M.Tech. Mechanical Engineering Design (CBCS) Semester - II

MED22 - Finite Element Analysis

P. Pages : 2 **GUG/S/23/14194**

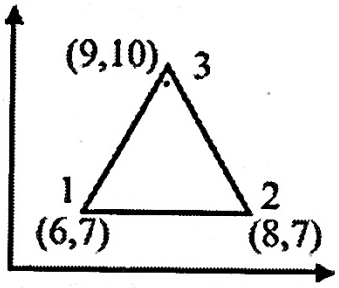
Time : Three Hours * 2 9 2 8 * Max. Marks : 70

Notes : 1. All questions carry equal marks.
2. Solve **any five** questions.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.

1. Derive the shape function for 4 noded rectangular element by using natural co-ordinate system. **14**

2. Calculate the element stiffness matrix for the axis symmetric triangular element shown in figure. Element experiences a 15°C increase in temperature. The co-ordinate are in mm. **14**

$\alpha = 10*10^{-6}/^{o}C$ $E = 2*10^{5} N/mm^{2}, 1/m = 0.25$



3. a) Explain in detail the isoparametric element & its uses. **5**

b) Derive an expression for strain displacement relation matrix B, for a linear bar element. **9**

4. A axial force P = 400kN is applied to a composite block shown in figure. Determine the stress in each material. **14**

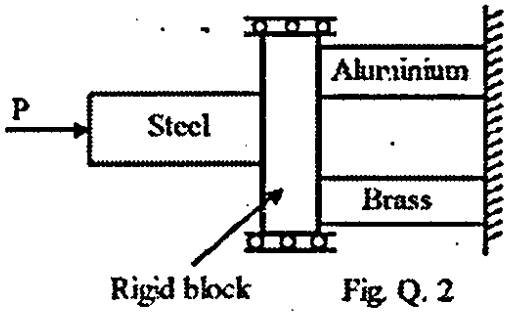
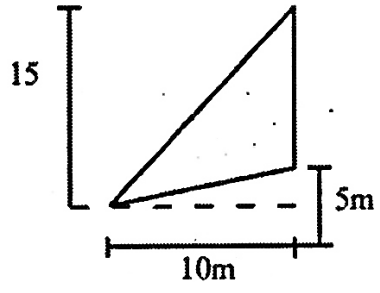


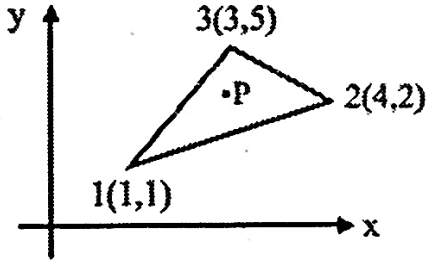
Fig. Q. 2

Steel	Alluminium	Brass
Area = 1000mm^2	Area = 600mm^2	Area = 600mm^2
E = 200 GPa	E = 70 GPa	E = 105 GPa
L = 400 mm	L = 400 mm	L = 400 mm

5. For the triangular element as shown in figure determine displacement matrix [B] and constitutive matrix [D], assume plane stress condition, Take $\mu = 0.3$, $E = 30 * 10^6 N/m^2$ and thickness t = 0.1m. Also calculate the element matrix for triangular element. **14**



6. For the point 'P' located inside the triangle shown in figure, shape functions N1 = 0.15 and N2 = 0.25. Determine the x, y co-ordinates of point P. **14**



7. Write a note on **any two**. **14**

1) Steps involved in FEM.

2) Natural coordinates and Shape functions.

3) Raleigh Ritz Method

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