Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University, Manipal – 576 104

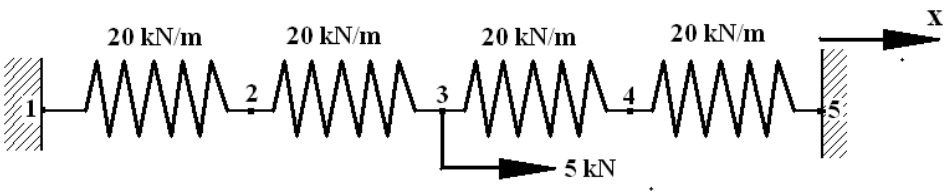
VI SEMESTER B.TECH (AUTOMOBILE ENGINEERING)
END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: PROGRAM ELECTIVE II - FINITE ELEMENT METHOD (AAE- 372)
REVISED CREDIT SYSTEM

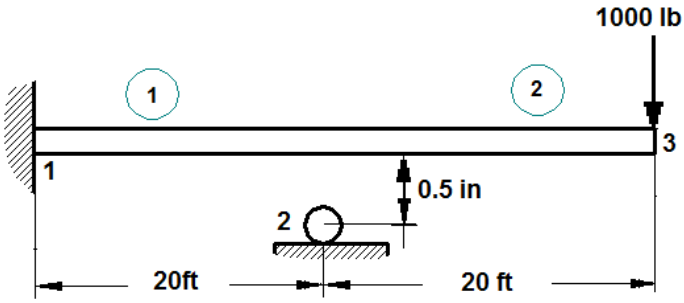
Time: 3 Hours. MAX.MARKS: 50

Instructions to Candidates:
- Answer **ANY FIVE FULL** questions.
- Missing data, if any, may be suitably assumed and stated clearly.

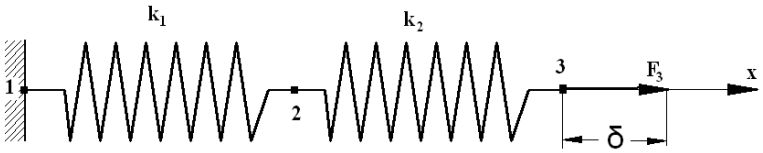
1A) For the spring assemblages shown in Figure, determine the nodal displacements, the forces in each element. Use the direct stiffness method for problem. (05)



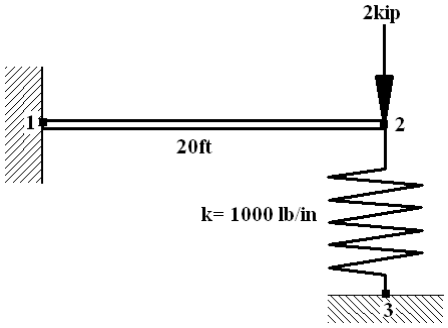
1B) For the beams shown in Figure, determine the displacements and the slopes at the nodes. Given: E= 30X10^6 psi, I=100 in^4. (05)



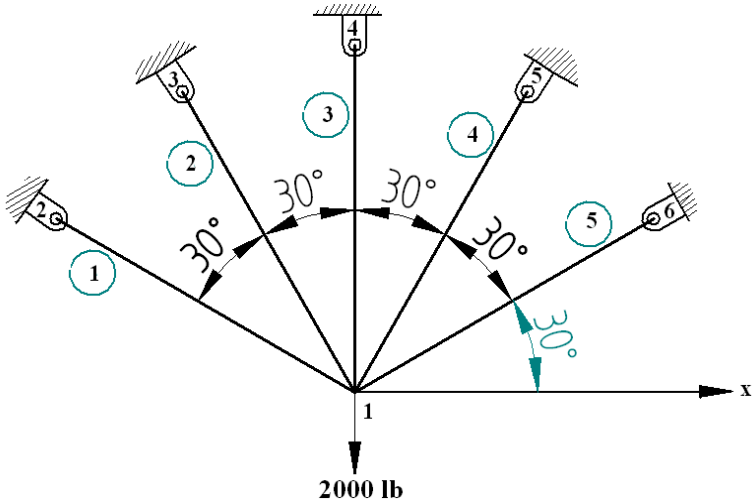
2A) For the spring assemblage shown in Figure, determine the displacement at node 2 and the force F3. Given: Node 3 displaces an amount δ= 1 in. in the positive x direction because of the force F3 and $k_1 = k_2 = 500$ lb/in. Use the principle of minimum potential energy to solve the problem. (05)



2B) For the beams shown in Figure, determine the displacements and the slopes at the nodes. $E = 29 \times 10^6\ psi, I = 200\ in^4$. (05)

