Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

II SEM M. Tech. (CAAD and T&M) DEGREE END SEMESTER EXAMINATIONS APRIL 2019

SUBJECT: FINITE ELEMENT METHODS (MME 5202)
REVISED CREDIT SYSTEM

Time: 3 Hours. Max. Marks: 50

Instructions to Candidates:
- Answer **ALL** questions.
- Missing data, if any, may be assumed appropriately.
- The use of **CERTIFIED DATA SHEET** is permitted.

1. a) What are higher order elements? With examples highlight the advantages of these elements over first order elements. **(04)**

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

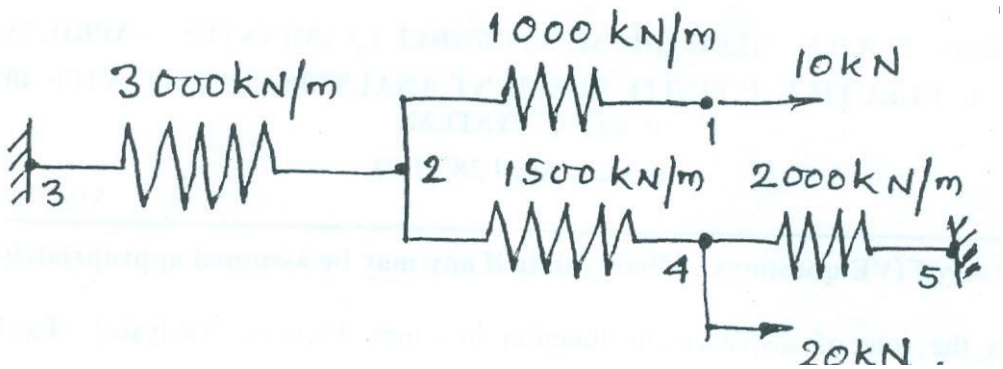

Fig. Q. 1b

2. a) Obtain the shape functions of a beam element in X-Y plane. **(04)**

   b) Evaluate the unknown displacements and element stresses for the plane truss shown in **Fig. Q. 2b.** Let E = 200 GPa and A = 4 x 10^{-4} m^2 for all the elements as per their relevance. **(06)**

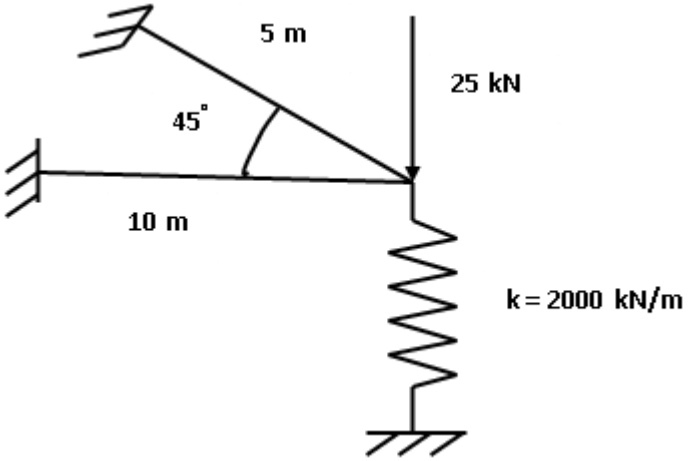

Fig. Q. 2b

3. Evaluate the unknown displacements and rotations in the plane frame shown in **Fig. Q. 3**. Let F_1 = 5000N, F_2 = 8000N, F_3 = 3000N, E = 207 GPa, I = 5x10^{-4} m^4 and A = 5x10^{-2} m^{-2}. **(10)**

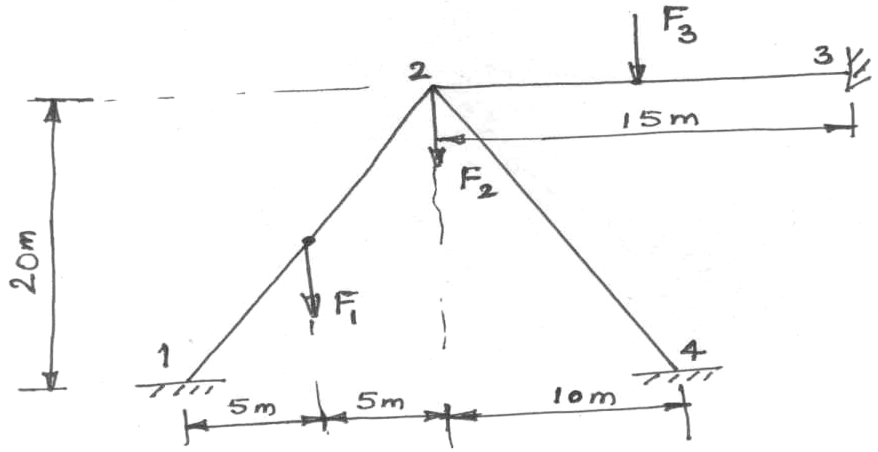

Fig. Q. 3

4. a) Obtain the stiffness matrix of an arbitrarily oriented truss element in XY plane **(05)**

   b) Evaluate the stiffness matrix in the global Cartesian coordinate system for a plane stress triangular element i – j - m defined by the coordinates (40, 40), (100, 60) and (70, 100) respectively with all dimensions are in millimeter. Let E = 200 GPa, μ = 0.3 and t = 10 mm. **(05)**

5. a) Discuss the factors to be considered while discretizing the geometry to obtain Finite Element Model **(04)**

   b) For the beam shown in **Fig. Q. 5b**, evaluate the unknown displacements and rotations. **(06)**

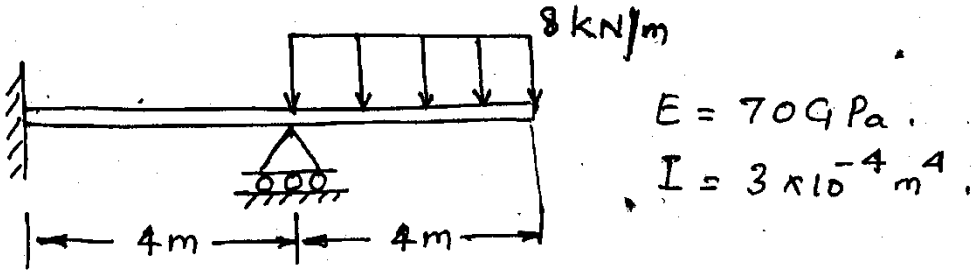

Fig. Q. 5b