### 

**DHANALAKSHMI SRINIVASAN COLLEGE OF ENGINEERING AND TECHNOLOGY**

**Mamallapuram, Chennai-603104.**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**QUESTION BANK**

### Subject Code: ME8692 Year/Semester: III /06

### Subject Name: Finite Element Analysis

|  |  |
| --- | --- |
| **UNIT I INTRODUCTION** | |
| **PART \* A** | |
| **Q.No.** | **Questions** |
| 1. | **What should be considered during piecewise trial functions?(APRIL 2011)**BTL1 Continuity of the ﬁeld variable and its derivatives at the junctions are considered. |
| 2 | **Mention the basic steps of Rayleigh-Ritz method. (APRIL 2011)**BTL1 Basic steps of Rayleigh-Ritz method are, '   * Assume a displacement ﬁeld * Evaluation of the total potential * Setup and solve the system of equations. |
| 3 | **What is meant by node or joint?(APRIL 2019)**BTL1  Each kind of finite element has a specific structural shape and is interconnected with the adjacent element by nodal point or nodes. At the nodes, degrees of freedom are located. The forces will act only at nodes at any others place in the element. |
| 4 | **What is the basic of finite element method**J**?**IT - JEPPIAAR BTL1  Discretization is the basis of finite element method. The art of subdividing a structure in to convenient number of smaller components is known as discretization. |
| 5 | **What are the types of boundary conditions?(APRIL 2019)**BTL1   * Primary boundary conditions * Secondary boundary conditions |
| 6 | **State the methods of engineering analysis. (APRIL 2010)** BTL1   * Experimental methods * Analytical methods * Numerical methods or approximate methods |
| 7 | **State the three phases of finite element method.(APRIL 2019)**BTL1   * Preprocessing * Analysis * Post Processing |
| 8 | **What is nonstructural problem? (APRIL 2014)** BTL1  Temperature or fluid pressure at each nodal point is obtained. By using these values properties such as heat flow fluid flow for each element can be calculated. |
| 9 | **What is structural problem? (APRIL 2013)** BTL1  Displacement at each nodal point is obtained. By these displacements solution stress and strain in each element can be calculated. |
| 10 | **What are the methods are generally associated with the finite element analysis?** BTL1   * Force method * Displacement or stiffness method. |

