Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: **PE-III** FINITE ELEMENT METHODS [AAE 4028]

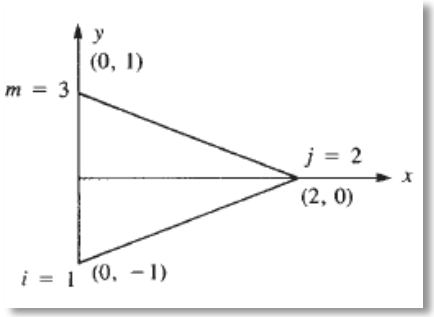
REVISED CREDIT SYSTEM
(24/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

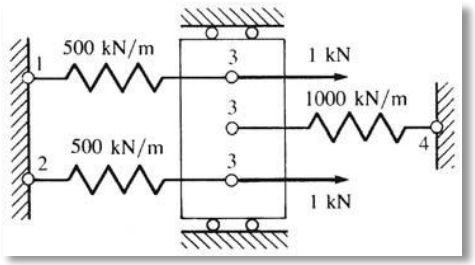
- Answer **ALL FIVE FULL** questions.
- Missing data, if any, may be suitable assumed.

1A. Evaluate the stiffness matrix for the element shown in Figure 1. The coordinates are shown in units of inches. Assume plane stress conditions. Let E = 30 e6 psi, v= 0.25, and thickness t =1 in. Assume the element nodal displacements have been determined to be u1 = 0, v1= 0:0025 in., u2 = 0.0012 in., v2 =0, u3 =0, and v3 =0.0025 in. Determine the element stresses. (All units in inches) **(07)**



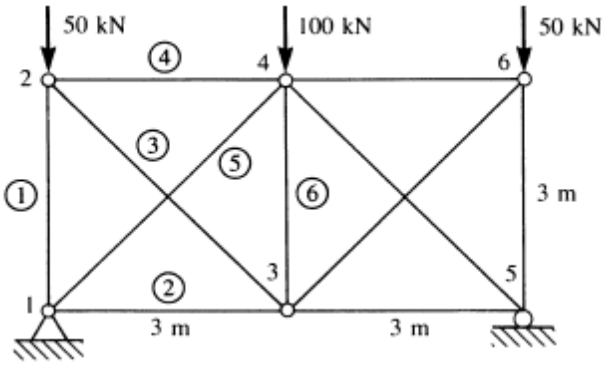
1B. Enumerate the applications of beam and truss elements in day to day applications. **(03)**

2A. For the spring assemblages shown in Figure 2, determine the nodal displacements, the forces in each element, and the reactions. Use the direct stiffness method. **(06)**



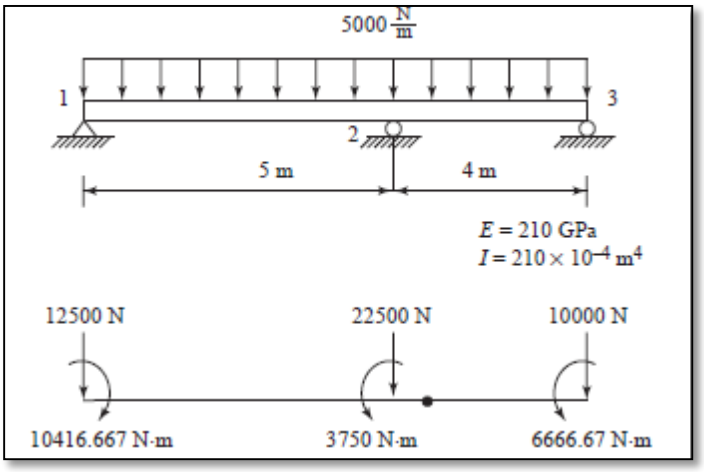
2B. With a neat sketch, deduce the relation for local coordinate conversion to a global coordinate. Consider a bar element. **(04)**

3A. For the plane trusses shown in Figure, solve for the nodal displacements, element forces, stresses and reactions. Let A = 0.0003 m^2 , E =70 GPa for each truss. Use symmetry. **(07)**



3B. For the above arrangement, calculate element stresses. **(03)**

4. For the beam shown in Figure, determine the nodal displacements, forces in each element, and the reactions. **(10)**



5A. Briefly explain CST and LST elements. Mention any 2 use cases for each element. **(05)**

5B. For a 3-spring assemblage with stiffness k1, k2 and k3, with all notations, equilibrium equations, deduce the stiffness matrix and mention its reaction forces. **(05)**