Ministry of Higher Education
Giza Higher Institute for Eng. & Tech.
Civil Engineering Department
Course Name: **Theory of Structures (2)**
Course Code : **CIV 202**

Academic Year : **2013–2014**
Semester : **Second**
Level : **2nd**
Time : **3 Hours**
Date : **1 / 6 / 2014**
Examiner: ***Dr. M. Abdel-Kader***

Second Semester Final Examination

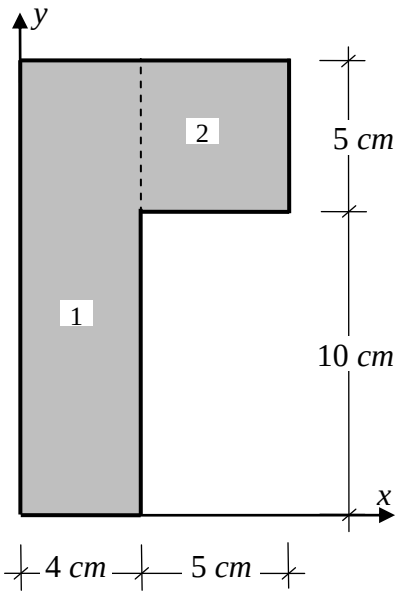
- Attempt all questions.
- The Exam consists of **4** questions in **2** pages.
- Maximum grade is **60 Marks**.

Question (1): (15 Marks)

For the shown cross-section, determine the following:

(a) The location of the centroid,
(b) The moments of inertia about the centroidal axes,
(c) The direction of the principal axes,
(d) The principal moments of inertia,

Note: *divide the cross-section to 2 elements as shown on the figure.*



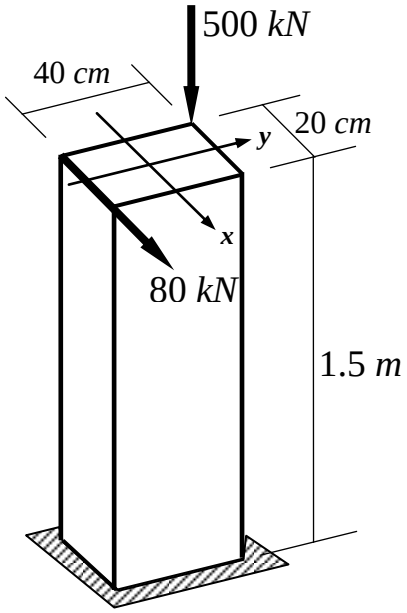
Question (2): (15 Marks)

(a) Determine the smallest area of bronze and steel cables required to support the bar shown.

Given Data:

Mass of bar, $m = 1600\ kg$
Maximum allowable stress for bronze, $\sigma_{bronze} = 90\ MPa$
Maximum allowable stress for steel, $\sigma_{steel} = 120\ MPa$

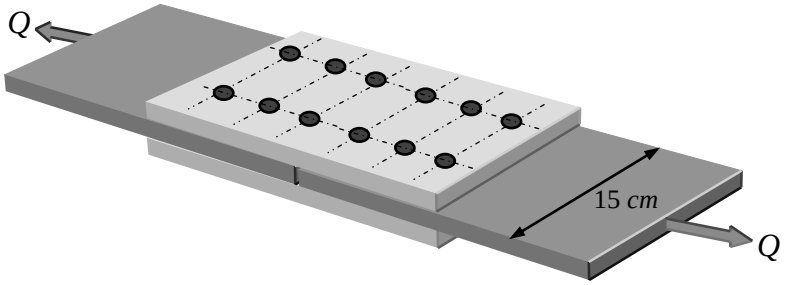
(b) A column of rectangular section carries the set of loads shown in the figure. Calculate and draw the normal stress distribution at **the base section** of the column. Neglect the column weight.



Please turn over

Question (3): (15 Marks)

(a) A bolted butt joint is shown. The diameter of the bolts is 1.8 *cm*. The width of the plates is 15 *cm*, and the thickness of the plates is 1.2 *cm*. The allowable stresses are as follows:



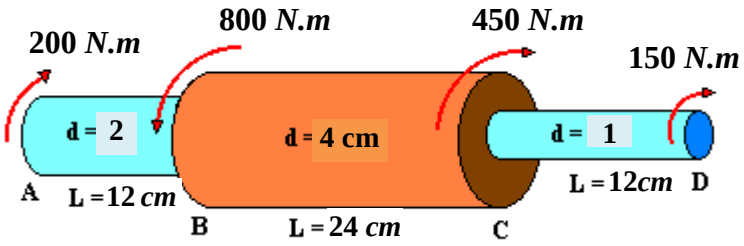
Bolts: $\tau_{all} = 1.1\ ton/cm^2$,

Plates: $\sigma_{t\ all} = 1.4\ ton/cm^2$ and $\sigma_{bearing\ all} = 1.6\ ton/cm^2$

Determine the strength of the joint, and the efficiency of the joint.

(b) A solid compound shaft is subjected to torques as shown. The shaft is in rotational equilibrium.

i) Determine the maximum transverse shear stress in each section of the shaft due to the applied torque.



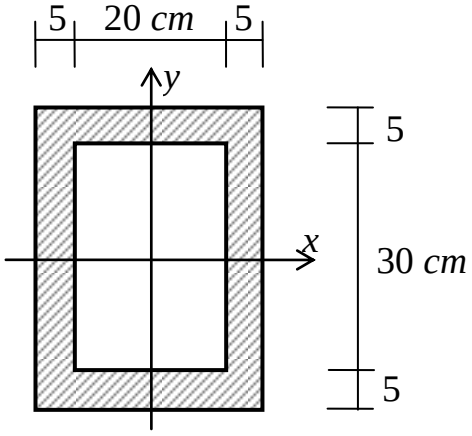
ii) Determine the angle of twist of end **D** with respect to end **A**. $G = 8000\ kN/cm^2$.

Question (4): (15 Marks)

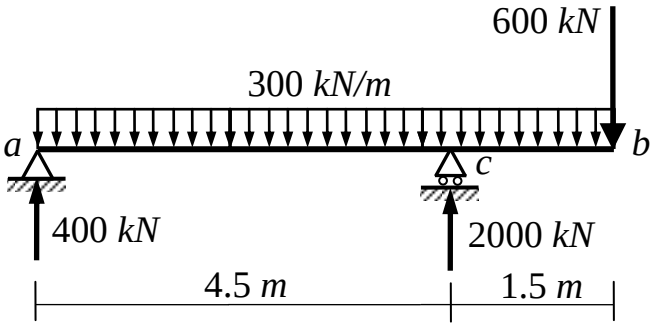
For the shown beam, calculate and draw:

(a) The **normal** stress distribution over the cross-section at ***c***.

(b) The **shear** stress distribution over the cross-section at ***a***.



Cross-section of the beam



With my best wishes

Dr. M. Abdel-Kader