

# Applied Mechanics Statics

## Lecture 1

# Objectives

After completing the course, you should be able to:

- Analyze forces and find out the resultant forces in two and three dimension
- Differentiate between various type of supports and draw free-body-diagram
- Compute the reaction force, internal forces and bending moment at a specific point on a simple structure (beam, frame, truss)
- Draw bending moment and shear force diagram to a simple structure.
- Obtain center of mass and centroid for deferent engineering shapes & moment of inertia for deferent sections

# Introduction to Mechanics

## What is mechanics?

Physical science deals with the state of rest or motion of bodies under the action of force

## Why we study mechanics?

This science form the groundwork for further study in the design and analysis of structures

# Basic Terms

Basic terms understand:

- **Statics:** dealing with the equilibrium of a rigid-body at rest
- **Rigid body:** the relative movement between its parts are negligible
- **Dynamics:** dealing with a rigid-body in motion
- **Length:** applied to the linear dimension of a straight line or curved line
- **Area:** the two dimensional size of shape or surface
- **Volume:** the three dimensional size of the space occupied by substance
- **Force:** the action of one body on another whether it's a push or a pull force
- **Mass:** the amount of matter in a body
- **Weight:** the force with which a body is attracted toward the centre of the Earth
- **Particle:** a body of negligible dimension

# Units of Measurement

Four fundamental quantities in mechanics

- Mass
- Length
- Time
- Force

Two different systems of units we dealing with during the course

- International System of Units or Metric Units (SI)
  - Length in metre (m)
  - Time in Seconds (s)
  - Force in Newton (N)

# Units of Measurement

The four fundamental quantities in the SI system

Quantity	SI Units	
	Unit	Symbol
Mass	kilogram	kg
Length	meter	m
Time	second	s
Force	newton	N

# Units of Measurement

## Metric System (SI)

- SI System offers major advantages relative to the FPS system
  - Widely used throughout the world
  - Use one basic unit for length → meter; while FPS uses many basic units → inch, foot, yard, mile
  - SI based on multiples of 10, which makes it easier to use & learn whereas FPS is complicated, for example
    - SI system → 1 meter = 100 centimeters, 1 kilometer = 1000 meters

## Metric System (SI)

- Newton's second law  $F = m \cdot a$ 
  - Thus the force (N) = mass (kg)  $\times$  acceleration ( $m/s^2$ )
- Therefore 1 Newton is the force required to give a mass of 1 kg an acceleration of  $1 m/s^2$