Ministry of Higher Education
Giza Higher Institute of Engineering & Technology
Civil Engineering Department
Course Name: **Theory of Structures (1)B**
Course Code : **CIV 121** Date: **19 / 5 / 2019**

Academic Year : **2018/2019**
Semester : **Second**
Level : **1st Civil**
Time : 3 **Hours**
Examiners: ***Dr. M. Abdel-Kader***

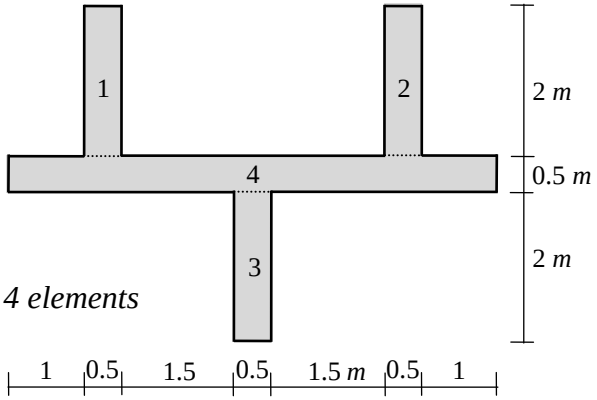
Final Exam

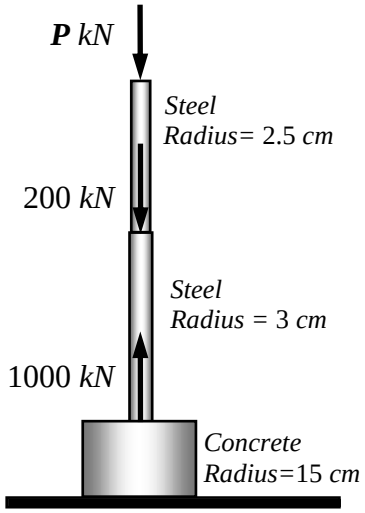
Total Marks: **90** No. of Questions: **3** (Attempt all questions)

Question (1): (30 Marks)

(a) For the shown cross-section, determine the following:
- The location of the centroid.
- The moments of inertia about the centroidal axes.
- The polar moment of inertia.
- The radii of gyration (r_x & r_y).

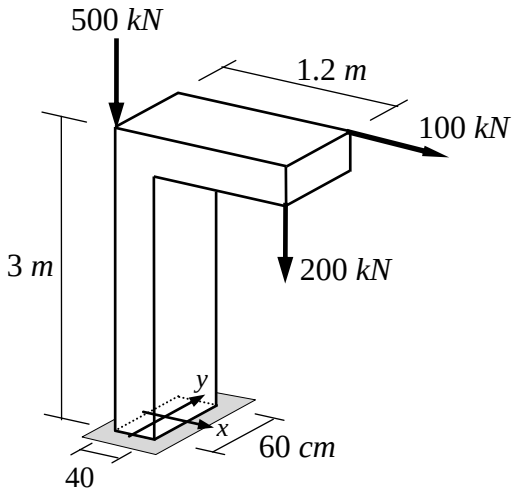
Note: *Divide the cross-section to 4 elements as shown on the figure.*





(b) A column of variable circular cross-section is subjected to axial loads as shown**.** Determine the safe range of ***P***.

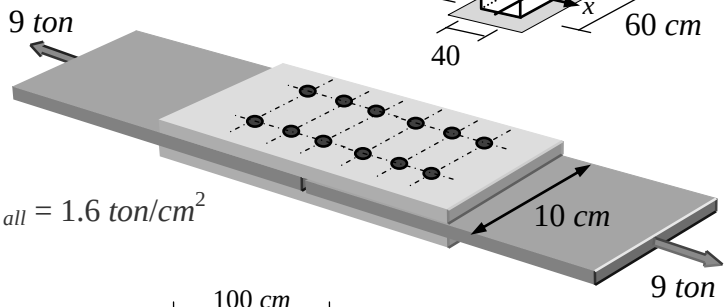
Given Data:
For **Steel:** Allowable compressive and tensile stresses = 140 *MPa*
For **Concrete:** Allowable compressive stress = 80 *MPa*
Allowable tensile stress = 10 *MPa*



Question (2): (30 Marks)

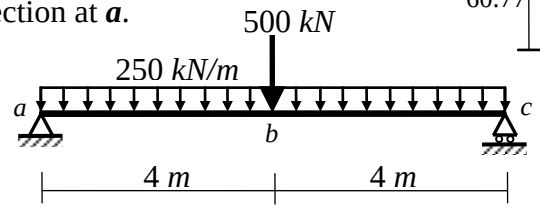
(a) For the shown column, draw the normal stress distribution at the base section (40 *cm* × 60 *cm*) and calculate the maximum normal stresses. Neglect the column weight.

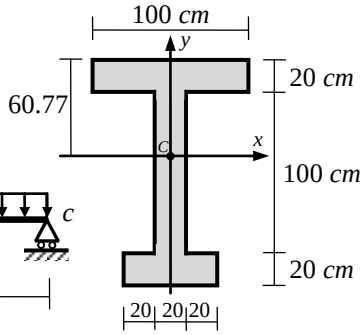
(b) For the shown bolted butt joint, determine the safe diameter of bolts. The width of plates is 10 *cm*, and the thickness of plates is 12 *mm*. The allowable stresses are as follows:
Bolts: τ_{all} = 1.1 ton/cm^2,
Plates: $\sigma_{t\ all}$ = 1.4 ton/cm^2 and $\sigma_{bearing\ all}$ = 1.6 ton/cm^2



Question (3): (30 Marks)

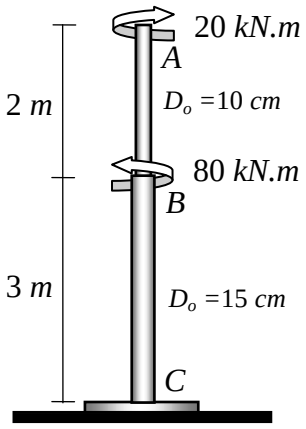
(a) For the shown beam, calculate and draw the shear stress distribution over the cross-section at ***a***.





Cross-section of the beam

(b) A column of two tubes must resist torques as shown. The tubes have outside diameters of 10 *cm* and 15 *cm* and a thickness of 10 *mm*.
- Draw the twisting moment diagram.
- Determine the maximum shear stress τ_{max} in the two tubes.
- Determine the relative angle of twist ϕ between ***A*** and ***C***, where G = 30 *GPa*.



With best wishes
Dr. M. Abdel-Kader