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-ELECTIVE III (AAE-4028)

REVISED CREDIT SYSTEM

(27/04/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. For the spring bar assemblage shown in Figure 1. Determine the nodal displacements, the forces in each element. **(05)**

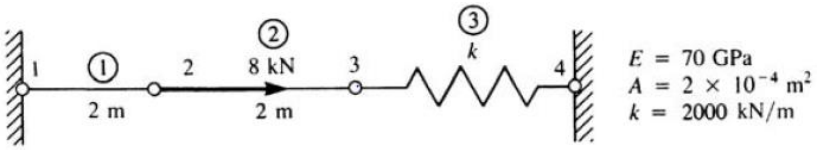


Figure 1

1B. For the beam shown in Figure 2. Determine the nodal displacements and slopes. **(05)**

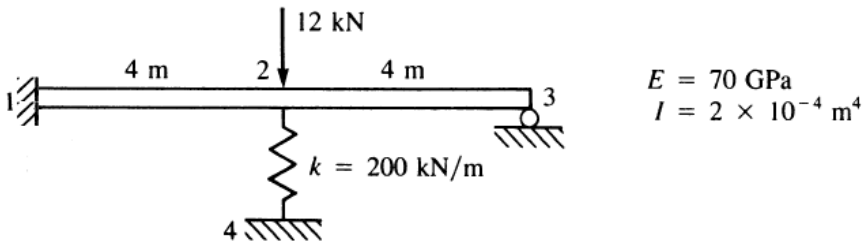


Figure 2

2A. For bar element shown in Figure 3, determine the nodal displacements and the forces in each element. Use the direct stiffness method for these problems. **(05)**

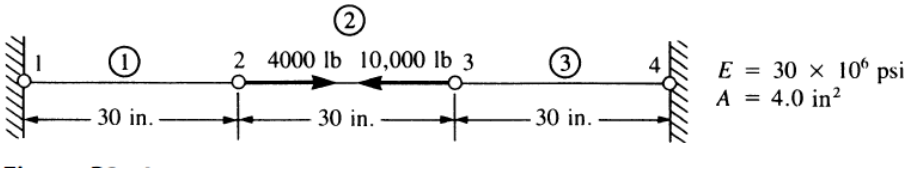


Figure 3

2B. The two-element truss in Figure 4 is subjected to external loading as shown. Determine the displacement components of node 3, the reaction force components at nodes 1 and 2, and the element displacements. The elements have modulus of elasticity $E_1 = E_2 = 10 \times 10^6$ lb/in.^{2} and cross-sectional areas $A_1 = A_2 = 1.5$ in.^{2} **(05)**

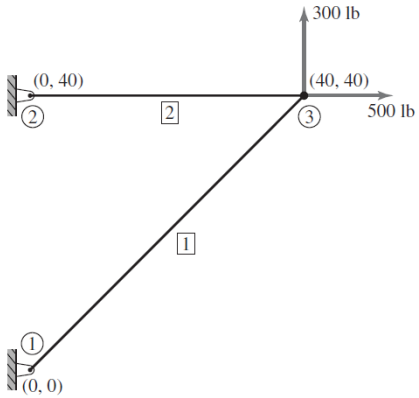


Figure 4

3A. The plane truss shown in Figure 5 is composed of members having a square 15 mm × 15 mm cross section and modulus of elasticity E = 69 GPa. **(07)**
a. Assemble the global stiffness matrix.
b. Compute the nodal displacements in the global coordinate system for the loads shown.

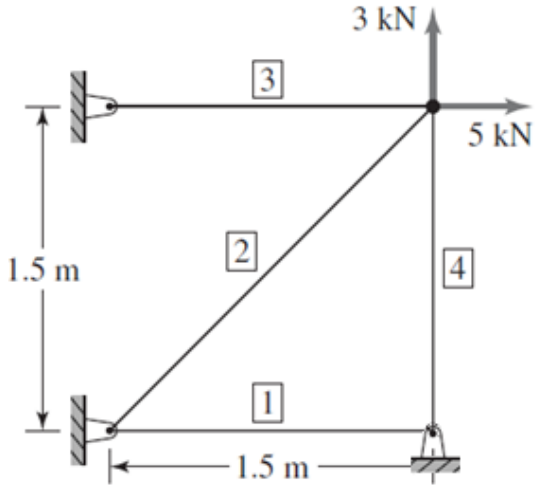


Figure 5

3B. Compute the axial stress in each element for the figure 5. **(03)**

4A. For the beams shown in Figure 6, determine the displacement and slope. **(06)**

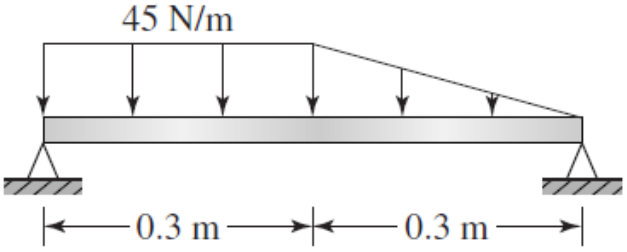
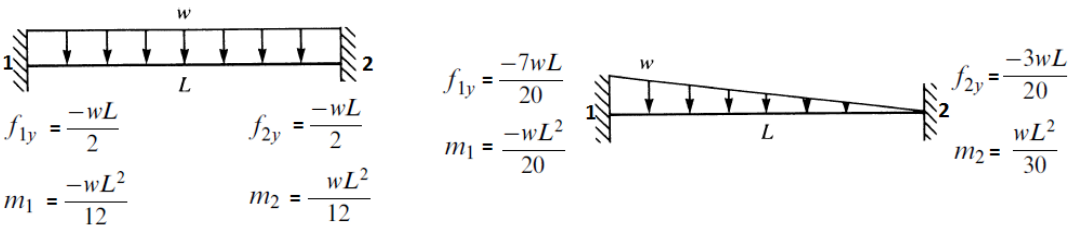


Figure 6



Equivalent Force body diagram for Figure 6

4B. For the beams shown in Figure 6, find the reaction of each elements. **(04)**

5A. Evaluate the stiffness matrix for the plane stress element shown in Figure 7. The coordinates are given in units of millimeter. E = 82 GPa and v= 0.3. **(05)**

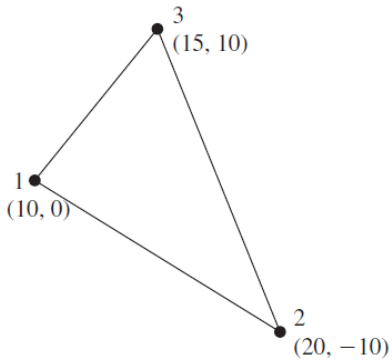


Figure 7

5B. For the plane strain elements shown in Figure 7, the nodal displacements are given as, u_1 = 0.005 mm, v_1 = 0.002 mm, u_2 = 0.0 mm, v_2 = 0.0 mm, u_3 = 0.005 mm, v_3 = 0.0 mm. Determine the element stresses σ_x , σ_y, τ_{xy} and σ_1 , σ_2, and the principal angle θ_p. **(05)**