

--	--	--	--	--	--	--	--	--	--

First Semester M.Tech. Degree Examination, Dec. 2013/Jan. 2014
Finite Element Method

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

1. a. Explain the steps involved in finite element method, with suitable example. (10 Marks)
 b. List the engineering application of FEM. (05 Marks)
 c. Discuss the advantage and limitations of FEM. (05 Marks)
2. a. What are the shape functions? Derives the shape function for 1 – D bar element in natural co-ordinates. (10 Marks)
 b. Explain the convergence criterion. (05 Marks)
 c. Write a note on properties of a shape function. (05 Marks)
3. a. Determine the displacement, strain and stress in the bar subjected to concentrated load as shown in Fig. Q3(a). Take $P = 12 \text{ kN}$, $E_{\text{steel}} = 210 \text{ GPa}$; $E_{\text{Aluminium}} = 70 \text{ GPa}$; $A_1 = 0.02 \text{ m}^2$; $A_2 = 0.01 \text{ m}^2$. (15 Marks)

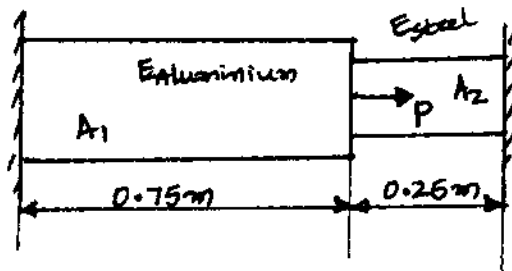


Fig. Q3(a)

- b. Explain the various considerations for discrimination process. (05 Marks)
4. A four bar truss element is shown in Fig. Q4. Determine the following :
 i) Nodal displacement
 ii) Stress in each element. (20 Marks)

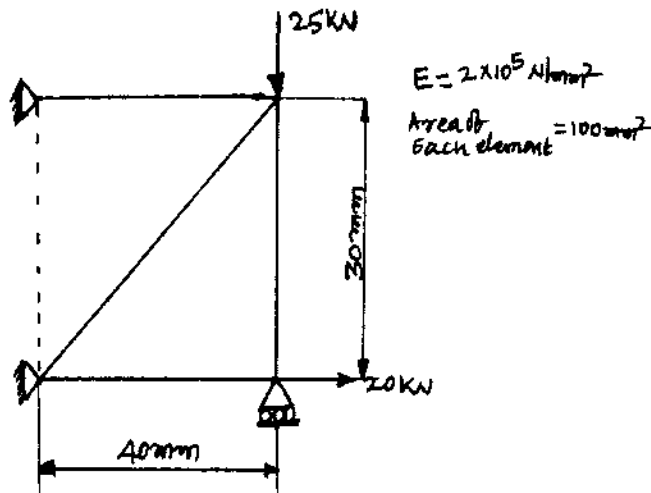


Fig. Q4
1 of 2

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 5 a. A rectangular bar is subjected to an axial load 'P' as shown in Fig. Q5(a). Determine the expression for potential energy functional and hence determine the extreme value of the PE following data $E = 200 \text{ GPa}$, $P = 3 \text{ kN}$; $l = 100 \text{ mm}$, $b = \text{width} = 20 \text{ mm}$; $t = 10 \text{ mm}$.

(10 Marks)

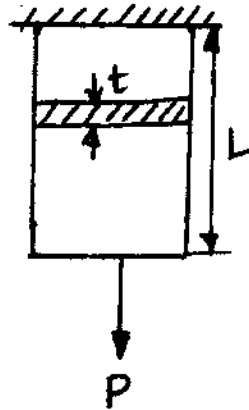


Fig. Q5(a)

- b. Using the principle of minimum potential energy determine the displacement at nodes for a spring system. Fig. Q5(b).

(10 Marks)

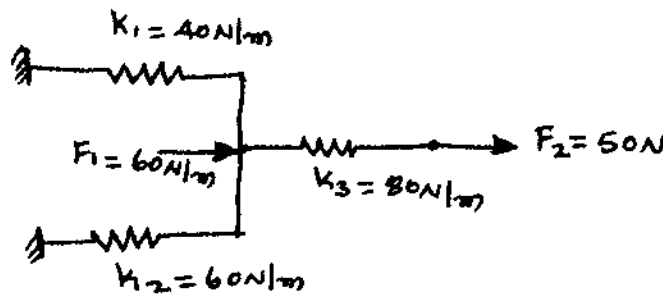


Fig. Q5(b)

- 6 a. Explain the various steps in the design process and the salient features of parametric and variational design. (10 Marks)
- b. Explain the integrated data base management system in CAE. (10 Marks)
- 7 a. Write the 3D homogenized transformation matrices. (10 Marks)
- b. Explain 3D transformation used 3D rotation of object. (10 Marks)
- 8 a. Explain the various construction techniques and representation scheme used in solid modeling. (10 Marks)
- b. Explain the salient features of cubic splines and Bezier curves. (10 Marks)
