APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Scheme for Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

EIGHTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: CE466

Course Name: FINITE ELEMENT METHODS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) 1. element type (1) (10)

2.Select displacement model and shape functions(2)

3.Strain -displacement relation(1)

4.Element Stiffness matrix(1)

5.Assembly of elements(1)

6.Boundary conditions(1)

7.Solution of equilibrium equation for displacements(1)

8.Stress computations and reactions(2)

b) 1.continuous (5)

2.interelement continuity

3.rigid body displacement

4.Constant strain state

5.Monotonic convergence, complete

2 a) State principle(2), example of simple bar element- Internal strain energy(1), external strain energy(1), Total SE minimization with derivative =0 (1) (5)

b) Ax=B form (1), forward elimination(2), backward elimination(2) (5)

c) Potential π (3)

$u=a_1x$ (1)

Stress $=qL^2/3A$ (1)

3 a) 1)Collocation method (2)

2)Galerkin method with 2 terms, $U=a_1x+a_2x^2$ (2)

Stress=cL/2AE x -c/6AE x^3

3)Least squares method (2)

b) Definition of shape functions (1.5)

		Properties (2x3)	(6)
		Significance	(1.5)

PART B

Answer any two full questions, each carries 15 marks.

4	a)	Element stiffness matrix – (1 x 3 = 3 marks) Global stiffness matrix - (2 marks) Boundary conditions - (1 marks) Equilibrium equations – (1 mark) Solution to obtain nodal displacements - (1 marks) Forces in each element - (1 mark) Reactions - (1 mark)	(10)
	b)	Static condensation – need for condensation (2 marks) Method for condensation - (3 marks)	(5)
5	a)	Element stiffness matrix –(1.5 x 2 = 3 marks) Global stiffness matrix - (1 mark) Boundary conditions - (2 marks) Equilibrium equations –(1 mark) Solution to obtain nodal displacements - (2 marks) Reactions – (1 mark)	(10)
	b)	Displacement boundary conditions – (2 marks) Equilibrium equations in terms of restrained and unrestrained displacements – (3 marks)	(5)
6	a)	2-noded beam element using Hermitian interpolation 3-noded bar using Lagrangian interpolation	(5) (5)
	b)	C^0 definition, example bar/truss element C^1 definition, example beam element Trigonometric functions can model both C0 and C1 elements	(2) (2) (1)

PART C

Answer any two full questions, each carries 20 marks.

7	a)	Lagrange Interpolation functions	(2) (8)

		Derivation of shape functions at four nodes	
	b)	Constant strain	(2.5)
		Linear strain	(2.5)
	c)	Isoparametric relation- shape functions of quadrilateral element	(2)
		Substituting (0.6,.8) and finding shape functions	(1)
		X=N1x1+N2x2+N3x3+N4x4 and for y	(1)
		Substituting and finding values x=5.82, y=7.02	(1)
8	a)	2-point Gauss quadrature, weights and gauss points	(6)
		Result	(2)
		Exact solution comparison	(2)
	b)	Kirchoff plate bending theory	(2.5)
		Mindlin plate bending theory	(2.5)
	c)	Patch test description	(4)
		Importance	(1)
9	a)	Definition	(1)
		Expression for consistent nodal load	(2)
		shape function matrix along the edge where surface load acts	(2)
		shape functions	(3)
		surface load vector along the corresponding edge	(2)
	b)	1. element type (1)	(10)
		2. Geometry mapping using isoparametric mapping(3)	
		3.Select displacement model and same shape functions(2)	
		4.Strain -displacement relation(2)	
		5.Element Stiffness matrix(2)	

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