Welcome to Physics 2130

Physics is the **Language** of Nature!

Therefore it is the basis of science and engineering

So.....
you will be learning a new *language* this semester!!
Chapter 1  Measurement

• Importance of Physics
  – Basic law of the universe
  – Foundation of all science and engineering field

• Physics is based on observation and measurement. The result of measurement is a physical quantity which consists of a numerical value together with its units
  – e.g. the length of the table: \( l = 2 \text{ m} \)
International System of Units (SI)

- **Length**
  - meter (m)

- **Time**
  - second (s)

- **Mass**
  - kilogram (kg)

- And other basic quantities to be introduced later....
Length

Describe “length”.

Units of length measurement:
• meter (SI -- preferred)
• inch/foot/yard/rod/mile
• furlong
• Smoot
• etc.....

1 meter = length light travels in vacuum in $1/299,792,458$ seconds
Time

Describe “time”.

Units of temporal measurement:

• second (SI -- preferred)
• day
• year
• fortnight
• etc.....

1 second = time taken by 9192631770 oscillations of light emitted by a cesium-133 atom.
Mass

Describe “mass”.

Units of mass measurement:
- kilogram (SI -- preferred)
- slug
- ounce
- grain
- etc...

1 amu (atomic mass unit) is universal and defined as 12 u = mass of carbon-12 ($^{12}$C) atom. But mass varies with relative speed!!

$1 \text{ kg} = 6.02213665 \times 10^{26} \text{ u}$. 
Unit Conversion

• A physical quantity may have more than one choice of units

e.g. Time can be measured in day, hour, minute or second:

Example: Express the speed of light \( c = 3.0 \times 10^8 \text{ m/s} \) in terms of mile per hour (mph)

we know: 1 mile = 1609 m, 1 h = 3600 s

\[
c = \frac{3 \times 10^8 \text{ m}}{s} \times \frac{1 \text{ mile}}{1609 \text{ m}} \times \frac{3600 \text{ s}}{1 \text{ h}} = 6.7 \times 10^8 \text{ mph}
\]