

Name :

Roll No. :

Invigilator's Signature :

CS/M.TECH (SE)/SEM-1/SE-103/2011-12

2011

ADVANCED STRUCTURAL ANALYSIS

Time Allotted : 3 Hours

Full Marks : 70

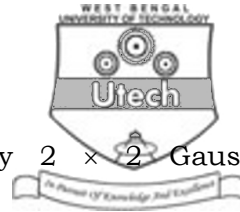
The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Answer any *five* questions.

5 × 14 = 70

1.
 - a) What is finite element method ?
 - b) Write the steps of finite element method.
 - c) Write the advantage and disadvantage of finite element method.
2.
 - a) What do you mean by shape function ? Write some properties of shape function.
 - b) Derive the shape function for three noded one dimensional element following local co-ordinate system.
3.
 - a) Write short notes on 'Jacobian matrix' and its use in finite element analysis of two dimensional problem.
 - b) Explain the terms 'isoparametric element', 'sub-parametric element', 'super-parametric element'.



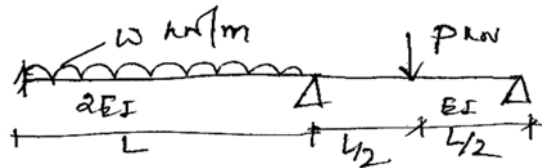
- c) Evaluate the following integral by 2×2 Gauss quadrature rule :

$$I = \int_{-1}^{+1} \int_{-1}^{+1} \frac{2 + \xi}{3 + \xi \eta} d\xi d\eta.$$

given for sampling points $\xi_i = \pm \left(\frac{1}{\sqrt{3}} \right)$ weight factor

$$w_i = 1.0.$$

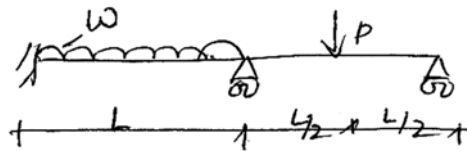
4. Derive the shape function of three noded triangular element having co-ordinate system of the vertices (2, 3), (7, 5), (5, 12) in global co-ordinate system.
5. Analyze the beam shown below by the stiffness matrix :



Assume $P = 20\text{kN}$, $W = 3\text{ kN/m}$, $L = 5\text{ m}$.

6. Analyze the beam shown in the fig. below by flexibility method assuming $P = W_L$.

$W = 5\text{ kN/m}$ and $L = 4\text{ m}$.



Draw the SFD and BMD.



7. Write short notes on the following :

- a) Local and global co-ordinate system
- b) Element stiffness matrix
- c) Equivalent joint load.

8. Solve the differential equation $\frac{d^2u}{dx^2} + u + x = 0, 0 < x < 1$

subject to the boundary conditions $u(0) = u(1) = 0$ by

- i) Galerkin approach
- ii) Least square method.

Assume approximate solution $\tilde{u} = x(1-x) + bx^2(1-x)$.

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