

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
SECOND SEMESTER M.TECH. DEGREE EXAMINATION, MAY 2016  
CIVIL ENGINEERING  
SPECIALIZATION: COMPUTER AIDED STRUCTURAL ENGINEERING

**10CE6104 FINITE ELEMENT METHOD**

Max. Marks : 60

Duration: 3 Hrs

**Part A**

*(Answer any two questions : 9 x 2 = 18 Marks)*

1. a) Briefly explain the principle of minimum potential energy.  
b) Differentiate between variational method and weighted residual method. 9 Marks
2. Explain the various steps involved in Finite Element Analysis with the help of an example. 9 Marks
3. Using Galerkin's method to obtain an approximate solution for the following boundary value problem.

$$u''(x) + u(x) + x = 0 ; 0 < x < 1$$

$$u(0) = 0; u(1) = 0$$

Assume a) a quadratic polynomial as a trial solution.

b) a cubic polynomial as a trial solution 9 Marks

**Part B**

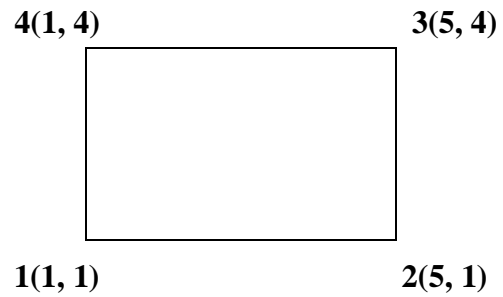
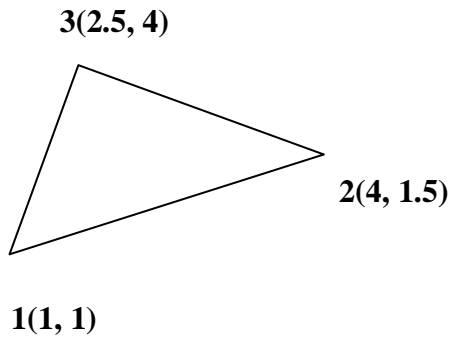
*(Answer any two questions: 9 x 2 = 18 Marks)*

4. a) Explain the advantages of isoparametric formulation. Explain sub parametric and super parametric elements.  
b) Explain Lagrange and Hermitian methods of deriving interpolation function. 9 Marks
5. Derive shape functions for three noded bar element using Lagrangian interpolation function. Also plot the variation of shape functions. 9 Marks
6. What are the prerequisites for the selection of displacement function in FEM ? 9 Marks

**Part C**

(Answer any two questions: 12 x 2 = 24 Marks)

7. Determine the interpolation functions for the following elements in Cartesian co-ordinates. Write the co-ordinate transformation also.



12 Marks

8. Explain briefly the formulation of axisymmetric solid element for axisymmetric loading case.

12 Marks

9. Using one and two Gauss-point numerical integration formula, evaluate the following integrals.

i)  $1 = \int_3^5 \frac{1}{x} dx$

ii)  $1 = \int_{-1}^1 \cos \pi x / 2 dx$

Compare the results with the exact integration

12 Marks