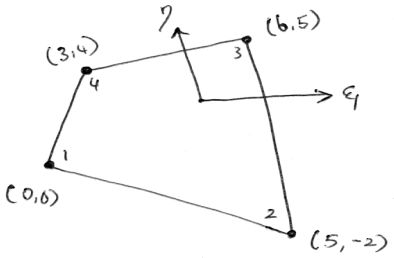

Figure-8

25. a) An aluminium alloy fin of 1 cm diameter, 6 cm long, protrudes from a wall which is maintained at 50°C.The ambient air temperature is 10°C.The thermal conductivity and heat transfer coefficient are 2 W/cm°C and 0.2 W/cm^2°C respectively. Determine the temperature distribution of fin by considering 2 elements.

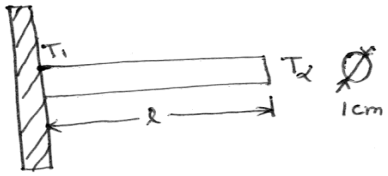

Figure-9

(OR)

b) Compute element matrices and load vectors for the element shown in figure-10. When the edge k-j experiences convection heat loss.

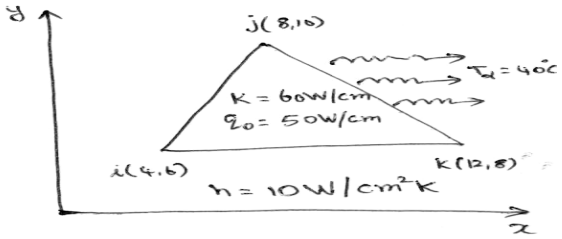

Figure-10

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