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| Regulation…R20 Subject code: TKR COLLEGE OF ENGINEERING AND TECHNOLOGY  (Autonomous, Accredited by NAAC with ‘A’ Grade)  ***C:\Users\india\Desktop\tkrcet-logo.jpg*B.Tech -IV-Year …I…Semester Regular/Supply Examinations, 2023**  **SUBJECT NAME: FINITE ELEMENT METHODS**  **(Mechanical Engineering)**  ***Maximum Marks: 70*** **Duration: 3 Hours**  **Note:** **1.This question paper contains two parts A and B.**  **2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.**  **3. Part B consists of 10 questions. Answer any 5 questions which carries 10M.**  **4. Each question carries 10 marks and may have a, b, c, d as sub questions.** | | |
| SET-I  Part-A | | | |
| **All the following questions carry equal marks (10x2M=20 Marks)** | | | |
| 1 | Define Finite Element Method. | | |
| 2 | What are local coordinates? | | |
| 3 | Write the stiffness matrix of a bar element. | | |
| 4 | Draw the beam element and show the slopes in it. | | |
| 5 | What is meant by node | | |
| 6 | What is the shape function for a four node element? | | |
| 7 | Explain ID beam element | | |
| 8 | Write the governing equation for convection process. | | |
| 9 | What is the equation of Langrangean in dynamic analysis? | | |
| 10 | What is the required condition for the Eigen vector, if it is to be non- trivial? | | |
| Part-B | | | |
| Answer **ANY FIVE QUESTIONS** (**10MX 5=50Marks)** | | | |
| 11 | | How to write the equilibrium equation for a finite element method? | |
|  | | OR | |
|  | | State the advantage of finite element method over numerical analysis methods? | |
| 12 | | Distinguish between ID bar element and ID beam element | |
|  | | OR | |
|  | | Classify boundary conditions? | |
| 13 | | How to write the equilibrium equation for a finite element? | |
|  | | OR | |
|  | | What is meant by node? List the types of nodes? | |
| 14 | | a) Discuss in detail about 2D heat conduction in Composite slabs using FEA.  b) Determine the temperature distribution along a circular fin of length 5 cm and radius1 cm. The fin is attached to boiler whose wall temperature 1400C and the free end is open to the atmosphere. Assume T= 400C, h = 10 W/cm2/0 C, k = 70 W/cm 0C. | |
|  | | OR | |
|  | | Derive the stiffness matrix for 2D truss Element | |
| 15 | | Draw beam element in global and intrinsic co-ordinate system. | |
|  | | OR | |
|  | | Use galerkin’s approach to find the stiffness matrix of a torsional triangular element | |

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| Regulation…R20 Subject code: C36PC3 TKR COLLEGE OF ENGINEERING AND TECHNOLOGY  (Autonomous, Accredited by NAAC with ‘A’ Grade)  ***C:\Users\india\Desktop\tkrcet-logo.jpg*B.Tech -IV-Year …I…Semester Regular/Supply Examinations, 2023**  **SUBJECT NAME: FINITE ELEMENT METHODS**  **(Mechanical Engineering)**  ***Maximum Marks: 70*** **Duration: 3 Hours**  **Note:** **1.This question paper contains two parts A and B.**  **2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.**  **3. Part B consists of 10 questions. Answer any 5 questions which carries 10M.**  **4. Each question carries 10 marks and may have a, b, c, d as sub questions.** | | |
| SET-II  Part-A | | | |
| **All the following questions carry equal marks (10x2M=20 Marks)** | | | |
| 1 | Define Finite Element Method. | | |
| 2 | What is Discretization? | | |
| 3 | How the element displacement vector q is represented? | | |
| 4 | What are local coordinates? | | |
| 5 | In 2-D, what is the equation of element stiffness matrix? | | |
| 6 | What is the shape function for a four node element? | | |
| 7 | What is the Unit for convection heat transfer coefficient? | | |
| 8 | Write the governing equation for convection process. | | |
| 9 | What is the equation of Langrangean in dynamic analysis? | | |
| 10 | What is the required condition for the Eigen vector, if it is to be non- trivial? | | |
| Part-B | | | |
| Answer **ANY FIVE QUESTIONS(10MX 5=50Marks)** | | | |
| 11 | | Different the different types of boundary conditions? Give examples? | |
|  | | OR | |
|  | | List the various methods of solving boundary value problems | |
| 12 | | What are the types of boundary conditions? give an example? | |
|  | | OR | |
|  | | Write down the stress strain relationship for a three dimensional stress field? | |
| 13 | | The spring system show in the figure, find the displacement the nodes and the reactions given K1=100N/mm2, K2=200N/mm2, K3 =100N/mm2 and P=500N Stiffness matrix | |
|  | | OR | |
|  | | How to write the equilibrium equation for a finite element? | |
| 14 | | Analyse the beam shown in figure by finite element method and determine displacements and slopes at the nodes. E=2 x 105 N/mm2 & I= 5 x 106 mm4 | |
|  | | OR | |
|  | | Explore the stress strain relation for 2D and 3D elastic problems | |
