Reg.No.					



MANIPAL INSTITUTE OF TECHNOLOGY

Manipal University, Manipal – 576 104



II SEM M. Tech. (CAMDA/Mfg Engg & Tech) DEGREE END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: FINITE ELEMENT METHODS (MME 561) REVISED CREDIT SYSTEM

Time: 3 Hours.

MAX.MARKS: 50

Instructions to Candidates:

- Answer ANY FIVE FULL questions.
- ✤ Use of a <u>certified data sheet</u> is permitted.

• 3

- Missing data, if any, may be assumed appropriately.
- a) Discuss the factors to be considered while discretizing the geometry to obtain Finite Element Model. [04]

b) For the spring assemblage shown in Fig. Q.1b, evaluate the unknown displacements using *potential energy method*. [06]

Fig. Q 1b

 a) Obtain the stiffness matrix of two-dimensional 4-node isoparametric plane stress/strain element in the form, [06]

$$\int_{-1}^{+1} \int_{-1}^{+1} [B]^T [D][B]h|J|dsdt$$

Where, [B] = Strain-displacement matrix [D] = Stress-strain matrix J = Jacobian matrix h = thickness of element

b) What is modal analysis? Discuss the theoretical formulation of modal analysis problems. [04]

 Evaluate the unknown displacements, rotations and reactions in the plane frame structure shown in Fig. Q. 3 [10]



Fig. Q 3

4. a) What is thermo-mechanical analysis? Discuss the theoretical formulation of thermo-mechanical problems [04]

b) Obtain the stiffness matrix of a beam element in XY plane by Galerkin's Weighted Residual method. [06]

5. a) Evaluate the stiffness matrix in the global Cartesian coordinate system for a plane stress triangular element i – j - m defined by the coordinates (4, 4), (10, 6) and (7, 10) respectively, with x-axis of element coordinate system along i -j side of the element. Let E = 200 GPa, μ = 0.3 and t = 10 mm. [06]

b) What are higher order elements? With examples highlight the advantages of these elements over first order elements. [04]

6. a) What is displacement function? What are the differences between displacement and shape functions in FEM? Discuss with examples . [04]

b) For the plane truss supported by the spring shown in Fig. 6b, evaluate the unknown displacements and element stresses. Let E = 210 GPa, $A = 5x10^{-4}$ m². [06]



Fig. Q 6b