<div align="right">**10MAR12**</div>
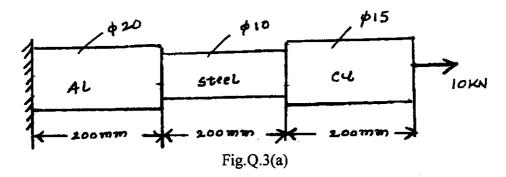
First Semester M.Tech. Degree Examination, December 2011
Finite Element Methods

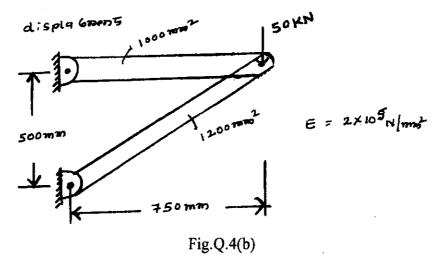Time: 3 hrs.   Max. Marks:100

*Note: **Answer any FIVE full questions.***

1   a. Explain the salient features of FEM and steps in FEM to solve any problem.   **(10 Marks)**

      b. What is discretization? Explain with neat sketches, 1D, 2D and 3D elements, used for discretization.   **(10 Marks)**

2   a. What are the various considerations for discretisation process? Explain in detail.   **(10 Marks)**

      b. Compare 1D linear, 1D quadratic and 1D cubic elements.   **(04 Marks)**

      c. Derive the shape functions for an 1D linear element.   **(06 Marks)**

3   a. Determine the deflection and stresses in three different portions of the rod shown in Fig.3(a).

Fig.Q.3(a)

$E_{AL} = 0.67 \times 10^5$ MPa ; $E_{steel} = 2.1 \times 10^5$ N/mm^2 ; $E_{cu} = 1.23 \times 10^5$ MPa.   **(14 Marks)**

      b. Explain the principle of minimum potential energy and its approach to FEM.   **(06 Marks)**

4   a. Derive the element stiffness matrix for a truss element.   **(08 Marks)**

      b. A truss, shown in Fig.Q.4(b), is subjected to a load of 50 kN. Determine the nodal displacements.   **(12 Marks)**

Fig.Q.4(b)

5 a. Explain the various engineering functions integrated in CAE product development approach and write the advantages of this approach. **(08 Marks)**

 b. Explain the integrated database management system used in CAE. **(08 Marks)**

 c. Explain the simulation based design. **(04 Marks)**

6 a. Write the homogeneous transformation matrix for 2D translation, scaling, rotation and reflection. Explain its use, with an example. **(10 Marks)**

 b. A rectangle is formed between points (2, 3), (6, 3), (6, 7) and (2, 7). Determine its position after taking the

 i) Reflection about the line joining (2, 3) and (2, 7).

 ii) Reflection about the line joining (2, 7) and (6, 7). **(10 Marks)**

7 a. Write the 3D transformation matrices. **(06 Marks)**

 b. Write the concatenated matrix for rotating a 2D object about a point (3, 4) in a clockwise direction by 30°. **(06 Marks)**

 c. Explain the characteristic features of cubic splines and Bezier curves. **(08 Marks)**

8 a. What are the techniques used for construction and editing of solid objects? Explain in detail. **(10 Marks)**

 b. What are the different representation schemes, used for representing a 3D solid object? Explain with examples. **(10 Marks)**

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