|  |  |
| --- | --- |
| 11 | **Explain stiffness method.** BTL1  Displacement or stiffness method, displacement of the nodes is considered as the unknown of the problem. Among them two approaches, displacement method is desirable. |
| 12 | **What is meant by post processing?** BTL1  Analysis and evaluation of the solution result is referred to as post processing. Postprocessor computer program help the user to interpret the result by displaying them in graphical form. |
| 13 | **Name the variation methods.** BTL1   * Ritz method * Ray-Leigh Ritz method |
| 14 | **What is meant by degrees of freedom?** BTL1  When the force or reaction act at nodal point node is subjected to deformation. The deformation  includes displacement rotation, and or strains. These are collectively known as degrees of freedom. |
| 15 | **What is meant by discretization and assemblage?** BTL1  The art of subdividing a structure in to convenient number of smaller components is known as discretization. These smaller components are then put together. The process of uniting the various elements together is called assemblage. |
| 17 | **What is truss element?** BTL1  The truss elements are the part of a truss structure linked together by point joint which transmits only axial force to the element. |
| 18 | **What is Aspect ratio?** BTL1 OM   * It is defined as the ratio of the largestJIT - JEPPIAAR dimension of the element to the smallest dimension. * In many cases, as the aspect ratio increases the in accuracy of the solution increases. * The conclusion of many researches is that the aspect ratio should be close to unity as possible |
| 19 | **What is Rayleigh-Ritz method?**BTL1  It is integral approach method which is useful for solving complex structural problem, encountered in finite element analysis. This method is possible only if a suitable function is available. |
| 20 | **What are the h and p versions of finite element method?** BTL1   * It is used to improve the accuracy of the finite element method. * In h version, the order of polynomial approximation for all elements is kept constant and the numbers of elements are increased. * In p version, the numbers of elements are maintained constant and the order of polynomial approximation of element is increased. |
|  | **PART \* B** |
| 1 | Find the nodal displacement and elemental stresses for the bar shown in fig.**(13M) (APRIL 2015,APRIL 2019)** BTL3 |
| 2 | Calculate nodal displacement and elemental stresses for the truss shown in fig. E= 70 Gpa. Cross sectional area A= 2 cm2 for all truss members. **(13 M) (APRIL 2011)** BTL3 |
| 3 | The following differential equation is available for a physical phenomenon AE d2y/dx2 +q0  =0 with the boundary condition y(0)=0, x=L, dy/dx=0, find the value of f(x) using the weighted residual method**. (13M) (APRIL 2014)**BTL3 |
| 4 | We know that, linearly varying pressureJIT - JEPPIAAR acting on the side J, K,N =0 Determine the expression for the deflection and bending moment in a simply supported beam subjected to uniformly distributed load over the entire span. Find the deflection and moment at midspan and compare with exact solution using Rayleigh Ritz method Use y = a1sin (πx/l)  + a2 sin(3πx/l). **(13M) (NOVEMBER 2008)**BTL2 |
| 5 | Explain brieﬂy General steps of the ﬁnite element analysis**. (13M) (NOVEMBER 2014)**BTL2 |
| 6 | Find the solution for the following differential equation. d2y/dx2+50=0, 0<x<10  Trial function is y=a1x(10-x)  Boundary conditions are y(0)=0 Y(10)=0.  Find the value of the parameter a1 by the following methods (i)point collocations,  (ii)subdomain collocation, (iii)least square method,  (iv)galerkins **(15m) (May 2014)** BTL4 |
| 7 | Determine the expression for the deflection and bending moment in a simply supported beam subjected to uniformly distributed load over the entire span. Find the deflection and moment at mid span and compare with exact solution using Rayleigh Ritz method Use y = a1sin (πx/l) + a2 sin(3πx/l). **(15M) (November 2008,APRIL 2019)**BTL2 |
| 8 | The differential equation of a physical phenomenon is given by d2y/dx2 + 500x2=0; 0<x<1 by using the trial function, Y=a1(x-x3) + a2(x-x5), calculate the value of the parameter a1 and a2 by the following methods**. (15M)(NOVEMBER 2019)B**TL2  **(**i)point collocation (ii)subdomain method  JIT - JEPPIAAR  (iii)least square (iv)galerkins |

|  |  |
| --- | --- |
| **UNIT II - ONE-DIMENSIONALPROBLEMS** | |
| **PART \* A** | |
| **Q.No.** | **Questions** |
| 1. | **When do we resort to 1 D quadratic spar elements? (APRIL 2011)** BTL1   1. Better accuracy. 2. Representation of curved boundaries. 3. Faster convergence. |
| 2 | **What is the difference between static and dynamic analysis?(APRIL 2019)** BTL1   1. Static analysis:   The solution of the problem does not vary with time is known as static analysis Example: stress analysis on a beam   1. Dynamic analysis:   The solution of the problem varies with time is known as dynamic analysis.  Example: vibration analysis problem. |
| 3 | **Differentiate between global and local axe**JIT - J**s**EPPIAAR **.** BTL1   1. Local axes are established in an element. Since it is in the element level, they change with the change in orientation of the element. The direction differs from element to element. 2. Global axes are defined for the entire system. They are same indirection for all the elements even though the elements are differently oriented. |
| 4 | **Name any four FEA software.** BTL1   1. ANSYS 2. NASTRAN 3. COSMOS |
| 5 | **List the two advantages of post processing.** BTL1   1. Required result can be obtained in graphical form. 2. Contour diagrams can be used to understand the solution easily and quickly. |
| 6 | **During discretization, mention the places where it is necessary to place anode?** BTL1   1. Concentrated load acting point 2. Cross-section changing point 3. Different material interjections 4. Sudden change in point load |
| 7 | **Distinguish between potential energy function and potential energy functional.** BTL1  If a system has finite number of degree of freedom (q1, q2,and q3), then the potential energy expressed as,  π = f (q1, q2, and q3)  It is known as function. If a system has infinite degrees of freedom, then the potential |
| 8 | **What are the types of loading acting on the structure?** BTL1   1. Body force (f) 2. Traction force (T) 3. Point load (P) |
| 9 | **Define traction force.** BTL1  Traction force is defined as distributed force acting on the surface of the body. Unit: Force per unit area.  Example: Frictional resistance, viscous drag, surface shear |