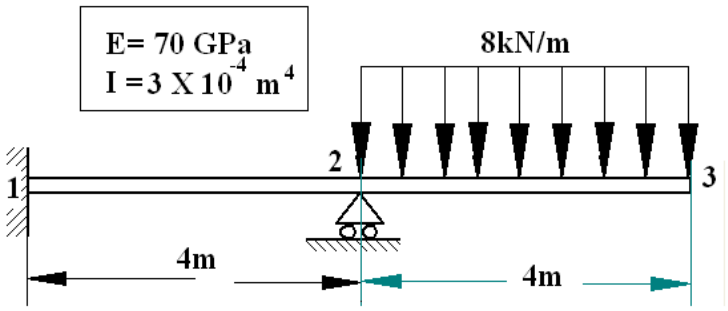


3A) For the symmetric plane truss shown in Figure, determine (a) the deflection of node 1. AE/L for element 3 is twice AE/L for the other elements. Let AE/L = 10^6 lb/in. Then let A = 1 in^2, L = 10 in., and E = $10X10^6$ psi to obtain numerical results. (07)

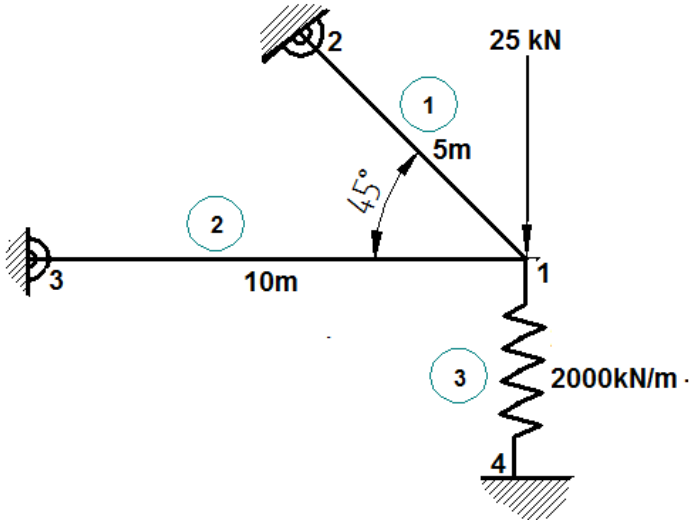


3B) Briefly explain the co-ordinate systems used in FEM (03)

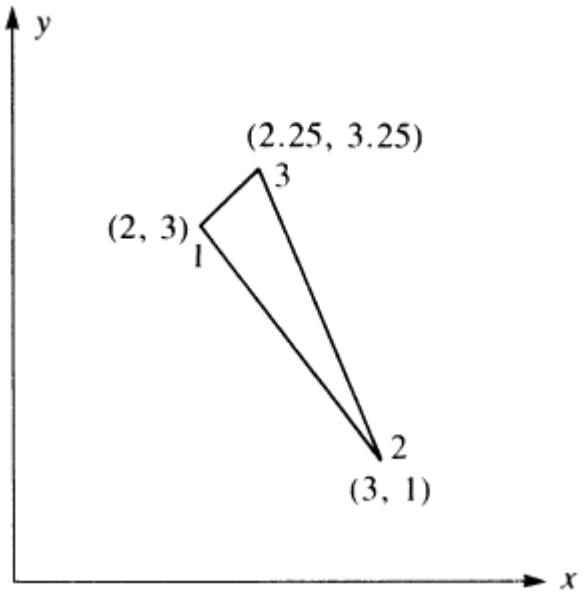
4) For the beams shown in Figures, determine the nodal displacements and slopes, the reaction in each element. (10)



5) Solve the two-bar truss supported by a spring shown in Figure. Both bars have E = 210 GPa and A = 5X104 m2. Bar one has a length of 5 m and bar two a length of 10 m. The spring stiffness is k = 2000 kN/m. Determine the element stiffness matrix, unknown displacement and stresses in the bar elements. (10)



6) For the element shown in Figure. The coordinates are shown in units of inches. Let E= $30X10^6$ psi, v= 0.25, and unit thickness for plane strain. Assume the element nodal displacements have been determined to be u_1 = 0.001 in, v_1 = 0.005 in., u_2 = 0.001 in., v_2 = 0.0025, u_3 = 0.0, and v_3 = 0.0025 in. Evaluate stiffness matrix and the elemental stresses, principle stresses and principle angle. (10)


y
(2.25, 3.25)
3
(2, 3)
1
2
(3, 1)
x