Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE 2017

SUBJECT: FINITE ELEMENT METHOD (AAE-3202)

REVISED CREDIT SYSTEM

(17/06/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

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

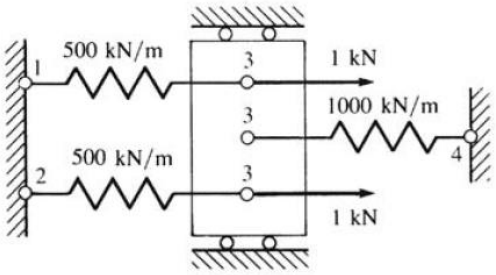


Figure 1

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

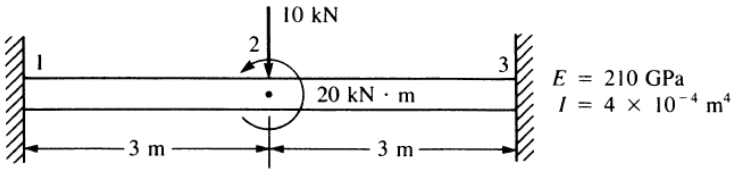


Figure 2

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

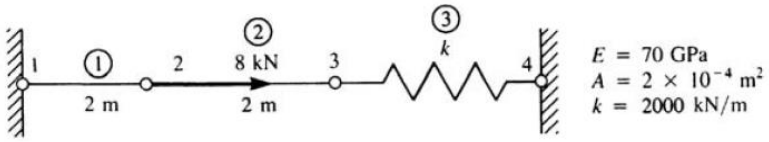


Figure 3

2B. For the beams shown in Figure 4, determine the displacements and the slopes at the nodes. **(05)**

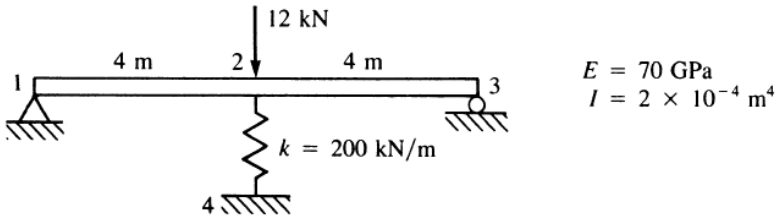


Figure 4

3A. For the truss shown in Figure 5, use symmetry to determine the displacements of the nodes and the stresses in each element. All elements have E = 30 X10^6 psi. Elements 1, 2, 4, and 5 have A = 10 in^2 and element 3 has A = 20 in^2. **(07)**

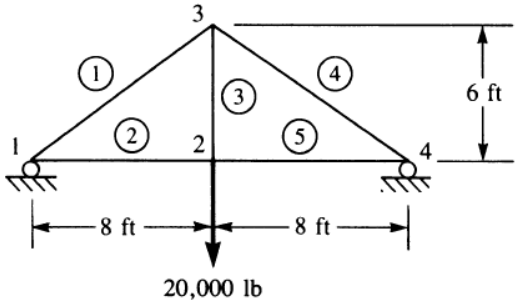


Figure 5

3B. List the steps involved in finite element method. **(03)**

4A. For the beams shown in Figure 6, determine the nodal displacements and slopes **(07)**

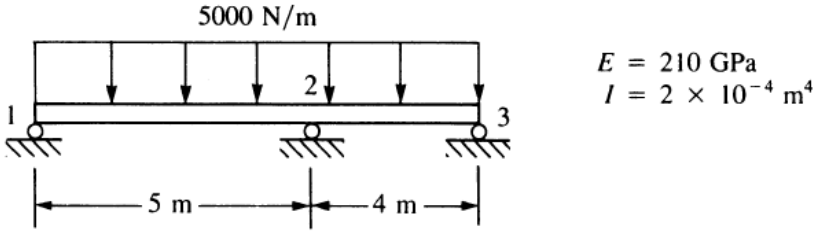
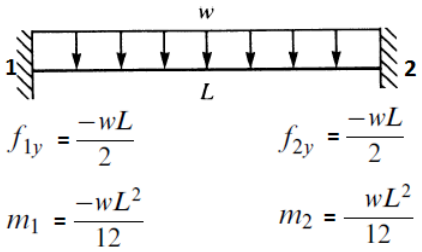


Figure 6



Equivalent Force body diagram for Figure 6

4B. For the beams shown in Figure 6 Problem 4A. Find the reaction in each element. **(03)**

5A. Evaluate the stiffness matrix for the plane stress element shown in Figure 7. The coordinates are given in units of millimeter. E = 70 GPa and v= 0.3. **(05)**

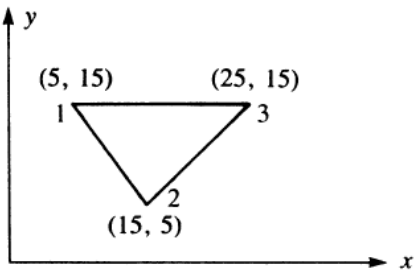


Figure 7

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)**