|  |  |
| --- | --- |
| 10 | **Define the body force.** BTL1  A body force is distributed force acting on every elemental volume of the body Unit: Force per unit volume.  Example: Self weight due to gravity |
| 11 | **What is point load?** BTL1  Point load is force acting at a particular point which causes displacement |
| 12 | **What are the basic steps involved in the finite element modeling.(NOVEMBER 2009)**BTL1   1. Discretization of structure. 2. Numbering of nodes. |
| 13 | **What is discretization?** BTL1  The art of subdividing a structure in to a convenient number of smaller components is known as discretization. |
| 14 | **What are the classifications of coordinates?(APRIL 2011)** BTL1   1. Global coordinates 2. Local coordinates JIT - JEPPIAAR 3. Natural coordinates |
| 15 | **What is Global coordinates?** BTL1  The points in the entire structure are defined using coordinates system is known as global coordinate system. |
| 17 | **How do you calculate the size of the global stiffness matrix?(APRIL 2011)** BTL1 Global stiffness matrix size = Number of nodes X Degrees of freedom per node |
| 18 | **What is natural coordinates?** BTL1  A natural coordinate system is used to define any point inside the element by a set of dimensionless number whose magnitude never exceeds unity. This system is very useful in assembling of stiffness matrices. |
| 19 | **Define shape function.** BTL1  Approximate relation φ (x,y) = N1 (x,y) φ1 + N2 (x,y) φ2 + N3(x,y) φ3  Where φ1, φ2, and φ3 are the values of the field variable at the nodes N1, N2, and N3 are the interpolation functions.  N1, N2, and N3 are also called shape functions because they are used to express the geometry or shape of the element. |
| 20 | **What are the characteristic of shape function?(APRIL 2019)**BTL1   1. It has unit value at one nodal point and zero value at other nodal points. 2. The sum of shape function is equal to one. |
|  | **PART \* B** |
| 1 | Find the nodal displacement developed in the planer truss shown in figure when a  Vertically downward load of 1000 N is applied at node 4. The required data are given in the Table 1. **(13M) (NOVEMBER 2014)**BTL2 |
| 2 | Consider the triangular element shown in figure. The element is extracted from a thin plate of thickness 0.5 cm. The material is hot rolled low carbon steel. The nodal coordinates are x1 = 0, y1 = 0; xj 0; yj – 1, xk =2, yk = -2. Determine the elemental stiffness matrix. Assuming plane stress analysis, take µ = 0.3 and E = 2.1 x 107 N/cm2. **(13M) (NOVEMBER 2010)**BTL2 |
| 3 | What is one dimensional element? Explain their types? **(13M) (MAY 2010,NOVEMBER 2019 )**BTL2 |
| 4 | The loading and other parameters for a two bar truss element is shown in Fig.  Determine   1. the element stiffness matrix for each element 2. global stiffness matrix   (m) nodal displacements JIT - JEPPIAAR   1. reaction forces   (V) The stresses induced in the elements. Assume E = 200 GPa**.(13M)** BTL 2 |
| 5 | Explain about the beam element and formulate the stiffness matrix**. (13M) (NOVEMBER 2009)** BTL 2 |
| 6 | Find the slopes at the supports and suppoJIT - JEPPrIAAR t reaction forces and support reaction moments for the beam shown in Figure. Take E=210 GPa, I = 2×10-4 m4**(15M) (MAY 2009)**BTL3 |
| 7 | Given that E=210 GPa and I=4×10-4m4, cross section of the beam is constant. Determine the deflection and slope at point C. calculate the reaction forces and moments**. (15M) (NOVEMBER 2015)**BTL2 |
| 8 | Derive the 1-d 2-noded cubic beam element matrices**. (15M) (MAY 2009) BTL2** |

