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10CV841

**Eighth Semester B.E. Degree Examination, June/July 2018**  
**Finite Element Analysis**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting  
atleast TWO questions from each part.**

**PART – A**

- 1 a. Differentiate between :  
(i) Static and kinematic variable  
(ii) Internal node and external node  
(iii) Primary node and secondary node (06 Marks)  
b. Write constitutive laws for plane stress and plane strain conditions. (04 Marks)  
c. Obtain an expression for nodal force-displacement relation using energy principles. (10 Marks)
- 2 a. Explain advantages and disadvantages of finite element method. (06 Marks)  
b. A simply supported beam of span L and flexural rigidity EI is subjected to an uniformly distributed load of intensity W/unit length. Obtain expressions for deflection, slope, shear force and bending moment using Rayleigh-Ritz method. Also find their maximum values. Assume a trigonometric function. (14 Marks)
- 3 a. Explain the terms:  
(i) Local coordinates (ii) Global coordinates  
(iii) Generalized coordinates (iv) Natural coordinates. (08 Marks)  
b. What do you meant by aspect ratio? How it affects the solution? (04 Marks)  
c. What is band width minimization? Why it is required and how it is achieved? (08 Marks)
- 4 a. Calculate the nodal load vector due to uniformly varying load acting on the beam shown in Fig.Q4(a). (06 Marks)

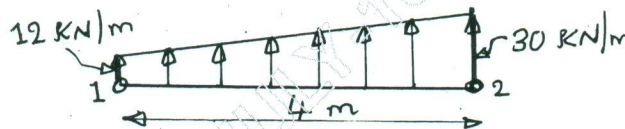


Fig.Q4(a)

- b. Obtain the shape function, strain-displacement matrix and stiffness matrix for a plane truss element in global direction. (14 Marks)

**PART – B**

- 5 Obtain the shape function, strain-displacement matrix and stiffness matrix for a constant strain triangle element used for two-dimensional plane stress/strain cases in Cartesian coordinates. (20 Marks)
- 6 a. What are the convergence and compatibility requirements of a good displacement model? Explain. (08 Marks)  
b. Using Lagrange function generate shape function for a 9-noded rectangular element. (12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.



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- 7 a. Explain the terms : Isoparametric, super parametric and subparametric elements. (09 Marks)  
b. Obtain the Jacobian matrix at Gauss point  $\xi = 0.57735$  and  $\eta = 0.57735$  for an isoparametric element with the following coordinates.

Node Number	Coordinates	
	X	Y
1	20	20
2	40	20
3	40	40
4	20	40

(11 Marks)

- 8 a. Explain in detail, the structure of a finite element analysis program. (10 Marks)  
b. List the desirable features of finite element analysis softwares. (06 Marks)  
c. Name any four commercially available Finite element analysis based softwares. (04 Marks)

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