

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

Degree

: **B.E**

Branch

Mechanical Engineering

Course Title : Finite Element Method **Duration**

: 90 Minutes

USN Semester

VI

Date

19-4-2023

Course Code :

18ME61

: 30 Max Marks

Note: Answer ONE full question from each part

Q.	Question	Marks	K Level	CO mapping	
No.	No. 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 $k_1 = 40N/m$, $k_2 = 60N/m$, $k_3 = 80N/m$ and $k_4 = 100N/m$, $F_1 = 60N$, $F_2 = 80N$ and $F_3 = 40N$	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 Gpa and A = 100 mm ² 8 kN y 20 y 20 y Derive the shape function for a 1D bar element by global	5	K3 Applying	CO1	
(c)	coordinate system	5	Applying	CO2	
	PART-B				
3(a)	Describe the Convergence requirements	5	K2 Understanding	CO1	

	A cantilever beam is subjected to UDL for entire span of intensity 'P ₀ '	5	K3 Applying	COL
(b)	Determine the equation for maximum	5	K3 Applying	CO2
(c)	Derive the shape function for cubic bar element OR		K2	CO1
	1 2004	5	Understanding	CO1
4(a)	Explain the variational principles in FEM A cantilever beam is subjected to point load at its free end. Determine	5	K3 Applying	CO1
(b)	the equation for maximum deflection by RR Method	5	К3	CO2
(c)	Derive the shape function for CST Element		Applying	
(S)	Course Incharge HOD IQAC-Coor	dinator	/ < . C~~ Principal	2

Course Incharge

IQAC- Coordinator



K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109 DEPARTMENT OF MECHANICAL ENGINEERING

SESSION: 2022-2023 (Even SEMESTER) I SESSIONAL TEST QUESTION PAPER

USN

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: B.E

Semester

VI

Branch Course Title

Mechanical Engineering : Finite Element Method

Date Course Code :

19-4-2023 18ME61

Duration

: 90 Minutes

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. $ \frac{\delta}{k_1=40 \text{ N/m}} \frac{1}{k_1=60 \text{ N/m}} \frac{\delta_1}{k_1=80 \text{ N/m}} \frac{2}{k_2=80 \text{ N/m}} = 50 \text{ N} $	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 $E_{AJ} = 70$ Gpa and $A_{AJ} = 900 \text{ mm}^2$ $E_{Steel} = 200$ Gpa and Steel = 1200 mm ² and P = 10000 N	5	K3 Applying	CO1	
(c)	Derive the shape function for a 1D bar element by global coordinate system	5	K3 Applying	CO2	
	PART-B			1	
3(a)	Derive the Potential energy function for 3D elastic body	5	K3 Applying	CO1	

	A Cantilever beam is subjected to UDL for entire span of intensity 'P ₀ '	5	K3 Applying	CO1
(b)	Determine the equation for maximum deflection re-	5	K3 Applying	CO2
(c)	Derive the shape function for CST Element		1155.)8	
OR K3				501
4(a)	Define Global and natural coordinate system and derive the relation	5	Applying	CO1
	between Cartesian and natural coordinate system A Cantilever beam is subjected to point load at its free end. Determine	5	K3 Applying	CO1
(b)	the equation for maximum deflection by RR Method		К3	~~~
(c)	Derive the shape function for cubic bar element	5	Applying	CO2

Course Incharge

IQAC-Coordinator Principal