|  |  |
| --- | --- |
| **UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS** | |
| **PART \* A** | |
| **Q.No.** | **Questions** |
| 1. | **What are higher order elements and why are they preferred? (APRIL 2011)** BTL1   * For any element, if the interpolation polynomial is the order of two or more, that element is known as higher order elements. * It is used to represent the curved boundaries. * The number of elements is reduced when compared with straight edge elements to model geometry |
| 2 | **State the properties of stiffness matrix.** BTL1   * It is a symmetric matrix. * The sum of elements in any column must be equal to zero * It is an unstable element. So, the determinant is equal to zero. |
| 3 | **Write down the expression of shape function N and displacement u for one dimensional bar element.(APRIL 2011)** BTL1 JIT - JEPPIAAR  U= N1u1+N2u2  N1= 1-X / l N2 = X / l |
| 4 | **Define total potential energy.**  Total potential energy, π = Strain energy (U) + potential energy of the external forces(w) |
| 5 | **State the principle of minimum potential energy.(November 2015)**BTL1  Among all the displacement equations that satisfied internal compatibility and the boundary condition those that also satisfy the equation of equilibrium make the potential energy a minimum is a stable system. |
| 6 | **What is truss?** BTL1  A truss is defined as a structure made up of several bars, riveted or welded together. |
| 7 | **States the assumption are made while finding the forces in a truss.(APRIL 2012)** BTL1   * All the members are pin jointed. The truss is loaded only at the joint * The self weight of the members is neglected unless stated. |
| 8 | **State the principles of virtual energy?** BTL1  A body is in equilibrium if the internal virtual work equals the external virtual work for the every kinematically admissible displacement field |
| 9 | **What is essential boundary condition?** BTL1  Primary boundary condition or EBC Boundary condition which in terms of field variable is known as Primary boundary condition. |
| 10 | **Naturalboundary conditions?** BTL1  Secondary boundary natural boundary conditions which are in the differential form of field variable is known as secondary boundary condition |
| 11 | **How do you define two dimensional elements?(APRIL 2013)** BTL1   * Two dimensional elements are defined by three or more nodes in a two dimensional plane. * The basic element useful for two dimensional analysis is the triangular element. |
| 12 | **What is CST element?** BTL1   * Three noded triangular elements are known as CST. * It has six unknown displacement degrees of freedom (u1, v1, u2, v2, u3, v3). * The element is called CST because it has a constant strain throughout it. |

|  |  |
| --- | --- |
| 13 | **What is LST element?(November 2012)**BTL1   * Six nodded triangular elements are known as LST. * It has twelve unknown displacement degrees of freedom. * The displacement function for the elements are quadratic instead of linear as in the CST. |
| 14 | **What is QST element?(November 2012)**BTL1  Ten nodded triangular elements are known as Quadratic strain triangle. It is also called as cubic displacement triangle. |
| 15 | **What meant by plane stress analysis?** BTL1  Plane stress is defined to be a state of stress in which the normal stress and shear stress directed perpendicular to the plane are assumed to be zero |
| 16 | **Define plane strain analysis.(November 2015)**BTL1  Plane strain is defined to be state of strain normal to the xy plane and the shear strains are assumed to be zero. |
| 17 | **State the assumption in the theory of pure torsion. (November 2012)**BTL1   * The material of the shaft is homogenJITe- JEPPIAARous, perfectly elastic and obeys Hooks law. * Twist is uniform along the length of the shaft. * The stress does not exceed the limit of proportionality. * Strain and deformation are small. |
| 18 | **Write down the stress-strain relationship matrix for plane strain condition. (November 2012)** BTL 1  For plane strain problems, stress-strain relationship matrix is    Where, E = Youngs modulus  V = Poisson’s ratio |
| 19 | **Write a strain-displacement matrix for CST element. (November 2012)** BTL2 |

