C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 52U01

M.E. DEGREE EXAMINATION, NOV 2019

Second Semester

Structural Engineering

15PSE201 - FINITE ELEMENT ANALYSIS FOR STRUCTURAL ENGINEERING

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 1= 5 Marks)

1. Bar element is an example of CO1- R

   (a) One dimensional element (b) Two dimensional element

   (c) Three dimensional element (d) None of the above

2. The coordinate system in which a separate co-ordinate is used for each element is known as CO2 -R

   (a) Local coordinate system (b) Global coordinate system

   (c) Natural coordinate system (d) None of the above

3. If the number of nodes used for defining the geometry is same as number of nodes used for defining the displacements then it is known as CO3- R

   (a) Super parametric element (b) Isoparametric element

   (c) Subparametric element (d) Parametric element

4. In which method of mesh refinement the order of polynomial approximation for all elements is kept constant and the number of elements are increased. CO4 -R

   (a) p method (b) s method (c) h method (d) None of these

5. If λ is the Eigen value and U is the eigen vecor, then the characteristic equation for eigen value problem is given by CO5- R

   (a) $MU=\lambda KU$ (b) $K\lambda= MU$ (c) $\lambda U=KM$ (d) $KU=\lambda MU$

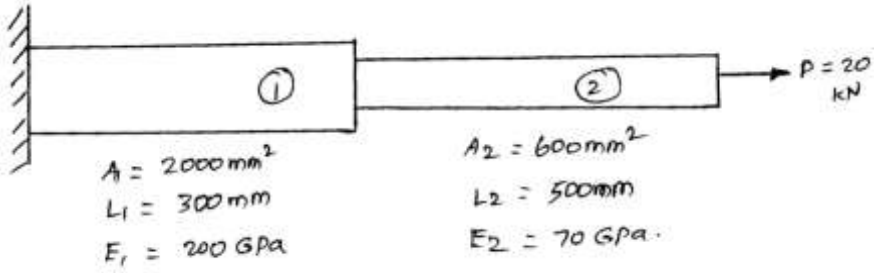
PART – B (5 x 3= 15 Marks)

6.	What is meant by natural discretisation?	CO1-U	
7.	Derive the shape functions for an axially loaded bar element.	CO2-App	
8.	Define the Lagrange interpolation polynomials used for higher order elements.	CO3-U	
9.	Explain h version refinement in finite element analysis.	CO4-R	
10.	Explain the process of dynamic condensation.	CO5-R	

PART – C (5 x 16= 80Marks)

11.	(a)	Using the Rayleigh-Ritz method calculate the deflection and bending moment at the centre of a simply supported beam of span L, with a concentrated load W at the midpoint of the span. Consider the first two terms of the trigonometric series in the trial function.	CO1-App	(16)

Or

	(b)	Find the approximate deflection of a simply supported beam under a uniformly distributed load of intensity p using Galerkin method	CO1-App	(16)
12.	(a)	Using finite element method obtain the element stresses for the stepped bar shown in figure. 	CO2- App	(16)

Or

	(b)	Derive the Hermitian polynomial shape functions for the beam element.	CO2- App	(16)
13.	(a)	The vertices of a constant strain triangular element is given by (3,2), (7,9) and (12,5). Determine the shape functions at the interior point P (10,4) and Strain –Displacement matrix B.	CO3-App	(16)

Or

	(b)	Calculate the element stresses and strains for the axisymmetric element having coordinates of node 1, 2 & 3 in mm are (0,0), (60,0) and (0,60) respectively. The displacement vector {u}T is {0.06, 0.04, 0.02, 0.03, 0.01, 0.01} in mm. E= 2x105 N/mm2, Poissons ratio = 0.25	CO3-App	(16)
14.	(a)	Discuss automatic mesh generation techniques and explain how the errors in FEM can be rectified to get accurate results.	CO4 - U	(16)
		Or		
	(b)	Discuss adaptive mesh generation techniques and explain how the errors in FEM can be rectified to get accurate results.	CO4 - U	(16)
15.	(a)	Discuss about problems with material nonlinearity and explain about solution methods for such problems.	CO5 - App	(16)
		Or		
	(b)	What is half band width in Finite Element Analysis? Write the impact of node numbering on the band width calculations with examples.	CO5 - U	(16)