Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Examination July 2010

Subject code: 720801

Subject Name: Finite Element Method

Date: 05 / 07 /2010 **Time: 11.00am – 1.30pm**

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) Explain the shape function in natural co-ordinate system. **06**

(b) Explain in detail the discretization process with respect to following points. **06**

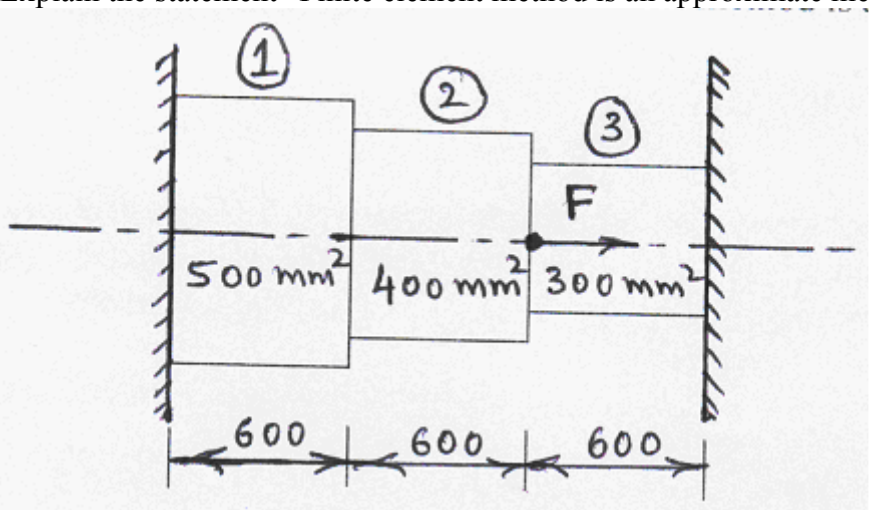
(i) Type of elements (iv) Numbering of elements

(ii) Size of elements (v) Node numbering system

(iii) Location of nodes

Q.2 (a) Explain the statement "Finite element method is an approximate method". **06**

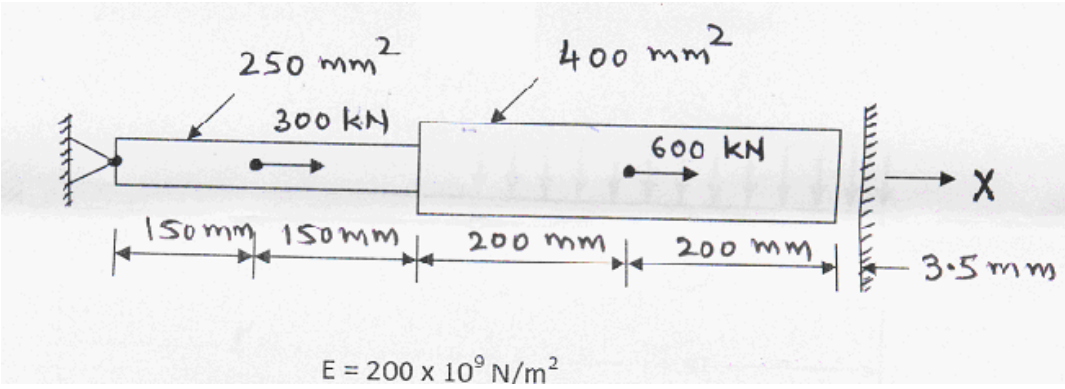
(b) **06**



A stepped shaft is as shown in above fig. Determine the stresses and deflections in each of the sections. Assume uniform material having E = 90 GPa and the axial force F as 50 kN. Use Penalty approach.

OR

(b) **06**



Consider the bar as shown in above fig. Determine the nodal displacements, element stresses and support reactions using elimination approach.

Q.3 (a) Explain the following elements used in FEA stating their applications. Draw their sketches showing position of nodes. **06**

(i) Plate bending elements

(ii) Curved shell elements

(iii) 3 D solid elements.

(b) Explain isoparametric element formulations. **06**

OR

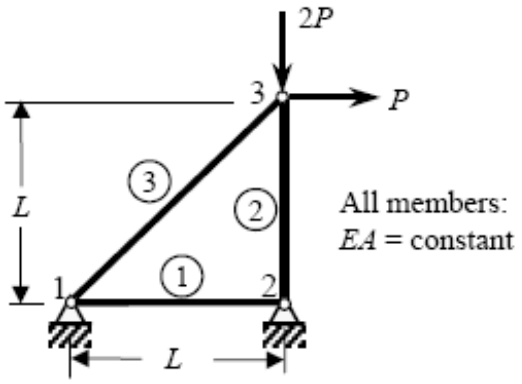
Q.3 **(a)** Explain the mesh generation technique for finite element analysis. **04**

(b) Explain the post processor and pre-processor in finite element software. **04**

(c) Explain at least five different commands used with any 3 D modeling software. Explain the same with suitable example. **04**

Q.4 **(a)** What is plane truss? Derive the Element stiffness matrix for plane truss in Global Coordinate system. **06**

(b) Determine the displacements at point 3 (Figure Shown below) using Finite Element Method. All members are made of same material and are of same cross section. **06**



OR

Q.4 **(a)** What is CST element? Obtain the strain matrix for CST element. **06**

(b) What is the significance of numerical integration in two dimensional finite element analysis? Explain in detail by giving examples. **06**

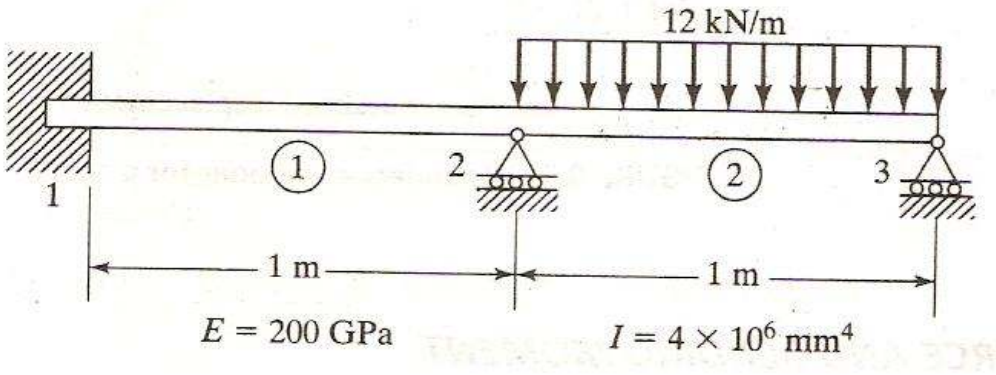
Q.5 **(a)** Define the Following terms **06**

(i) Pre-Processors (ii) Solver (iii) Post-Processors

(b) For the beam loading shown in Fig. Determine **06**

(1) The slopes at 2 and 3 and

(2) The vertical deflection at the midpoint of the distributed load.



OR

Q.5 **(a)** How would you formulate a frame element that would enable us to model a buckling problem? **06**

(b) Using FEM find the temperature distribution in one dimensional fin. **06**

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