

**PARUL UNIVERSITY**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**M.Tech. Summer 2017 - 18 Examination**

**Semester: 2**  
**Subject Code: 03209151**  
**Subject Name: Finite Element Method**

**Date: 18/05/2018**  
**Time: 02:00 pm to 04:30 pm**  
**Total Marks: 60**

**Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

**Q.1** A) Explain the terms 'Plane stress' and 'Plane strain' problems. (05)

B) State and explain the Kirchhoff's assumptions involved in plate bending. (05)

C) What do you mean by concept of finite element analysis? Write down the steps involved in finite element analysis. (05)

**Q.2** Answer the following questions. (Attempt any three) (15)

A) Using Lagrange polynomial, find shape function for three noded bar element.

B) Explain the terms isoparametric, subparametric and superparametric elements.

C) Describe in short:

- a) Element aspect ratio
- b) Shape function

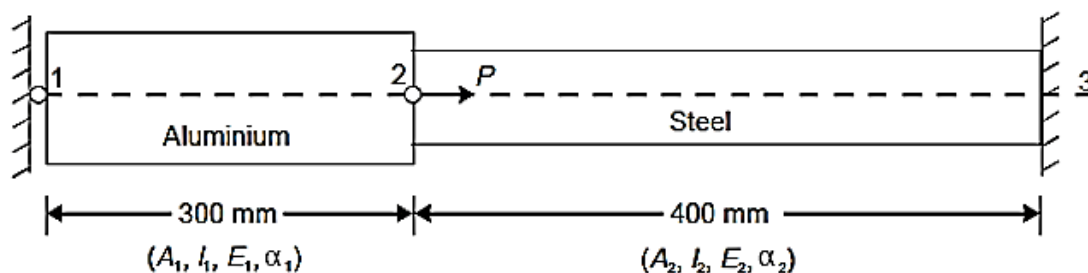
D) Write the difference between finite element method and finite difference method.

**Q.3** A) Write short note on pre and post processors. Also enlist the commercially available standard finite element analysis packages. (07)

B) Determine the nodal displacements at node 2 in the bar shown in the following **Figure. 1**, due to applied force,  $P = 400$  kN and temperature rise of  $30^\circ\text{C}$ . (08)

Given:

$A_1 = 2400 \text{ mm}^2$	$A_2 = 1200 \text{ mm}^2$
$I_1 = 300 \text{ mm}$	$I_2 = 400 \text{ mm}$
$E_1 = 0.7 \times 10^5 \text{ N/mm}^2$	$E_2 = 2 \times 10^5 \text{ N/mm}^2$ and
$\alpha_1 = 22 \times 10^{-6} / ^\circ\text{C}$	$\alpha_2 = 12 \times 10^{-6} / ^\circ\text{C}$



**OR**

B) Derive the expression for shape function for a two noded bar element taking natural coordinate  $\xi$  (08)  
as varying from -1 to 1.

**Q.4** A) What is meant by discretization of structures? Explain the various types of discontinuities in a structure briefly. (07)

**OR**

A) Derive strain-displacement matrix for Constant-Strain Triangular (CST) element. (07)

B) What do you mean by isoparametric formulation? State and explain the three basic laws on which isoparametric concept is developed. (08)