Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: FINITE ELEMENT METHODS [AAE 405]

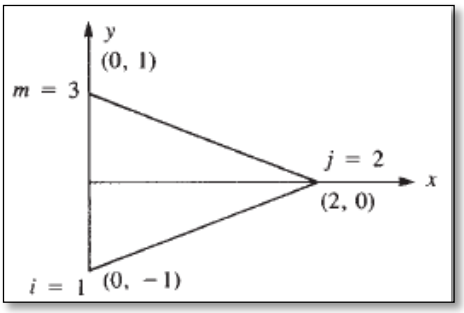
REVISED CREDIT SYSTEM
(28/11/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Evaluate the stiffness matrix for the element shown in figure below. 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 u_1= 0.0, v_1=0.0025 in., u_2 = 0.0012 in., v_2 = 0.0, u_3 = 0.0, and v_3 = 0.0025 in. Determine the element stresses. **(07)**

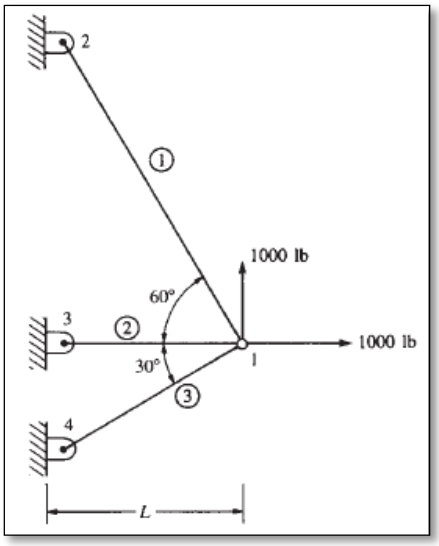


1B. Mention the assumptions and sign conventions used in beam theory. **(03)**

2A. 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. **(07)**

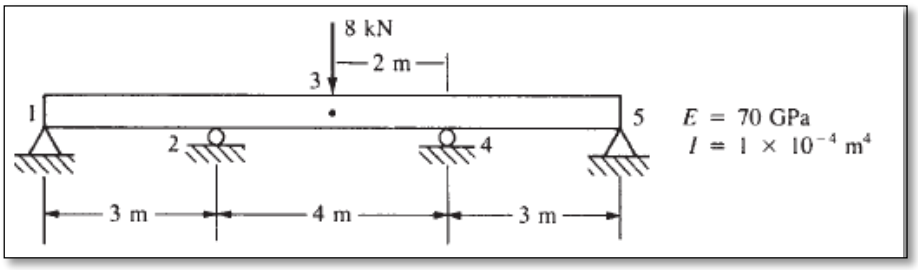
2B. Enumerate the applications of beam and truss elements in aircraft structure. **(03)**

3A. For the truss shown in figure below, solve for the horizontal and vertical components of displacement at node 1 and determine the stress in each element. All elements have A= 1 $in.^2$ and E = 10 e6 psi. Let L = 100 in. **(08)**



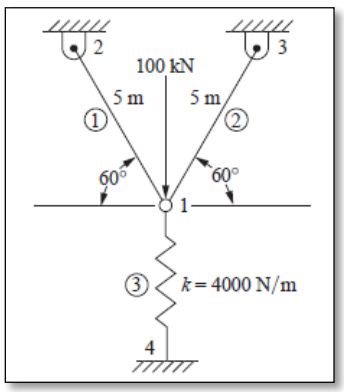
3B. For the above arrangement, verify force equilibrium at node 1 **(02)**

4A. For the beam shown below, using the principle of symmetry, determine the displacement at each node, forces in each element and reactions. **(08)**



4B. For the above beam, draw the SFD, BMD and FD **(02)**

5A. For the plane truss supported by a spring, as show in the figure below, determine the nodal displacements and reactions. Take E= 210 GPa and A= 5e-4 m^2 **(07)**



5B. For the above arrangement, calculate the stress in each element. **(03)**

6A. With a neat sketch, deduce the relation for local coordinate conversion to a global coordinate. Consider a bar element. **(05)**

6B. For the bar elements, evaluate the stiffness matrix and the generalized stress- strain relation. **(05)**