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 : **--- Hours**
Date : **27 / 4 / 2014**
Examiner: ***Dr. M. Abdel-Kader***

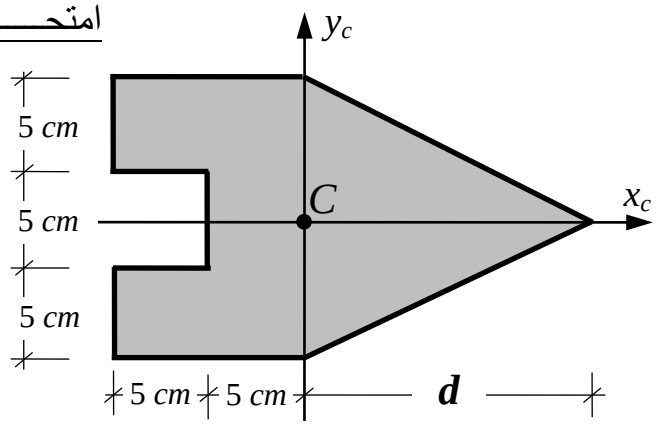
**الاسم:** **رقم الكود:**

امتحـــــان منتصف الترم

- The Exam consists of **2** questions in **2** pages.

## Question (1): (10 Marks)

For the shown area where the centroid is given as shown, determine the distance ***d***.




## Solution of Question (1)

The first moment of the area about $y_c$-axis = 0

or,

Moment of the area to the right of $y_c$-axis about $y_c$-axis = Moment of the area to the left of $y_c$-axis about $y_c$-axis

$$(0.5\times15\times\boldsymbol{d})(\boldsymbol{d}/3) = (15\times10)(5) - (5\times5)(7.5)$$

$$2.5\,\boldsymbol{d}^2 = 562.5$$

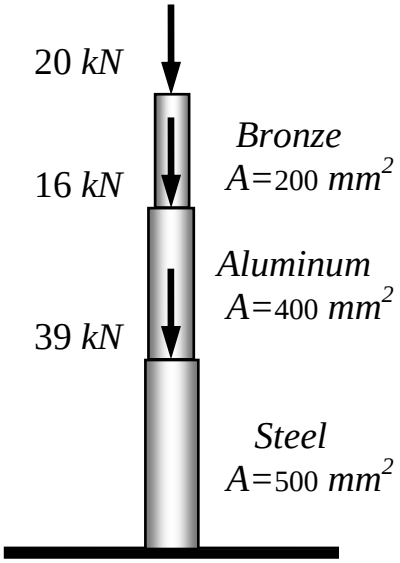
$$\boldsymbol{d}^2 = 225 \rightarrow \boxed{\boldsymbol{d} = 15\ cm}$$

***Please turn over***

**Question (2): (10 Marks)**

A column of variable cross-section is subjected to axial loads as shown**.**

Check if the column is safe or not.




**Given Data:**

Allowable stress for bronze = 100 *MPa*
Allowable stress for aluminum = 90 *MPa*
Allowable stress for steel = 140 *MPa*

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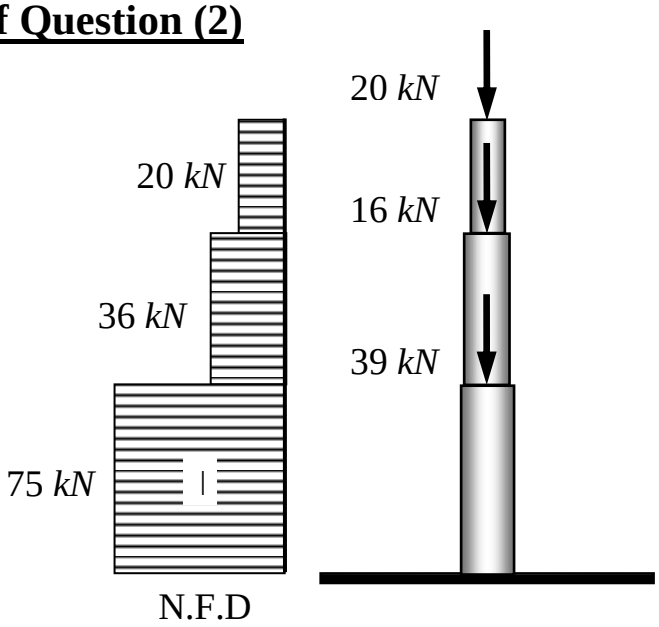
## Solution of Question (2)

Allowable stress for bronze = 100 $N/mm^2$
Allowable stress for aluminum = 90 $N/mm^2$
Allowable stress for steel = 140 $N/mm^2$




(1) For bronze:

$$\sigma_{bronze} = \frac{P_{bronze}}{A_{bronze}} = \frac{20000}{200} = 100 \ N/mm^2$$ = Allowable stress for bronze → **Safe**

(2) For aluminum:

$$\sigma_{alum} = \frac{P_{alum}}{A_{alum}} = \frac{36000}{400} = 90 \ N/mm^2$$ = Allowable stress for aluminum → **Safe**

(3) For steel:

$$\sigma_{steel} = \frac{P_{steel}}{A_{steel}} = \frac{75000}{500} = 150 \ N/mm^2$$ > Allowable stress for steel → **Unsafe**

Form 1, 2 and 3, the column is **unsafe** to subject these axial loads.

*With my best wishes*
***Dr. M. Abdel-Kader***