|  |  |
| --- | --- |
|  |  |
| 20 | **Write down the expression for the shape function for a constant strain triangular element.**BTL2 |
|  | **PART \* B** |
| 1 | Derivation of stiffness matrix and finiteJIT - Jelement equation for a truss element.**(13M) (NOVEMBER 2009)** BTL2 |
| 2 | Formulate the development of element equation. **(13M) (NOVEMBER 2009)** BTL2 |
| 3 | Derive the shape function for the constant strain triangular element**. (13M) (November 2012) BTL2** |
| 4 | Determine the stiffness matrix for the straight-sided triangular element of thickness t = 1 mm, as shown. Use E = 70 GPa, n = 0.3 and assume a plane stress condition**. (13M) (November 2012) BTL2** |
| 5 | Consider a thin plate having thickness *t*= 0.5 in. being modeled using two CST elements, as shown. Assuming plane stress condition, (a) determine the displacements of nodes 1 and 2, and (b) estimate the stresses in both elements. **(13M)(November 2012) BTL2** |
| 6 | For the constant strain triangular element shown in figure. Assemble strain-displacement matrix. Take t = 20 mm, E = 2 X 105 N / mm2. **(15M)(November 2012)BTL3** |
| 7 | Determine the shape functions N1, N2 and N3 at the interior point P for the triangular element shown in figure**. (15M)(November 2012) BTL3** |

|  |  |
| --- | --- |
| **UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS** | |
| **PART \* A** | |
| **Q.No.** | **Questions** |
| 1. | **What is axisymmetric element?(MAY 2008)**BTL1  Many three dimensional problem in engineering exhibit symmetry about an axis of rotation such type of problem are solved by special two dimensional element called the axisymmetric element |
| 2 | **What are the conditions for a problem to be axisymmetric?**BTL1   1. The problem domain must be symmetric about the axis of revolution 2. All boundary condition must be symmetric about the axis of revolution 3. All loading condition must be symmetric about the axis of revolution |
| 3 | **What is the purpose of Isoperimetric element?** BTL1  It is difficult to represent the curved boundaries by straight edges finite elements. A large number of finite elements may be used to obtain reasonable resemblance between original body and the assemblage. |
| 4 | **Define super parametric element.(MAY 2008)** BTL1  If the number of nodes used for defining the geometry is more than of nodes used for defining the displacement is known as super parametric element. |
| 5 | **Define sub parametric element.** BTL1 JIT - JEPPIAAR  If the number of nodes used for defining the geometry is less than number of nodes used for defining the displacement is known as sub parametric element. |
| 6 | **What is meant by Isoparametric element?** BTL1  If the number of nodes used for defining the geometry is same as number of nodes used for defining the displacement is known as Isoparametric element. |
| 7 | **Is beam element an Isoparametric element?(MAY 2009)** BTL1  Beam element is not an Isoparametric element since the geometry and displacement are defined by different order interpretation functions. |
| 8 | **What is simple natural coordinate?** BTL1  A simple natural coordinate is one whose value between -1 and 1. |
| 9 | **Give example for essential boundary conditions.** BTL1  The geometry boundary condition are displacement, slope. |
| 10 | **Write down the shape functions for 4 noded rectangular elements using natural coordinate system.(MAY 2010)** BTL1  *N*1 = 1 (1-e)(1-h) *N*2 = 1 (1+e)(1-h)4 4  *N*3 = 1 (1 +e)(1+h) *N*4 = 1 (1 -e)(1 +h)4 4 |
| 11 | **Give example for non-essential boundary conditions.** BTL1 The natural boundary conditions are bending moment, shear force |
| 12 | **What is meant by degrees of freedom?** BTL1  When the force or reaction act at nodal point node is subjected to deformation. The deformation includes displacement rotation, and or strains. These are collectively known as degrees of freedom. |
| 13 | **What is QST element?** BTL1  Ten noded triangular elements are known as Quadratic strain triangle. It is also called as cubic displacement triangle. |

