Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (AERONAUTICAL ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: FINITE ELEMENT METHOD [AAE 3202]

REVISED CREDIT SYSTEM
(20/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A) For the beam assemblages shown in Figure 1, determine the nodal displacements, the global reaction forces. E= 70 GPa, I= 1X10^{-4} m^4 **(05)**

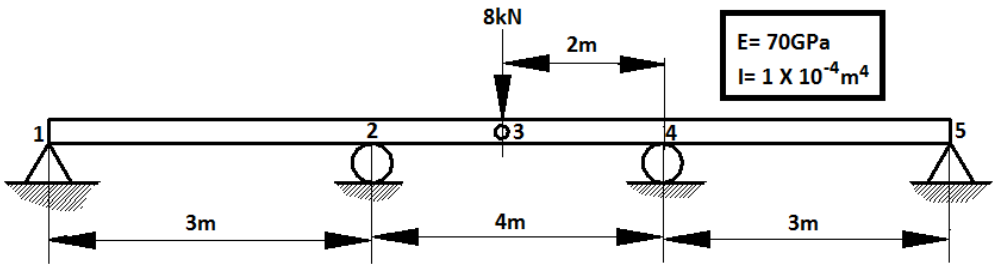


Figure 1

1B) Use the principle of minimum potential energy to solve the spring problems shown in Figure 2. **(05)**

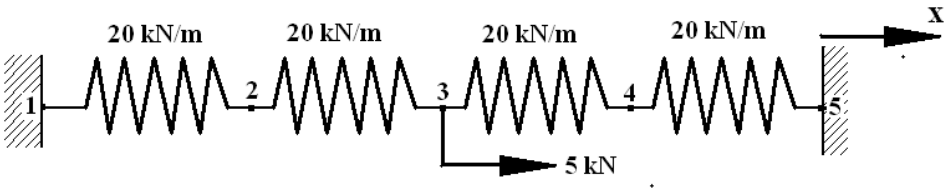


Figure 2

2A) For the plane trusses shown in Figure 3, determine the horizontal and vertical displacements of node 1 and the stresses in element 2. **(05)**

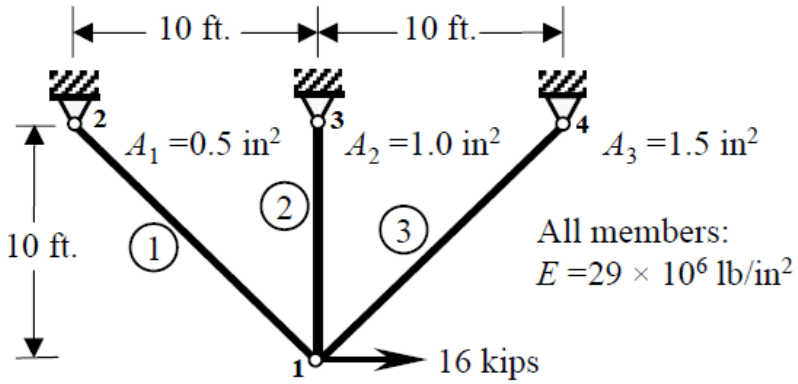


Figure 3

2B) For the truss assemblages shown in Figure 4, determine the nodal displacements, Use the direct stiffness method **05**

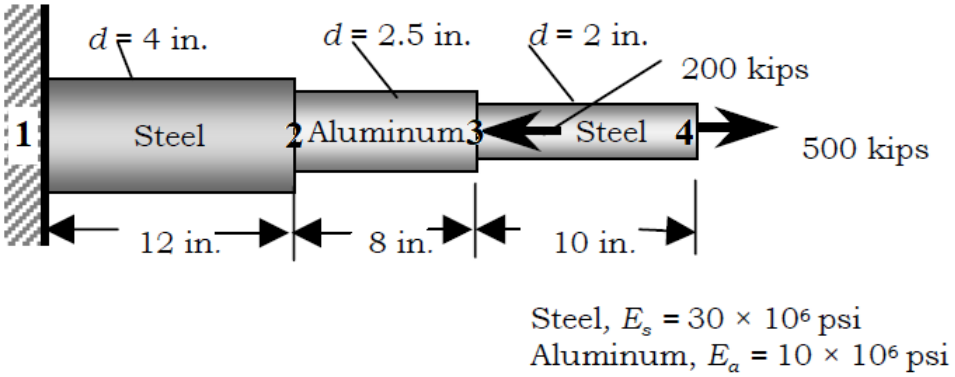


Figure 4

3) For the beam shown in Figure 5, subjected to distributed load on element 1. Determine the deflection and rotation and the reactions in each element. Use the equivalent load replacement method. **(10)**

