Menoufeya University
College of Engineering
Civil Engineering Dpt.

Minufiya University

Finite Element 600
M. Sc. Jun. 2017
Time allowed 3 hrs

OPEN BOOK

Question (1) (20 %)

Two straight bars ab and bc are pinned together as shown. Bar bc is cooled 40° C. Determine the displacement at b and the force in each bar. Thermal expansion coefficient $\alpha = 1.2 \times 10^{-5}$ mm/mm °C , E 200,000.0 MPa.

Question (2) (20 %)

Figure 2 shows two-member plane truss supported by a linearly elastic spring. The truss members are of solid circular cross section having d=20 mm and E =80 GPa. The linear spring has stiffness constant 50 N/mm.

a- Assemble the system global stiffness matrix and calculate the displacements at b.
b- Calculate the reactions at a and c.
c- Calculate the strain and stress in each bar.

Question (3) (20%)

For the beam shown in figure, use the stiffness method to :

a- Calculate the rotations at B.
b- Calculate the reactions at A and C.
c- Draw the shearing force and bending moment diagrams for the beam.

E = 200 GPa, $I = 50 \times 10^{-6}$ m^4.

Question (4) (20 %)

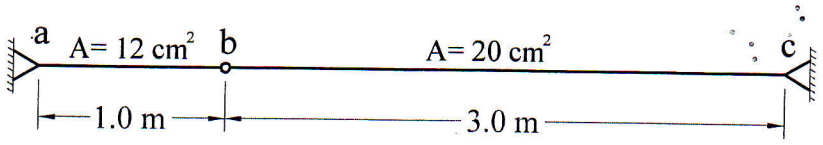
Analyze the grid shown in figure. The grid is fixed at nodes 1 and 3, and is subjected to a downward vertical load of 24 kN. The global coordinate axes and element lengths are shown in figure. each member have the following property :

E=210 GPa, G=84 GPa, $I = 16 \times 10^{-5}$ m^4, $J = 5 \times 10^{-5} m^4$

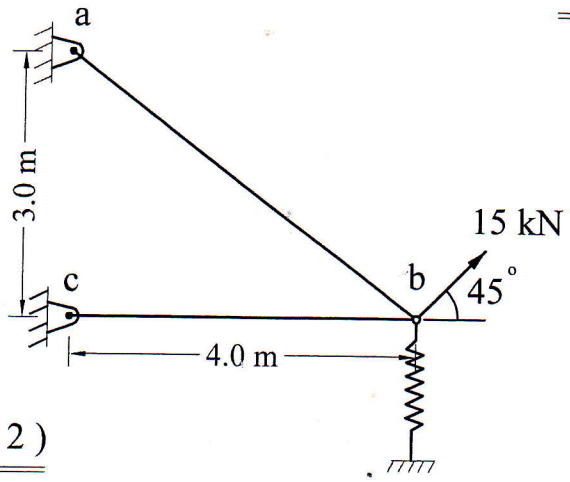
Question (5) (20 %)

Using the finite element method to:

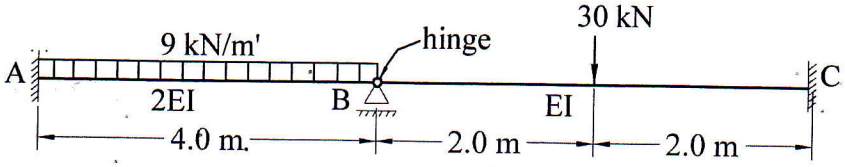
a- Calculate the approximate first buckling load for a cantilever beam of length L=3.0 m, and $EI = 16 \times 10^3$ kN.m^2.
b- Calculate the tip deflection and rotation of the cantilever beam when subjected to distributed transverse load of 12 kN/m along with a compression load of 1800 kN.
c- Compare the values of (b) with the values when P=0.



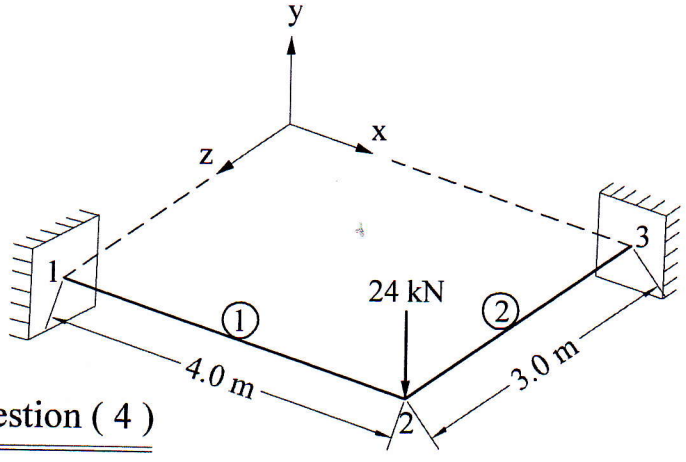
Question (1)



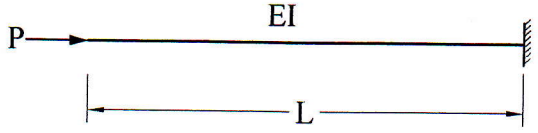
Question (2)



Question (3)



Question (4)



Question (5)