



K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109
DEPARTMENT OF MECHANICAL ENGINEERING
SESSION: 2022-2023 (EVEN SEMESTER)
I SESSIONAL TEST QUESTION PAPER

SET-A

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Degree : B.E
 Branch : Mechanical Engineering
 Course Title : Finite Element Method
 Duration : 90 Minutes

Semester : VI
 Date : 19-4-2023
 Course Code : 18ME61
 Max Marks : 30

Note: Answer ONE full question from each part


Q. No.	Question	Marks	K Level	CO mapping
PART-A				
1(a)	Explain the basic steps of FEM	5	K2 Understanding	CO1
(b)	Using the principle of minimum Potential Energy, Determine the displacements at the nodes for a spring system shown in figure. Take $k_1 = 40\text{N/m}$, $k_2 = 60\text{N/m}$, $k_3 = 80\text{N/m}$ and $k_4 = 100\text{N/m}$, $F_1 = 60\text{N}$, $F_2 = 80\text{N}$ and $F_3 = 40\text{N}$ 	5	K3 Applying	CO1
(c)	Derive the shape function for a quadratic bar element	5	K3 Applying	CO2
OR				
2(a)	Explain the Node numbering scheme	5	K2 Understanding	CO1
(b)	Use RR method, find the stress at a mid point of a bar as shown in figure. Take $E = 70\text{ Gpa}$ and $A = 100\text{ mm}^2$ 	5	K3 Applying	CO1
(c)	Derive the shape function for a 1D bar element by global coordinate system	5	K3 Applying	CO2
PART-B				
3(a)	Describe the Convergence requirements	5	K2 Understanding	CO1

(b)	A cantilever beam is subjected to UDL for entire span of intensity ' P_0 ' Determine the equation for maximum deflection RR Method	5	K3 Applying	CO1
(c)	Derive the shape function for cubic bar element	5	K3 Applying	CO2
OR				
4(a)	Explain the variational principles in FEM	5	K2 Understanding	CO1
(b)	A cantilever beam is subjected to point load at its free end. Determine the equation for maximum deflection by RR Method	5	K3 Applying	CO1
(c)	Derive the shape function for CST Element	5	K3 Applying	CO2

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Course Incharge


HOD


IQAC- Coordinator


Principal



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SET-B

Degree : B.E
 Branch : Mechanical Engineering
 Course Title : Finite Element Method
 Duration : 90 Minutes


USN

Semester : VI
 Date : 19-4-2023
 Course Code : 18ME61
 Max Marks : 30

Note: Answer ONE full question from each part

Q. No.	Question	Marks	K Level	CO mapping
PART-A				
1(a)	Explain the Discretization Process	5	K2 Understanding	CO1
(b)	Using the principle of minimum Potential Energy, Determine the displacements at the nodes for a spring system shown in figure. <div align="center"> </div>	5	K3 Applying	CO1
(c)	Derive the shape function for a quadratic bar element	5	K3 Applying	CO2
OR				
2(a)	Explain Simplex, Complex and Multiplex Elements	5	K2 Understanding	CO1
(b)	Use RR method, find the displacement of a bar as shown in figure. Element 1 is made of Al and Element 2 is made of steel $E_{Al} = 70 \text{ Gpa}$ and $A_{Al} = 900 \text{ mm}^2$ $E_{Steel} = 200 \text{ Gpa}$ and $Steel = 1200 \text{ mm}^2$ and $P = 10000 \text{ N}$ <div align="center"> </div>	5	K3 Applying	CO1
(c)	Derive the shape function for a 1D bar element by global coordinate system	5	K3 Applying	CO2
PART-B				
3(a)	Derive the Potential energy function for 3D elastic body	5	K3 Applying	CO1

(b)	A Cantilever beam is subjected to UDL for entire span of intensity ' P_0 ' Determine the equation for maximum deflection RR Method	5	K3 Applying	CO1
(c)	Derive the shape function for CST Element	5	K3 Applying	CO2
OR				
4(a)	Define Global and natural coordinate system and derive the relation between Cartesian and natural coordinate system	5	K3 Applying	CO1
(b)	A Cantilever beam is subjected to point load at its free end. Determine the equation for maximum deflection by RR Method	5	K3 Applying	CO1
(c)	Derive the shape function for cubic bar element	5	K3 Applying	CO2


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