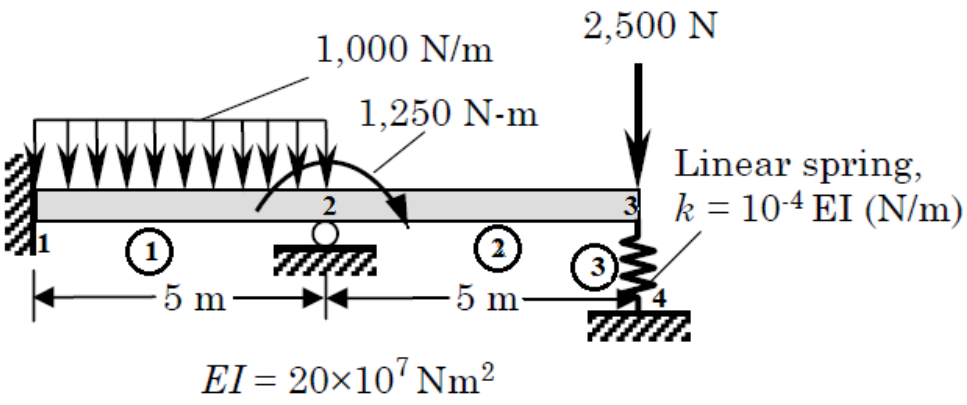


Figure 5

4) For the beam shown in Figure 6, subjected to the concentrated load P and the linearly varying line load w, determine the mid node deflection and rotation and the reactions. Use the equivalent load replacement method. Let EI be constant throughout the beam. **(10)**

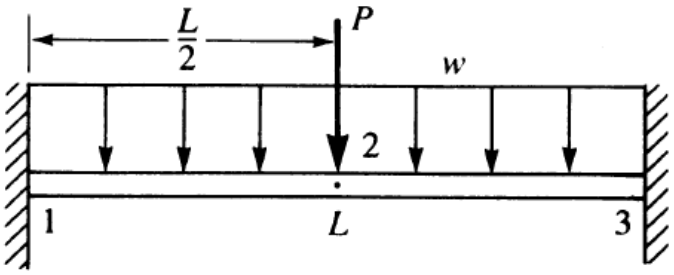
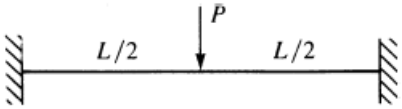
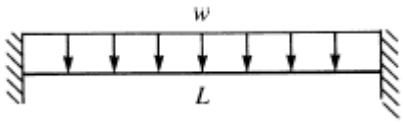


Figure 6

Force equivalent diagram	f1y	m1	f2y	m2
	$\frac{-P}{2}$	$\frac{-PL}{8}$	$\frac{-P}{2}$	$\frac{PL}{8}$
	$\frac{-wL}{2}$	$\frac{-wL^2}{12}$	$\frac{-wL}{2}$	$\frac{wL^2}{12}$

5) For the element shown in Figure 7. 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. stiffness matrix and evaluate the principle stresses and principle angle **(10)**

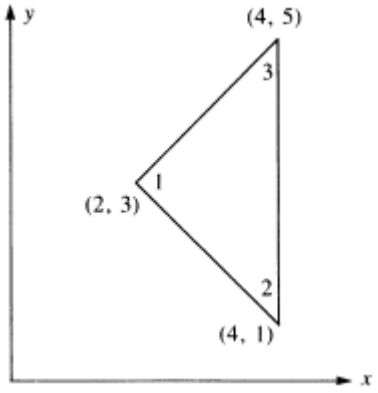


Figure 7