|  |  |
| --- | --- |
| 14 | **Write down the stiffness matrix equation for two dimensional CST elements.(MAY 2012)**BTL1  Stiffness matrix [*K* ]=[*B* ]*T* [*D* ][*B* ] [*B*]*T* -Strain displacement  [*D*]-Stress strain matrix  [*B*]-Strain displacement matrix |
| 15 | **State the assumptions made in the case of truss element. (MAY 2008)**  The following assumptions are made in the case of truss element,   * All the members are pin jointed. * The truss is loaded only at the joints * The self-weight of the members are neglected unless stated. |
|  | **PART \* B & C** |
| 1 | Derive the shape function equation for the Axisymmetric element. **(13M) (Nov/Dec’10)**  BTL2 |
| 2 | Derive the Strain Displacement Matrix for the Axisymmetric element**. (13M) (November 2011)** BTL2 |
| 3 | Derive the Stress Strain Relationship matrix for the Axisymmetric triangular element. **(13M) (November 2013)** BTL2 |
| 4 | The nodal co-ordinates for an axisymmetric triangular element are given below. r1= 10 mm, r2= 30 mm, r3= 30 mm z1 = 10 mm, z2 = 10 mm, z3 = 40 mm. Evaluate [B] Matrix for the element. **(13M) (November 2014)** BTL2 |
| 5 | The nodal coordinates for an Axisymmetric triangular element are given below r1= 20 mm, r2= 40 mm , r3= 30 mm z1 = 40 mm, z2 = 40 mm, z3 = 60 mm. Evaluate [B] Matrix for the element. **(13M) (November 2015)** BTL2 |
| 6 | For the element shown in fig, determine the stiffness matrix. Take E = 200Gpa and v =  0.25. The co-ordinates shown in fig are in millimeters**. (15M) (November 2013)** BTL2 |
| 7 | For the axisymmetric elements shown in fig, determine the stiffness matrix. Let E = 2.1 x 105 N/mm2 and v = 0.25. The co-ordinates shown in fig are in millimeters. **(15M) (November 2012)** BTL2 |
| 8 | For the axisymmetric elements shown in fig. Determine the element stresses. Let E = 210 Gpa and v = 0.25. The coordinates are in millimeters. The nodal displacements are u1= 0.05 mm, u2= 0.02 mm, u3= 0 mm, w1 = 0.03 mm, w2 = 0.02 mm, w3 = 0 mm. **(13M) (November 2014)** BTL3 |

