Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: FINITE ELEMENT METHOD [AAE 405]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

1A. For the spring element shown in Figure1, determine the displacements and global reaction. **(05)**

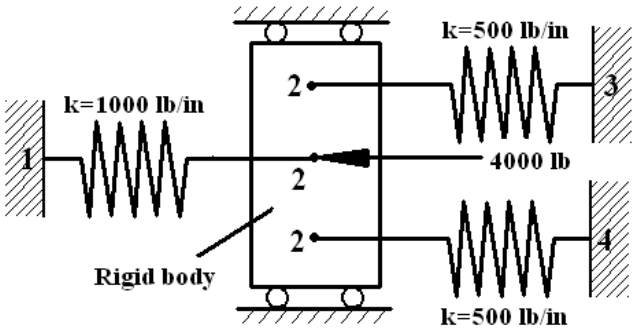


Figure 1

1B. For the spring assemblages shown in Figure 2, determine the nodal displacements of node 2 & Force applied on node 3, the forces in each element. Use the direct stiffness method to solve. **(05)**

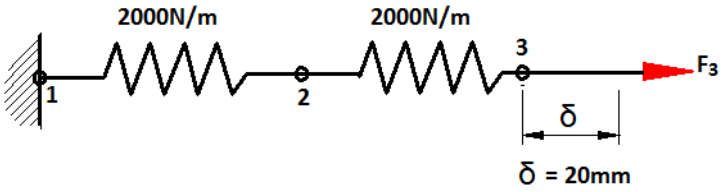


Figure 2

2A. For the beam assemblages shown in Figure 3, determine the nodal displacements, the global reaction forces. E= 70 GPa, I= $1X10^{-4}$ m^4 **(05)**

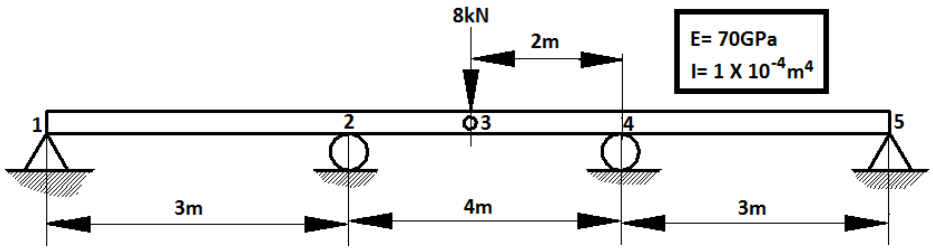


Figure 3

2B. Use the principle of minimum potential energy to solve the spring problems shown in Figure 4. Find the displacement of nodes 2, 3 and 4. **(05)**

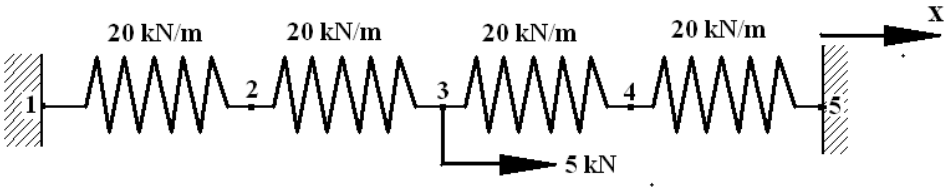


Figure 4

3A. For the symmetric plane truss shown in Figure 5, determine, the deflection of node 1 and stresses in elements. AE/L for element 3 is twice AE/L for the other elements. Let AE/L = 10^6 lb/in. Then let A = 1 in^2, L = 10 in., and E = 10X10^6 psi **(07)**

