Register Number:……………………..

B.E DEGREE EXAMINATIONS: APRIL 2015

(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. _____ are equations with differentials of the displacement functions, which must be satisfied to ensure that the displacements are continuous over the domain

   a) Iterations b) Constitutive equations

   c) Equilibrium equations d) Compatibility equations

2. _____ís a method of deriving the FE stiffness matrix by multiplying the partial differential equation by a suitable weighting function and minimizing the error

   a) Weighted residual method b) Newton-Raphson method

   c) Ritz method d) Galerkin method

3. In Galerkin's method, the error $\square(x)$ is called as

   a) Residual b) Total Strain energy

   c) Work potential d) Flexibility coefficient

4. _____are used for two-dimensional 'thin' structures, where the normal stress is zero, that is, the x -y plane is considered very thin.

   a) Lagrangian elements b) Plane stress elements

   c) Plane strain elements d) Plate elements

5. _____is the part of an FE program that deals with the generation of the data input, that is, mesh generation, boundary conditions, and load description.

   a) Patch test b) Transpose

   c) Pre-processor d) Post-processor

6. If the number of nodes used for defining the geometry is same as number of nodes used for defining the displacement is known as

   a) Cubic element b) Super element

c) Isoparametric element   d) Quad element

7. _____are the total number of points used in the Gaussian quadrature technique. More points produce better accuracy, but consume larger computation time.
   a) Gaussian points
   b) Jacobian matrix
   c) Gaussian elimination
   d) Integration points

8. What is the characteristic matrix of 1D potential flow element?
   a) The velocity dependent aerodynamic characteristics
   b) The viscosity dependent aerodynamic characteristics
   c) The viscosity independent aerodynamic characteristics
   d) The velocity independent aerodynamic characteristics

9. _____are three-dimensional elements (rectangular prism shape) with straight line or quadratic curved sides.
   a) Brick elements
   b) Beam elements
   c) Hybrid elements
   d) Truss elements

10. Flexibility coefficient (F) is the displacement produced by a
    a) Unit area
    b) Unit pressure
    c) Unit force
    d) Stress

PART B (10 x 2 = 20 Marks)

11. What is meant by Discretization and Assemblage?

12. What is the difference between static and dynamic analysis?

13. Define flexibility co-efficient.

14. Give stiffness matrix of a simple beam element.

15. Why is a convergence criterion very important in finite element analysis?

16. What is meant by stability analysis?

17. Write down the shape function of cubic element.

18. When is an element called as isoparametric element?

19. What is the characteristic matrix of 1D potential flow element?

20. State the principles of virtual energy?

PART C (5 x 14 = 70 Marks)

21. a) Find the expression for the maximum deflection and Maximum bending moment using Raleigh-Ritz Method for simply supported beam of length L subjected to uniformly distributed load q.

(OR)

b) Explain in detail the various procedures for the formulation of finite element problem.

22. a) For a tapered plate of uniform thickness t=10mm, find the displacement at the nodes by forming into two element model. The bar has mass density ρ=7800 kg/m^3, Young's modulus, E=2*10^{5}MN/m^2. In addition to self-weight, the plate is subjected to the point load P=10kN at its center.

(OR)

b) Consider the bar element Area of element 1, A_1=300 mm^2 Area of element 2, A_2= 300 mm^2, Area of element 3, A_3=600 mm^2 ,Length of element 1, L_1=200mm, Length of element 2, L_2=200mm, Length of element 3, L_3=400mm, E = 2*10^5 N/mm^2,Point Load p = 400kN =400 * 10^3 N. Calculate The nodal displacement at point P.

23. a) A thin plate of uniform thickness 25mm is subjected to a point load of 25N at mid depth, the plate is also subjected to self-weight. If E=2*10^5 N/mm^2, ρ=.8*10^{-4} N/mm^3. Calculate, Nodal displacement

(OR)

b) Derive the stiffness matrix for a constant strain triangular element.

24. a) (i) Determine the Jacobian matrix [J] for the given isoparametric element. The value of $\Sigma = \eta = 0.5$. (7)

(ii) Evaluate the following integrate, by using Gassian 2 point formula.

(1) $\int_{-1}^{1} x^2 dx$ (2) $\int_{-1}^{1} \cos 2x dx$

(OR)

b) Derive the shape function for six node triangular element

25. a) Solve the given problem for temperature distribution consider the end convection coefficient Take $T_1 = 170^0$ C, $h_1 = 0.0025$ w/ cm^2 ^{0}C, $h_2 = 0.0625$ w/ cm^2 ^{0}C, $T\alpha = 25^0$C, $l = 10$ cm, $k = 0.17$ w/ cm^{0}C.

(OR)

b) An aluminum alloy fin of 1cm diameter, 6cm long. Protrodess from a wall which is maintained at 50^0C. The ambient air temperature is 10^0C. The thermal conductivity and heat transfer coefficient axe 2 w/cm^{0}C and 0.2w/cm^{2}C respectively. Determine the temperature distribution of fin by considering 2 elements.

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