|  |  |
| --- | --- |
| **UNIT V ISOPARAMETRIC FORMULATION** | |
| **PART \* A** | |
| **Q.No** | **Questions** |
| 1. | **What meant by plane stress analysis?(November 2014)**BTL1  Plane stress is defined to be a state of stress in which the normal stress and shear stress directed perpendicular to the plane are assumed to be zero. |
| 2 | **Define plane strain analysis.** BTL1  Plane strain is defined to be state of strain normal to the x,y plane and the shear strains are assumed to be zero. |
| 3 | **What is truss element?** BTL1  The truss elements are the part of a truss structure linked together by point joint which transmits only axial force to the element. |
| 4 | **List the two advantages of post processing. (November 2013)** BTL1   1. Required result can be obtained in graphical form. 2. Contour diagrams can be used to understand the solution easily and quickly. |
| 5 | **What are the h and p versions of finite ele**JIT -**m**JEPPIAAR **ent method?(NOVEMBER 2019)**BTL1  It is used to improve the accuracy of the finite element method. In h version, the order of polynomial approximation for all elements is kept constant and the numbers of elements are increased. In p version, the numbers of elements are maintained constant and the order of  polynomial approximation of element is increased. |
| 6 | **During discretization, mention the places where it is necessary to place a node?** BTL1   1. Concentrated load acting point 2. Cross-section changing point 3. Different material inter junction point 4. Sudden change in point load |
| 7 | **What is the difference between static and dynamic analysis?** BTL1  Static analysis: The solution of the problem does not vary with time is known as static analysis Example: stress analysis on a beam  Dynamic analysis: The solution of the problem varies with time is known as dynamic analysis Example: vibration analysis problem. |
| 8 | **What is meant by discretization and assemblage?** BTL1  The art of subdividing a structure in to convenient number of smaller components is known as discretization. These smaller components are then put together. The process of uniting the various elements together is called assemblage. |
| 9 | **What is Rayleigh-Ritz method?(November 2014)**BTL1  It is integral approach method which is useful for solving complex structural problem, encountered in finite element analysis. This method is possible only if a suitable function is available. |
| 10 | **How do you define two dimensional elements?** BTL1  Two dimensional elements are defined by three or more nodes in a two dimensional plane. The basic element useful for two dimensional analysis is the triangular element. |
| 11 | **State the principles of virtual energy? (November 2015)** BTL1  A body is in equilibrium if the internal virtual work equals the external virtual work for the every kinematically admissible displacement field. |

|  |  |
| --- | --- |
| 12 | **Define Eigen value problem.** BTL1  The problem of determining the constant is called eigen value problem. |
| 13 | **What is non-homogeneous form?** BTL1  When the specified values of dependent variables are non-zero, the boundary condition said to be non-homogeneous. |
| 14 | **What is homogeneous form?** BTL1  When the specified values of dependent variables is zero, the boundary condition are said to be homogeneous. |
| 15 | **Define initial value problem.** BTL1  An initial value problem is one in which the dependent variable and possibly is derivatives are specified initially. |
| 16 | **Define boundary value problem.** BTL1  A differential equation is said to describe a boundary value problem if the dependent variable and its derivatives are required to take specified values on the boundary. |
|  | **PART \* B & C** |
| 1 | For the isoparametric quadrilateral element shown in fig determine the local co- ordinates of the point P which has CJIT PPaIAAR rtesian co-ordinates (7,4). **(13M)(November 2014)**BTL2 |
| 2 | Evaluate the integeral 𝑰 = ∫𝟏 (𝟐 + 𝒙 + 𝒙𝟐) and compare with exact solution**.(13M)**BTL2 |
| 3 | Derive the shape functions for 4 noded rJIT - JEPPIAeAR ctangular parent element by using natural co- ordinates system and co-ordinate transformation. **(13M)(November 2015)** BTL2 |
| 4 | Evaluate the integral by using Gaussian Quadrature 𝑰 = ∫𝟏 𝒙𝟐 𝑑𝑥. **(13M)(November**  −𝟏  **2010,APRIL 2019)**BTL2 |
| 5 | Derive the element stiffness matrix equation for 4 noded isoparametric quadrilateral element**. (13M)(November 2011)**BTL2 |
| 6 | Evaluate the integral 𝑰 = ∫ (𝒙𝟒 − 𝟑𝒙 + 𝟕) 𝑑𝑥. **(15M)(November 2011)**BTL2  −𝟏 |
| 7 | Evaluate the integral by applying 𝑰 = ∫𝟏 𝒄𝒐𝒔 𝒙 𝑑𝑥3 point Gaussian quadrature.  −𝟏 𝟏−𝒙𝟐  **(15M)(November 2011)**BTL2 |
| 8 | Evaluate the integral by applying 𝑰 = ∫𝟏 (𝟑𝒆𝒙 + 𝒙𝟐 + 𝟏 )3 point Gaussian quadrature.  −𝟏 𝒙+𝟐  **(15M)(November 2014)**BTL2 |