| 15 | | Estimate the Stiffness matrix in 1-D fin as shown in the figure by making the fin in to two elements. | |
|  | | OR | |
|  | | Draw beam element in global and intrinsic co-ordinate system. | |

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| SET-III  Part-A | | | |
| **All the following questions carry equal marks (10x2M=20 Marks)** | | | |
| 1 | | What is Discretization? | |
| 2 | | Explain briefly about global coordinate system. | |
| 3 | | How the element displacement vector q is represented? | |
| 4 | | The Strain- Displacement matrix of 1-D bar element is given by [B] | |
| 5 | | What are local coordinates? | |
| 6 | | Write the stiffness matrix of a bar element. | |
| 7 | | Draw the beam element and show the slopes in it. | |
| 8 | | What is meant by node | |
| 9 | | What is the Unit for convection heat transfer coefficient? | |
| 10 | | Write the governing equation for convection process. | |
| Part-B | | | |
| Answer **ANY FIVE QUESTIONS(10MX 5=50Marks)** | | | |
| 11 | What are the various types of lathe? How are they classified? Explain any one type with  a neat sketch.  What are the various types of lathe? How are they classified? Explain any one type with  a neat sketch.  What are the various types of lathe? How are they classified? Explain any one type with  a neat sketch.  What are the various types of lathe? How are they classified? Explain any one type with  a neaDefine principle of virtual work. Describe the FEM formulation for 1D barList the Various methods of solving boundary value?  Derive the stiffness matrix and consistent load vector in matrix form for one Dimensional quadratic element. | | |
|  | OR | | |
|  | Define principle of virtual work. Describe the FEM formulation for 1D bar element. | | |
| 12 | Derive the strain displacement matrices for triangular element of revolving body. | | |
|  | OR | | |
|  | Explain the elimination method and penalty method for imposing specified displacement boundary conditions | | |
| 13 | Explore the stress strain relation for 2D and 3D elastic problems | | |
|  | OR | | |
|  | The spring system show in the figure, find the displacement the nodes and the reactions given K1=100N/mm2, K2=200N/mm2, K3 =100N/mm2 and P=500N Stiffness matrix | | |
| 14 | Draw beam element in global and intrinsic co-ordinate system. | | |
|  | OR | | |
|  | Consider axial vibrations of the steel stepped bar as shown in the below figure. Develop global stiffness matrix and mass matrix | | |
| 15 | Draw beam element in global and intrinsic co-ordinate system. | | |
|  | OR | | |
|  | Estimate the Stiffness matrix in 1-D fin as shown in the figure by making the fin in to two elements. | | |
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| SET-IV  Part-A | | | |
| **All the following questions carry equal marks (10x2M=20 Marks)** | | | |
| 1 | | Explain briefly about global coordinate system. | |
| 2 | | Define Finite Element Method. | |
| 3 | | What is Discretization? | |
| 4 | | How the element displacement vector q is represented? | |
| 5 | | What are local coordinates? | |
| 6 | | In 2-D, what is the equation of element stiffness matrix? | |
| 7 | | Write the stiffness matrix of a bar element. | |
| 8 | | Draw the beam element and show the slopes in it. | |
| 9 | | What is meant by node | |
| 10 | | What is the Unit for convection heat transfer coefficient? | |
| Part-B | | | |
| Answer **ANY FIVE QUESTIONS(10MX 5=50Marks)** | | | |
| 11 | Define principle of virtual work. Describe the FEM formulation for 1D bar element. | | |
|  | OR | | |
|  | Consider the bar shown in fig. an axial load P=200x103 N is applied as shown. Determine the nodal displacements in each material. | | |
| 12 | How local and global coordinates are related in a truss problem? | | |
|  | OR | | |
|  | Explain the elimination method and penalty method for imposing specified displacement boundary conditions | | |
| 13 | Derive the Hermit shape functions for beam element. | | |
|  | OR | | |
|  | The spring system show in the figure, find the displacement the nodes and the reactions given K1=100N/mm2, K2=200N/mm2, K3 =100N/mm2 and P=500N Stiffness matrix | | |
| 14 | Determine the temperature distribution in a fin having rectangular cross section and is 8 cm long, 4 cm wide and 1 cm thick. Assume convection heat loss occurs from the free end of the fin. One end is fixed. Take k=3 W/cm0C, h= 0.1 W/cm 2 0C and T∞=200C | | |
|  | OR | | |
|  | Consider axial vibrations of the steel stepped bar as shown in the below figure. Develop global stiffness matrix and mass matrix | | |
| 15 | For the stepped bar shown in the figure, Develop the global stiffness and mass matrices Assume E = 200 GPa and mass density = 7850 kg/m3, L1 = L2 = 0.3 m, A2 = 350 mm2, A1 = 600 mm2. | | |
|  | OR | | |
|  | Draw beam element in global and intrinsic co-ordinate system. | | |