	Alexandria Higher Institute of Engineering & Technology (AIET)		
	Industrial Department		First Year
	ME142	Design of Machine elements	Midterm, Mars, 23, 2015
	Examiners:	Dr. Rola Afify and committee	Time: 1.5 hour

Answer the following questions:

Question one (10 marks)

a) Define: Ductility - Machinability -Resilience - Hardness.

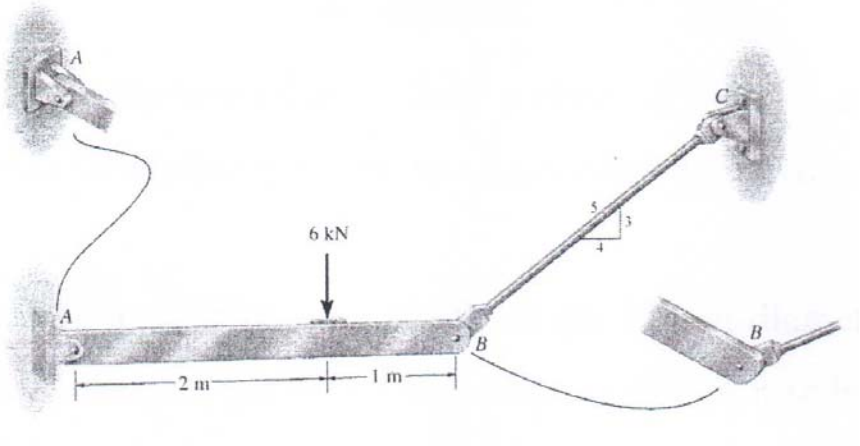
5. ***Ductility***. It is the property of a material enabling it to be drawn into wire with the application of a tensile force. A ductile material must be both strong and plastic. The ductility is usually measured by the terms, percentage elongation and percentage reduction in area. The ductile material commonly used in engineering practice (in order of diminishing ductility) are mild steel, copper, aluminium, nickel, zinc, tin and lead.

9. ***Machinability***. It is the property of a material which refers to a relative case with which a material can be cut. The machinability of a material can be measured in a number of ways such as comparing the tool life for cutting different materials or thrust required to remove the material at some given rate or the energy required to remove a unit volume of the material. It may be noted that brass can be easily machined than steel.

10. ***Resilience***. It is the property of a material to absorb energy and to resist shock and impact loads. It is measured by the amount of energy absorbed per unit volume within elastic limit. This property is essential for spring materials.

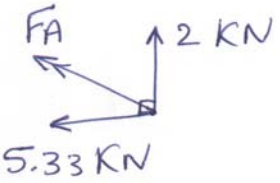
13. ***Hardness***. It is a very important property of the metals and has a wide variety of meanings. It embraces many different properties such as resistance to wear, scratching, deformation and machinability etc. It also means the ability of a metal to cut another metal. The hardness is usually

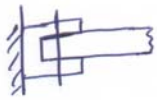
b) Two members, shown in figure, are pinned together at B. If pins have an allowable shear stress of τ_{all} = 90 MPa, and allowble tensile stress of rod CB is $(\sigma_t)_{all}$ = 115 MPa. Determine to nearest mm the smallest diameter of pins, A, B, C and the diameter of rod CB necessary to support the load.



pin A

$$F_A = \sqrt{5.33^2 + 2^2} = 5.68\ KN$$





double shear

$$\tau = \frac{F_A}{n A} \leq \tau_{all}$$

$$\frac{5.68 * 10^3}{2 * \frac{\pi}{4} d_A^2} \leq 90$$

$$6.35 \leq d_A$$

$$\therefore d_A = 7\ mm$$

* تقريب لأكبر رقم صحيح

pin B single shear

$$\tau = \frac{F_{BC}}{A} \leq \tau_{all}$$

$$\frac{6.667 * 10^3}{\frac{\pi}{4} d_B^2} \leq 90$$

$$9.712 \leq d_B$$

$$\therefore d_B = 10\ mm$$

pin C double shear

$$\frac{6.667 * 10^3}{2 * \frac{\pi}{4} d_C^2} \leq 90$$

$$6.867 \leq d_C$$

$$\therefore d_C = 7\ mm$$

pin c double shear

$$\frac{6.667 * 10^3}{2 * \frac{\pi}{4} d_c^2} \leq 90$$

$$6.867 \leq d_c$$

$$\therefore d_c = 7 \text{ mm}$$

Question two (10 marks)

a) What are the general procedure in machine design?

* General procedure in machine Design

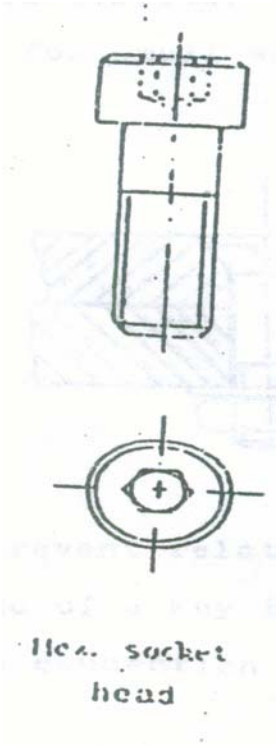
1. Recognition of a need
2. Mechanism
3. Analysis of foces
4. Material selection
5. Design of elements (size and stresses)
6. Modifications
7. Detailed drawing
8. production

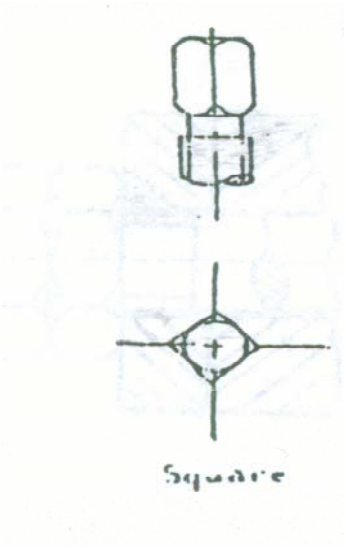
b) Draw, using neat sketches, the following:

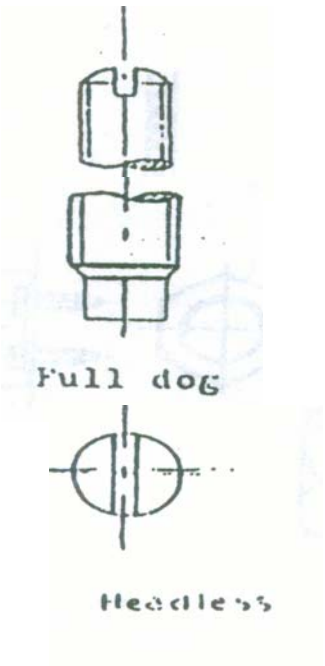
a. Elevation and Plan of a cap screw with Hex. socket head.

b. Elevation and Plan of a cap screw with Square head.

c. Elevation of a set screw with Headless head with Full dog point.







Good Luck 4/4
Dr. Rola Afify