Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)
END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: FINITE ELEMENT METHOD (AAE-3202)

REVISED CREDIT SYSTEM
25/04/2017

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. For the spring assemblages shown in Figures 1, determine the nodal displacements, the forces in each element. **(05)**

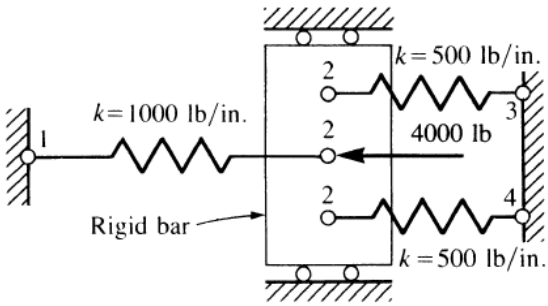


Figure 1

1B. For the bar assemblages shown in Figure 2, determine the nodal displacements and global reaction. **(05)**

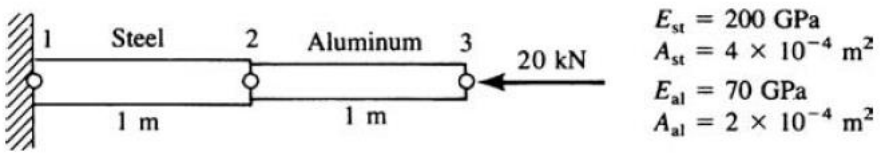


Figure 2

2A. For the bar and spring assemblage shown in Figure 3, determine the nodal displacements and global reaction. **(05)**

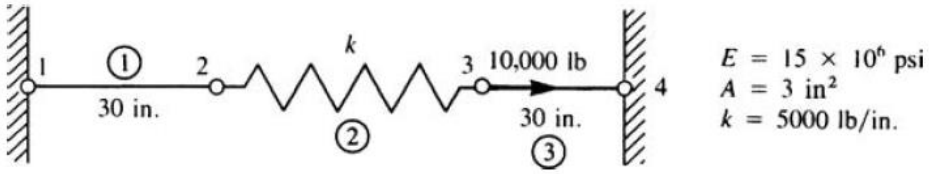


Figure 3

2B. Using the direct stiffness method, solve the problem for nodal displacements and slopes of the propped cantilever beam subjected to end load *P* in Figure 4. The beam is assumed to have constant EI and length 2L. It is supported by a roller at mid length and is built in at the right end. **(05)**

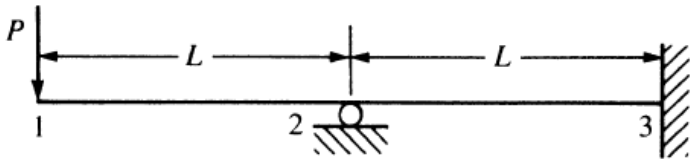


Figure 4

3A The Figure 5 shows a two-member plane truss supported by a linearly elastic spring. The truss members are of a solid circular cross section having d = 20 mm and E = 80 GPa. The linear spring has stiffness constant 50 N/mm. Assemble the system global stiffness matrix and calculate the global displacements of the unconstrained node. **(06)**

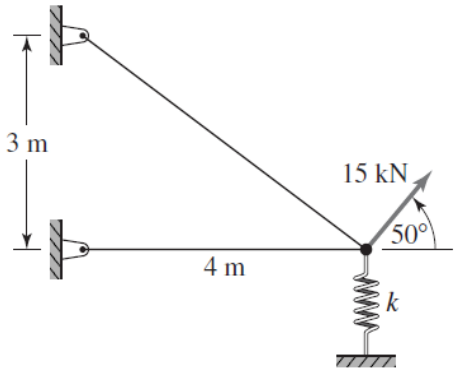


Figure 5

3B Compute the reaction forces in each element for the problem 3A. **(04)**

4A For the beam variable load distribution shown in Figure 6, determine the nodal displacements and slopes. **(06)**

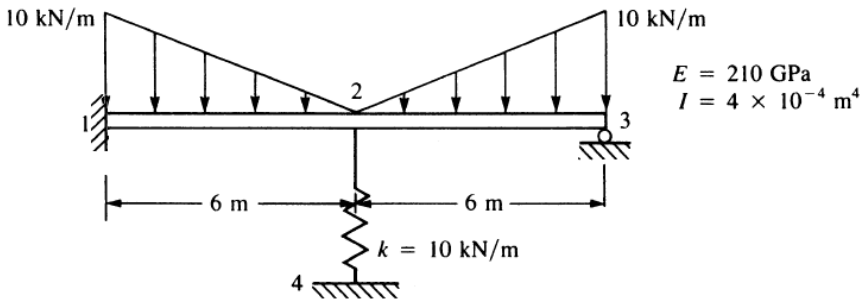
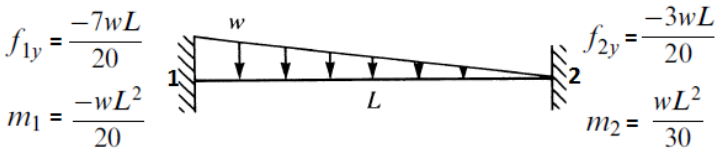


Figure 6



Equivalent nodal force diagram

4B For the above problem 4A, determine the forces in each element. **(04)**

5A Evaluate the stiffness matrix for the plane strain elements shown in Figure 7. **(05)** The coordinates are given in units of inch. E = 30X10^6 psi and v= 0.25.

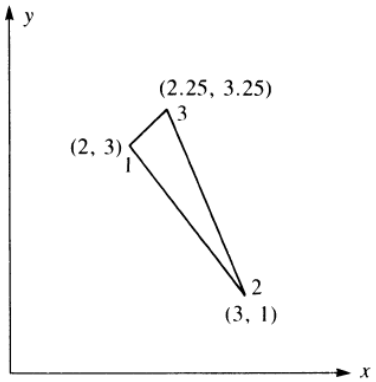


Figure 7

5B For the above problem 5A. The nodal displacements are given as **(05)** u_1 = 0.001 in, v_1 = 0.005 in, u_2 = 0.001 in, v_2 = 0.0025 in, u_3 = 0.0 in, v_3 = 0.0 in. Determine the element stresses σ_x , σ_y, τ_{xy} and σ_1 , σ_2, and the principal angle θ_p.Use unit thickness for plane strain.