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Reg. No. : .....

Name : .....

First Semester M.Tech. Degree Examination, March 2013
(2008 Scheme)
(Mechanical-Machine Design)
MDC 1005 : FINITE ELEMENT METHOD

Time : 3 Hours Max. Marks : 100

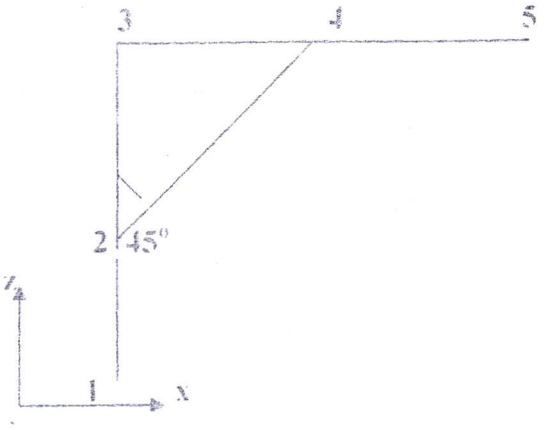
Instruction : *Answer* ***any 5*** *questions.*

I. a) Explain C^0 and C^1 continuity of functions. 5

b) Derive the Element of Stiffness matrix for constant strain triangle. What are the characteristics of the element ? 15

II. a) Compare Global, Local and Natural coordinate systems. 5

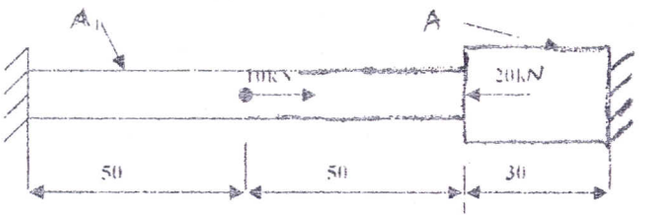
b) What is a transformation matrix ? Obtain transformation matrices for the 5 elements shown in the structure, if two node beam elements (two DOF/node) are used for idealization. Also find the size of global stiffness matrix. 15



P.T.O.

III. a) Name two FE software and discuss the features. 5

b) Find the displacements, strains and stresses in the bar shown in figure using FEM. (A_1 = 10 cm^2, A_2 = 20 cm^2, E = 20 MN/cm^2). 15



IV. a) Derive the element body force vector for a 2-node axial element. 5

b) Distinguish between consistent mass matrix and lumped mass matrix. 5

c) Discuss h and p methods of refinement. 5

d) Discuss rigid body modes of vibration analysis. 5

V. a) Discuss the types of elements used in FEM. 5

b) Discuss Axisymmetric analysis. Explain how problems with axi-symmetric geometry having non-axisymmetric loads are handled in FEM. 5

c) Using 2 element discretisation find the displacements, strain and stresses in a rod (E = 210 GPa, length 1 m, density 7800 kg/m^3 and uniform cross section 10 cm^2), suspended vertically and subjected to self weight alone. 10

VI. a) Write notes on bandwidth reduction techniques. 5

b) Estimate the natural frequencies of axial vibration of a cantilever bar of length 1 m, Young's Modulus E = 210 GPa and density ρ = 7800 kg/m^3 and area of cross section A = 40×10^{-6} m^2. 15