Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

MAKEUP EXAMINATIONS, JUNE 2017

SUBJECT: FINITE ELEMENT METHOD-ELECTIVE III (AAE-4028)

REVISED CREDIT SYSTEM

(20/06/2017)

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)**

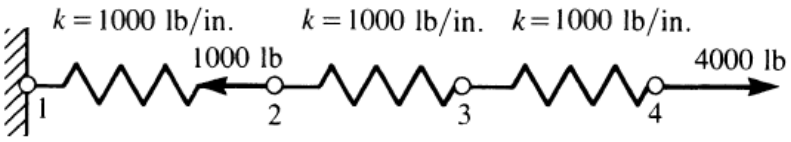


Figure 1

1B. For the truss shown in Figure 2, solve for the horizontal and vertical components of displacement at node 1. Also determine the stress in element 1. Let A = 1 in^2, E = 10X10^6 psi, and L= 100 in. **(05)**

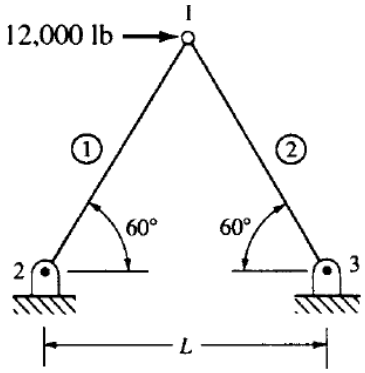


Figure 2

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

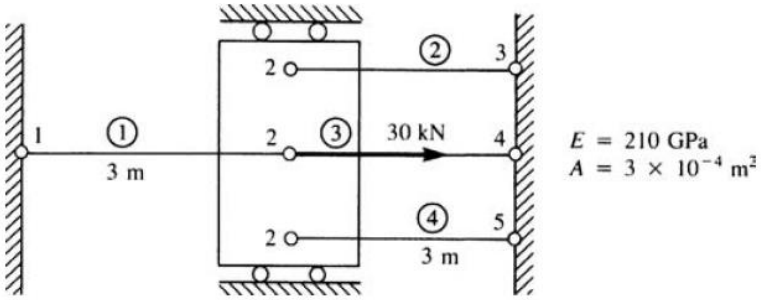


Figure 3

2B. The plane truss shown in Figure 4 is subjected to a downward vertical load at node 2. Determine via the direct stiffness method the deflection of node 2 in the global coordinate system specified and the axial stress in each element. For both elements, A = 0.5 in.^{2}, E = 30 × 10^6 psi. **(05)**

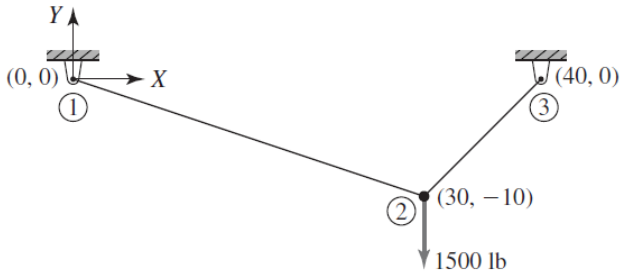


Figure 4

3A. For the plane trusses shown in Figure 5, determine the horizontal and vertical displacements of node 1 and the stresses in each element. All elements have E = 210 GPa and A = 4X10^{-4} m^2. **(07)**

a. Assemble the global stiffness matrix.

b. Compute the nodal displacements in the global coordinate system for the loads shown.

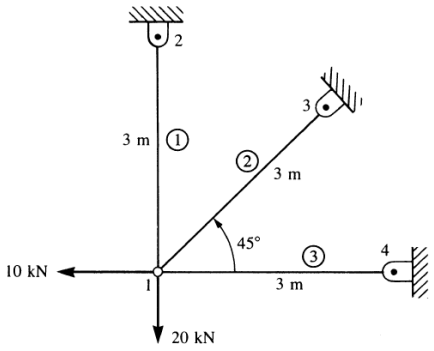


Figure 5

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. **(07)**

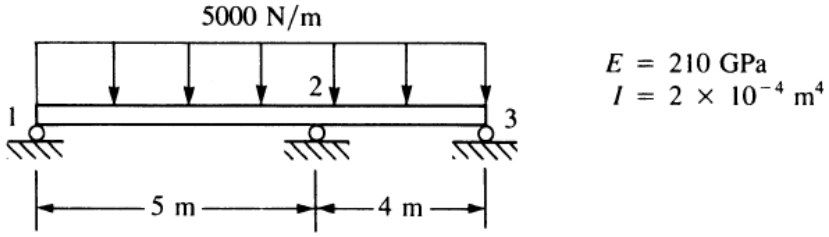
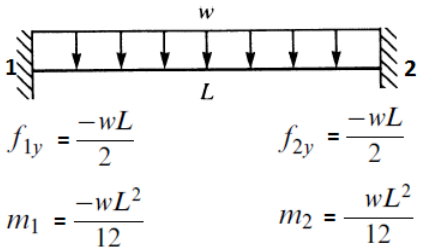


Figure 6



Equivalent Force body diagram for Figure 6

4B. For the beams shown in Figure 6, find the reaction of each elements **(03)**

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)**

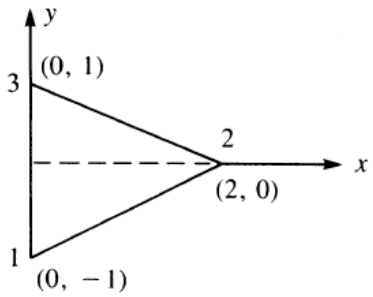


Figure 7

5B. For the plane strain elements shown in Figure 7, the nodal displacements are given as **(05)**
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 $\sigma_x, \sigma_y, \tau_{xy}$ and σ_1, σ_2, and the principal angle θ_p.