Engineering Materials (MSE-220)
Assignment #3

1- **Explain the differences between yield strength and tensile strength**.

Ans:

Yield strength is the stress below which a material will recover from an applied force (stress). The material behaves elastically in tension or compression. The tensile strength is the stress that will produce fracture in tensile loading. Structural designs use a safety factor on the yield strength. We never want to exceed the tensile strength of a material.

2- **How is elastic modulus obtained from a stress-strain diagram?**

Ans:

Elastic modulus or modulus of elasticity is mathematically the slope (rise/run) of the stress/strain plot in a tensile test.

3- **Explain the difference between elastic limit, engineering yield strength, and true yield strength.**

Ans:

Elastic limit is another term for the yield strength of a material; engineering yield strength is the stress at a slight amount of strain (0.2%) in a tensile test. This is the agreed-to way to pinpoint yielding in a tensile test. Sometimes it is difficult to discern the exact point of yielding, thus an "offset" is used. The true yield strength is the stress on a material obtained by dividing the force at yield by its instantaneous area at yield. It is the "true" yield strength. The engineering yield strength is less "correct," but much easier for users to measure. True stress and true stain are mostly used in formability calculations. Engineering stress and strain values are used in structural design calculations.

4- **Explain how percent elongation and percent reduction in area are measured and what they are used for.**

Ans:

Percent elongation is the "stretch" a specimen can tolerate in tensile load before breaking. Fiduciary marks (gage marks) are made on the test specimen (in the reduced section) before testing. The specimen is stretched until it breaks; the broken pieces are put back together and the distance between gage marks is measured. The prior distance divided by the after-testing distance (original length/final length) is expressed as a percent and this is a measure of a material's ductility or ability to stretch in tension.

Reduction in area is a similar measurement using starting cross-section area and final cross-section area in the break area (break area/original area). This is a second measure of the ductility of a material.

5- **Explain how you would assess a material's impact characteristics from a tensile test.**

Ans:

The area under the load/extension diagram from a tensile test can be used to compare the toughness of various materials. The area under the curve has units of force x distance (load and stretch) which are energy units. The larger the included area, the more energy it took to fracture a specimen. Toughness is essentially the energy it requires to fracture.

6- **What is resilience and where is it used?**

Ans:

Resilience is a material's ability to forcibly return to its original shape after deformation. Of course, resilience is important in rubbers that are used to cushion things, seat cushions, bumpers, seals, etc.

7- **Explain the difference between shear stress and tensile stress.**

Ans:

Shear tends to cleave a material; a shear stress is the stress trying to cleave a material; tensile stress is a stress tending to elongate and pull a material apart by loading in the direction of the long axis.

8- **How do you measure shear strength?**

Ans:

Shear strength can be measured on a tensile tester by cleaving shapes with fixture like the one shown in Figure 4-13.

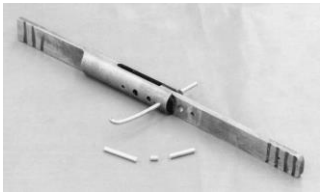

Figure 4–13 Shear test fixture for use in a tensile machine

9- **Explain the concept of endurance limit and how it is obtained. Give an example of its use.**

Ans:

Endurance limit is also called fatigue strength. It is measured by fatiguing specimens at different stress levels and developing a curve showing failures at different stress levels. The stress at which the data show a material can withstand an infinite (usually 10^7 or more) number of stress cycles is called the endurance limit. If you apply a higher stress than this in service, the part may fail. Most structural members on aircraft are designed to a fatigue strength.

10- **Which manufacturing technique produces the lowest Roughness (Ra)?**

a. milling	**d. grinding**
b. lapping	**e. time saver**
c. planning	**f. scraping**

Ans:

(a) Lapping (goal – a feeling for the roughnesses produced by various machining processes)