	Alexandria Higher Institute of Engineering & Technology (AIET)		
	Industrial Department		First Year
	ME142	Design of Machine elements	Midterm, April, 28, 2014
	Examiners:	Dr. Rola Afify and committee	Time: 1.5 hour

Answer the following questions:

Question one (10 marks)

a) Define: Machine Design - Malleability - Creep - Fatigue.

*Definition

Machine Design is the creation of new and better machines and improving the existing ones.
A new or better machines have to be more economical in the overall cost of production and operation.

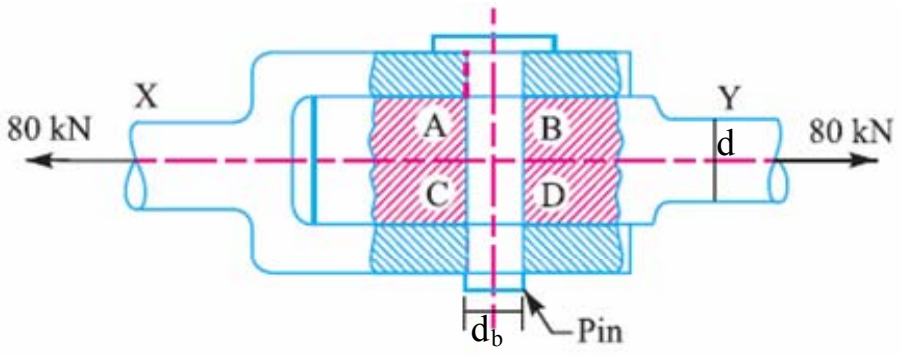
Malleability حالة خاصة من الـ ductility وهى خاصية للمادة التى يمكن تحويلها إلى thin sheets

7. ***Malleability.*** It is a special case of ductility which permits materials to be rolled or hammered into thin sheets. A malleable material should be plastic but it is not essential to be so strong. The malleable materials commonly used in engineering practice (in order of diminishing malleability) are lead, soft steel, wrought iron, copper and aluminium.

creep عند تعرض جزء لاجهاد ثابت عند درجة حرارة عالية لفترة زمنية كبيرة حيث لها تغير بطئ ودائم

Fatigue : عند تعرض مادة لاجهاد متكرر وحيث لها انهيار تحت اجهاد أقل من yield

b) A pull of 80kN is transmitted from a bar X to the bar Y through a pin as shown in figure. If the maximum permissible tensile stress in the bars is 100N/mm^2 and the permissible shear stress in the pin is 80N/mm^2, find the diameter of bars and of the pin.



Solution. Given : $P = 80$ kN $= 80 \times 10^3$ N; $\sigma_t = 100$ N/mm^2 ; $\tau = 80$ N/mm^2

Diameter of the bars

Let D_b = Diameter of the bars in mm.

$\therefore$ Area, $A_b = \frac{\pi}{4} (D_b)^2 = 0.7854 (D_b)^2$

We know that permissible tensile stress in the bar (σ_t),

$$100 = \frac{P}{A_b} = \frac{80 \times 10^3}{0.7854 (D_b)^2} = \frac{101\,846}{(D_b)^2}$$

$\therefore$ $(D_b)^2 = 101\,846 / 100 = 1018.46$

or $D_b = 32$ mm **Ans.**

Diameter of the pin

Let D_p = Diameter of the pin in mm.

Since the tensile load P tends to shear off the pin at two sections *i.e.* at AB and CD, therefore the pin is in double shear.

$\therefore$ Resisting area,

$$A_p = 2 \times \frac{\pi}{4} (D_p)^2 = 1.571 (D_p)^2$$

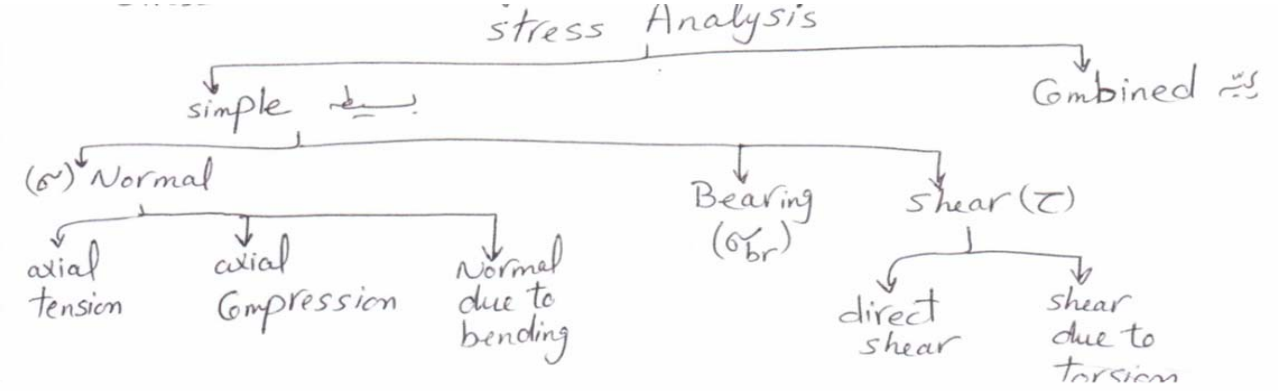
We know that permissible shear stress in the pin (τ),

$$80 = \frac{P}{A_p} = \frac{80 \times 10^3}{1.571 (D_p)^2} = \frac{50.9 \times 10^3}{(D_p)^2}$$

$\therefore$ $(D_p)^2 = 50.9 \times 10^3/80 = 636.5$ or $D_p = 25.2$ mm **Ans.**

Question two (10 marks)

a) Name the types of simple stresses each one with its equation.



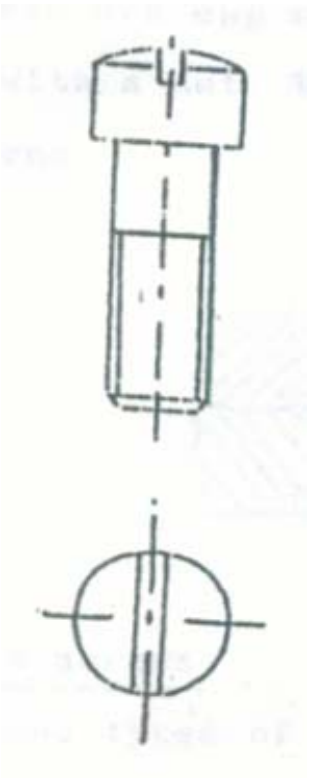
b) Draw, using neat sketches, the following:

a. Elevation and Plan of a cap screw with Filister head.

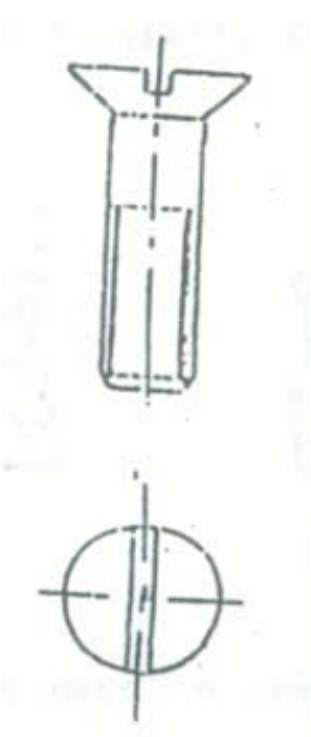
b. Elevation and Plan of a cap screw with Flat head.

c. Elevation of a set screw with Headless head and Cup point.

a.



b.



c.