ORDRE DES INGÉNIEURS DU QUÉBEC

NOVEMBER 2015 SESSION

Open-book examination
Calculators : only authorized models
Duration : 3 hours
The examination has 4 questions and 3 pages
Figures are not to scale

14-BA-A1 Elementary Structural Analysis

Question 1 (25%)

For the truss shown on figure 1, determine the horizontal displacement of point C when P_1 = 1000 N and P_2 = 0. Also, determine the vertical displacement of point F when P_1 = 0 et P_2 = 1000 N. All members are prismatic and have the same elastic modulus fixed at 200 GPa. Area of each member is indicated in brackets (mm^2).

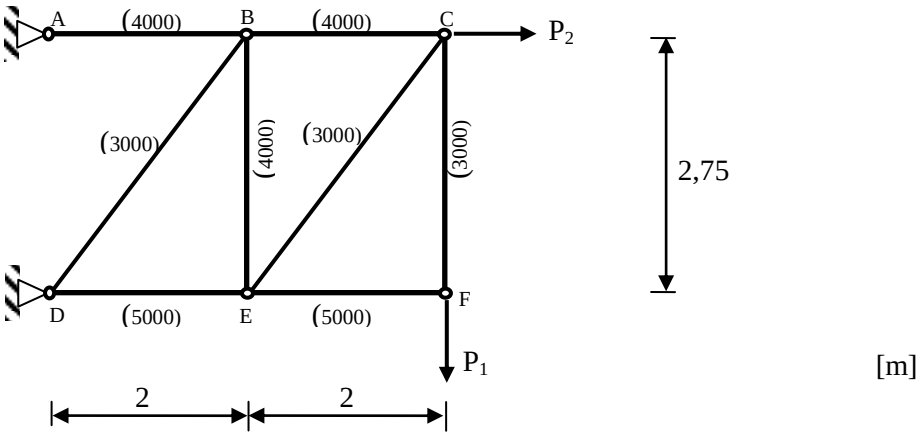

Figure 1

Question 2 (25%)

The three-hinged arch shown on figure 2 is made of two segments of a circle having a radius of 6 m. Determine the horizontal and vertical components of reaction at A and E. Also, compute all internal efforts at point B.

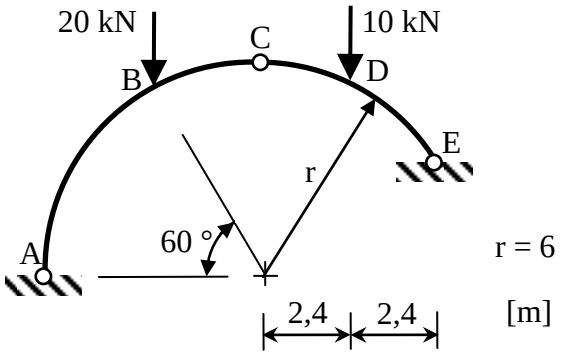

Figure 2

Question 3 (25%)

The beam CD shown on figure 3 has cross section area A_2 and inertia I_2 and is simply supported at D. Two members having area A_1 support the beam at C. Considering the uniformly distributed load of 15 kN/m and the 50 kN concentrated horizontal load applied at C, compute the vertical displacement at center of beam CD along with the horizontal displacement of point C. The modulus of elasticity of each member is the same (200 GPa).

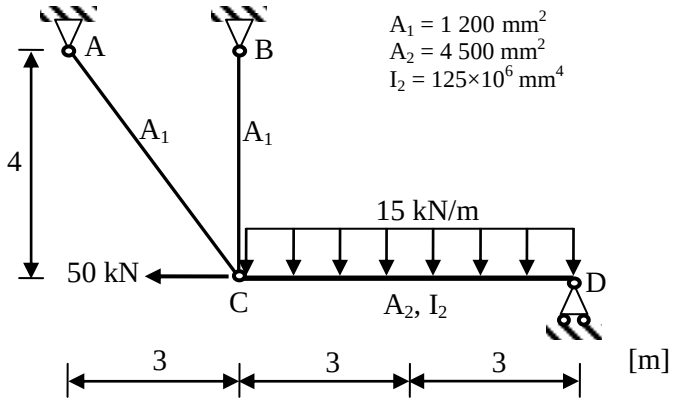

Figure 3

Question 4 (25%)

The rigid frame shown on figure 4 is loaded with a 12 kN/m distributed load. Compute and sketch shear force and bending moment diagrams. Indicate extreme values on both diagrams. All members have the same rigidity EI and are considered inextensible.

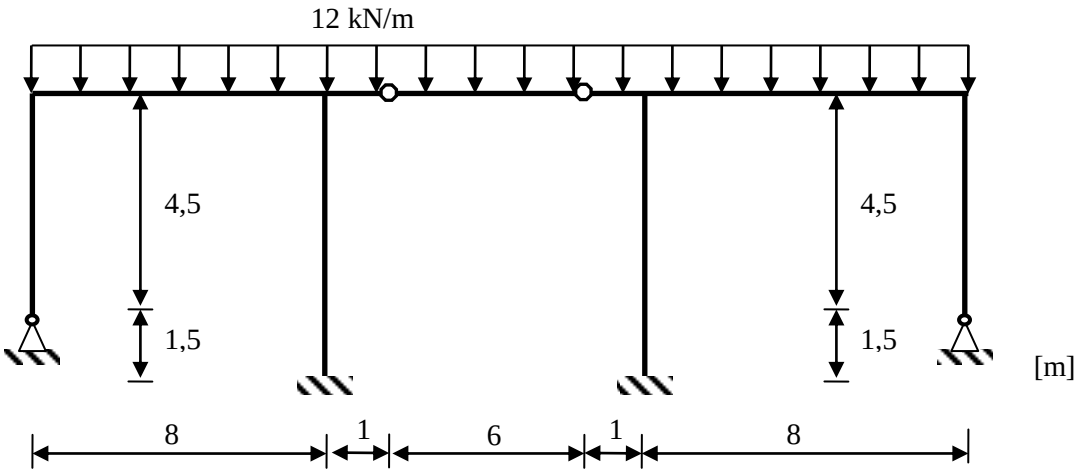

Figure 4