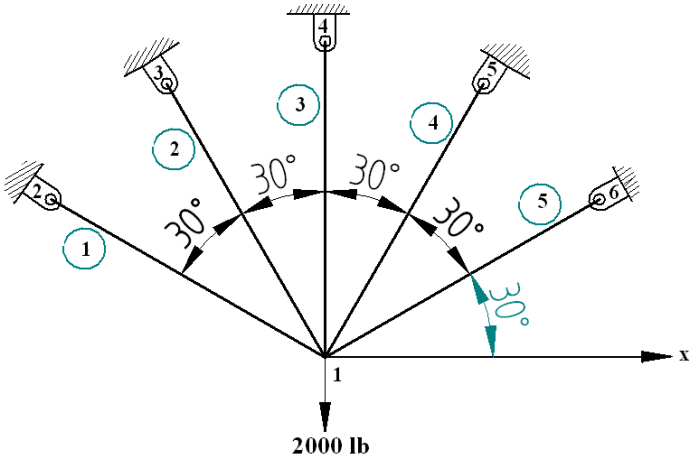


Figure 5

3B. Write the steps involved in the FEM analysis. **(03)**

4. For the beams shown in Figure 6, with internal hinge. Determine the nodal displacements and slopes. Let E=210GPa, I = 2x10^{-4} m^4. **(10)**

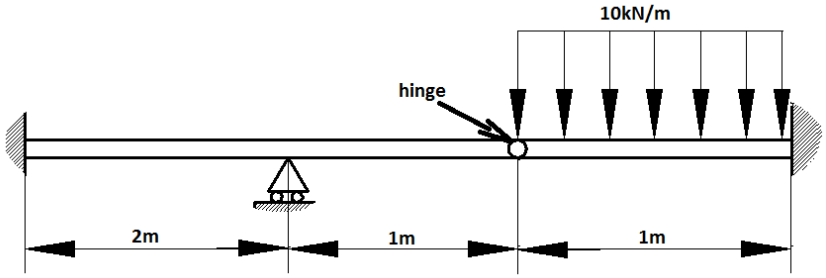
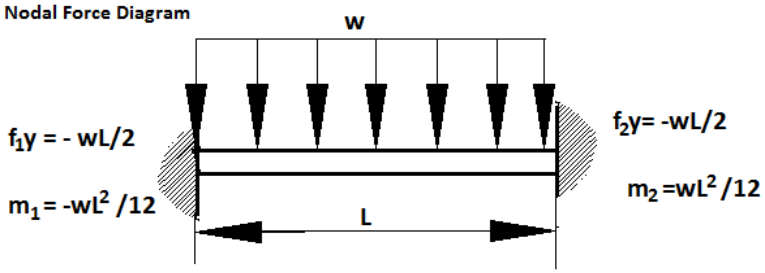


Figure 6



5. The four bar truss shown in the figure 7. Determine the nodal displacement, stresses in each element. All element have E= 200GPa and A= 500mm^2. **(10)**

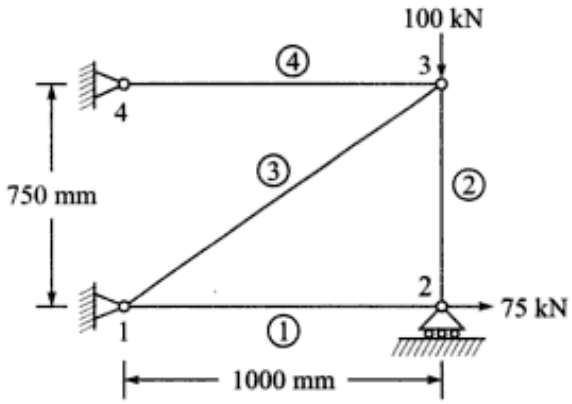


Figure 7

6. For the plane strain elements shown in Figure 8 , the nodal displacements are given as **(10)**

u1 = 0.001 in: v1 = 0.005 in: u2 = 0.001 in:
v2 = 0.0025 in: u3 = 0.0 in: v3 = 0.0 in:

Determine the element stresses $\sigma_x, \sigma_y, \tau_{xy}, \sigma_1, \text{and } \sigma_2$ and the principal angle θ_p. Let E = 30X10^6 psi and $\vartheta = 0.25$, and use unit thickness for plane strain. All coordinates are in inches.

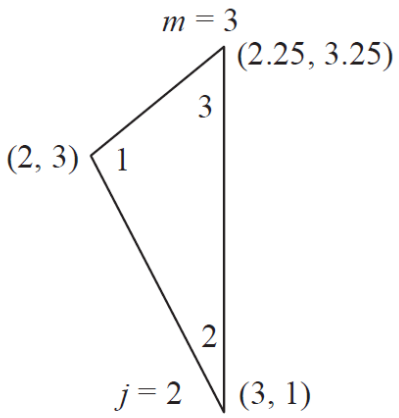


Figure 8