Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE 2018

SUBJECT: **PE-III** FINITE ELEMENT METHODS [AAE 4028]

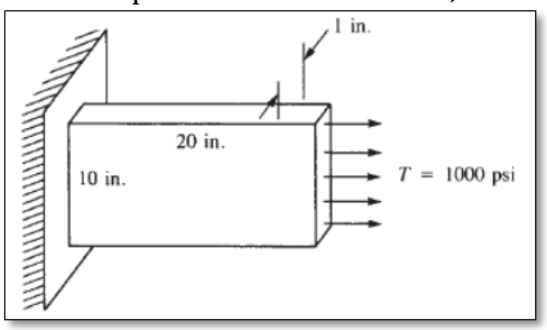
REVISED CREDIT SYSTEM
(20/06/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

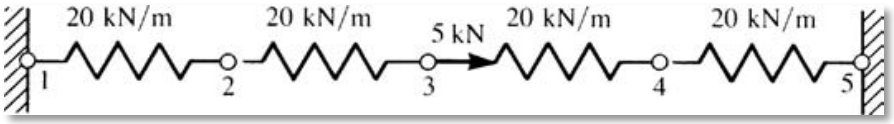
- Answer **ALL FIVE FULL** questions.
- Missing data, if any, may be suitable assumed.

1A. For a thin plate subjected to the surface traction shown in figure, determine the nodal displacements. The plate thickness t = 1 in., E = 30 e6 psi, and v=0.30. **(07)**



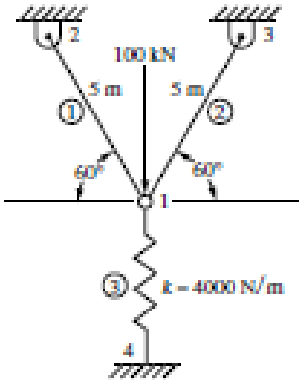
1B. Enumerate on plane stress and plane strain conditions in FEM for a 2D plane element. **(03)**

2A. For the spring assemblages shown in Figure 2, determine the nodal displacements, the forces in each element, and the reactions. Use the direct stiffness method. **(06)**



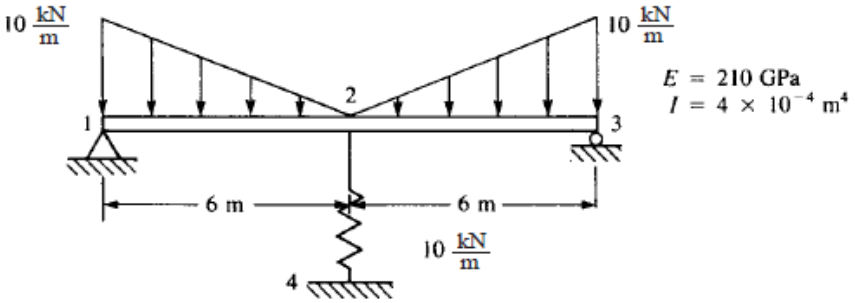
2B. Mention the assumptions and sign conventions used in beam theory. Also mention the equilibrium equations and draw a sample BMD, FD and SFD with all notations and sign convention. **(04)**

3A. For the plane trusses with inclined supports shown in Figure, solve for the nodal displacements and element forces and reactions in the bar. Let A =5* 10^{-4} in^2, E =210 GPa, for each truss. **(07)**



3B. For the above arrangement, calculate element stresses. **(03)**

4. For the beam shown in Figure, determine the nodal displacements, forces in each element, and the reactions. (F_{1Y}= -7WL/20, M_{1Y}= -WL^2/20, F_{2Y}= -3WL/20, M_{2Y}= +WL^2/20) **(10)**



5A. Briefly explain CST and LST elements. Mention any 2 use cases for each element. **(05)**

5B. With a neat sketch and notations, derive the element stiffness matrix in global coordinate system, for a truss element inclined at an angle θ (CCW direction) from the Y axis. Also mention the load and displacement vectors in global system. **(05)**