University of Mumbai

Examinations Summer 2022

Time: 2 hour 30 minutes   Max. Marks:80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks (02 Marks each)
1.	The derivative of dependent variables are known as
Option A:	Secondary Variables
Option B:	Primary Variables
Option C:	Boundary Variables
Option D:	Domain Variables
2.	The order of given differential equation is $5y'' - y + 50 = 0$; $0 \le x \le 1$, $y(0) = 0$, $y(1) = 0$
Option A:	0
Option B:	1
Option C:	2
Option D:	3
3.	The degree/s of freedom at each node of a two-node bar element is/are
Option A:	1
Option B:	2
Option C:	3
Option D:	4
4.	The sum of the shape functions over the element is always equal to
Option A:	0
Option B:	1
Option C:	0.5
Option D:	Infinity
5.	Which of the following is not a source of error in FEM?
Option A:	Discretization error
Option B:	Interpolation error
Option C:	Error due to computation
Option D:	Modelling error
6.	The no. of shape function for a given element is always equal to
Option A:	Degree of the shape function of the element
Option B:	Total degree of freedom for the element
Option C:	No. of nodes
Option D:	Twice the no. of nodes
7.	The range of natural coordinates is between
Option A:	0 to 1
Option B:	-1 to +1
Option C:	0 to -1
Option D:	0 to ∞

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8.	The matrix that gives the relationship between two coordinate system is
Option A:	Crammer
Option B:	Henry
Option C:	Jacobian
Option D:	Newton
9.	In P-method for convergence the refined mesh is obtained:
Option A:	By dividing existing elements into more number of elements
Option B:	By increasing the order of existing elements
Option C:	By increasing the number of elements as well as order of elements
Option D:	By decreasing the number of existing elements
10.	In lumped mass matrix, mass of element is distributed
Option A:	half at the nodes
Option B:	uniformly
Option C:	full at the nodes
Option D:	randomly

Q2.	Solve any Four out of Six	(5 marks each)
A	Explain the stages in FEA	
B	Write element matrix equation in the following fields explaining each term: i) 1D steady state, heat transfer by conduction ii) Torsion Analysis	
C	Explain types of elements with sketches.	
D	Derive the shape function for 1D linear element in the natural coordinate system.	
E	Explain plane stress and plane strain condition with examples	
F	What do you mean by consistent mass matrix and lumped mass matrix. Also state its matrix form.	

Q3	Solve any Two Questions out of Three	(10 marks each)
A	A constant strain triangle element has the nodal coordinates (10, 10), (40, 20) and (30, 50) mm for 1, 2, & 3 nodes respectively. Find the coordinates of point P inside the triangle, if the shape functions are N1=0.15 and N2=0.25. Also find the temperature at point P if temperature at node 1, 2, and 3 are 20°C , 30°C and 50°C respectively.	
B	Derive the shape functions of rectangular element in the local coordinate system.	
C	For a uniform cross section bar of Length L=1 m. made up of a material having E=2X1011 N/m2 & $\rho = 7800$kg/m3. Estimate the natural frequencies of axial vibration of the bar using lumped mass matrix method. Use a two element mesh. Assume A= 30 X 10-6 m2	

Q4.	Solve any Two Questions out of Three	(10 marks each)
A	State and Explain the principal of minimum potential energy?	
B	Explain iso parametric and sub parametric elements.	
C	Explain sources of errors in FEA.	