

Roll No



**PRESIDENCY UNIVERSITY  
BENGALURU**

**SET A**

**SCHOOL OF ENGINEERING  
END TERM EXAMINATION - JAN 2024**

**Semester :** Semester V - 2021

**Course Code :** MEC3091

**Course Name :** Finite Element Analysis

**Program :** B.Tech.

**Date :** 10-JAN-2024

**Time :** 9:30AM - 12:30 PM

**Max Marks :** 100

**Weightage :** 50%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

**PART A**

**ANSWER ALL THE QUESTIONS**

**4 X 5M = 20M**

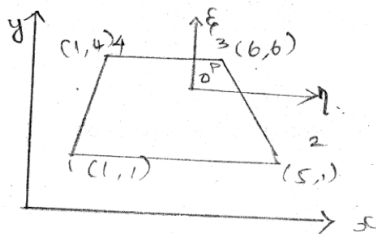
1. What are the various methods of formulation of material properties in FEA?  
(CO1) [Knowledge]
2. What are the advantages and disadvantages of FEA?  
(CO2) [Knowledge]
3. How the material behaviour is defined in FEA?  
(CO3) [Knowledge]
4. What is finite element methods and how it is utilized?  
(CO4) [Knowledge]

**PART B**

**ANSWER ALL THE QUESTIONS**

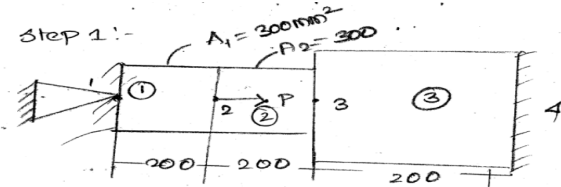
**5 X 10M = 50M**

5. For the iso parametric four node co-ordilateral element shown in figure. Determine co-ordinate at point P which is local coordinates  $\zeta = 0.5$  and  $\eta = 0.5$ .



(CO1) [Comprehension]

6. Consider a bar as shown in figure having  $E = 2 \times 10^5 \text{ N/mm}^2$ ,  $P=400 \text{ kN}$ ,  $A_1 = A_2 = 300 \text{ mm}^2$ ,  $A_3 = 600 \text{ mm}^2$ . Calculate the 1. Nodal displacement, 2. Element stress and 3. Support reactions

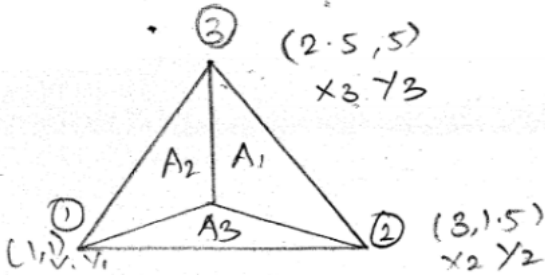


(CO2) [Comprehension]

7. Find the matrix of quadratic form for the following equation  $X^2 - 2Y^2 + 3Z^2 - 3YZ + 6XZ$

(CO3) [Comprehension]

8. Below represents the image in which the interior point P at (4,2) divides the three areas namely  $A_1$ ,  $A_2$  and  $A_3$ . Determine  $A_1/A$ ,  $A_2/A$  and  $A_3/A$ .



(CO4) [Comprehension]

9. Using co-factor method, determine the inverse of  $3 \times 3$  matrix of your own chosen values.

$$\begin{bmatrix} 8 & -2 & 0 \\ -2 & 9 & -3 \\ 0 & -3 & 3 \end{bmatrix}$$

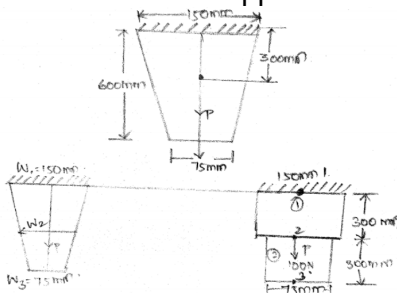
(CO3) [Comprehension]

### PART C

ANSWER ALL THE QUESTIONS

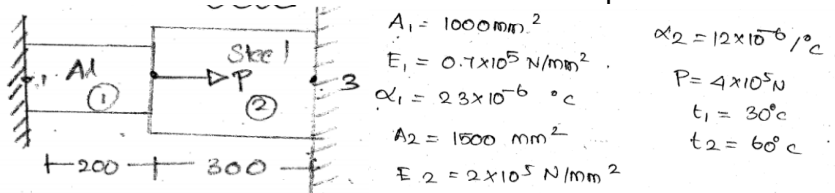
2 X 15M = 30M

10. Consider a steel plate of uniform thickness 25mm. Take  $E = 2 \times 10^5 \text{ MPa}$  and weight density as  $0.82 \times 10^{-4} \text{ N/mm}^3$ . The plate is subjected to a point load of 100 N. Calculate the following 1. Global force vector. 2. Global stiffness matrix 3. Displacement in each element 4. Stress in each element and Reaction force at support.



(CO3) [Application]

11. An axial load of  $3 \times 10^5 \text{ kN}$ , is acting at temperature of 30 degree celcius to the rod as shown. The temperature is raised to 60 degree celcius. Find 1. stiffness and force matrix 2. Load displacement 3. stress and 4. Reaction force.



(CO4) [Application]