SKAA 1213 - Engineering Mechanics

TOPIC 1

INTRODUCTION

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What is Mechanics

- Study of bodies at rest or motion that are subjected to the action of force
  - **Rigid-body mechanics**
  - Deformable-body mechanics
  - Fluid mechanics
- **Rigid body mechanics**
  - **Statics** - equilibrium of bodies either at rest or moving at a constant velocity
  - **Dynamics** – bodies in accelerated motion

Idealisations

- help to simplify application of the theory.
- **Particle** – has mass but the size can be neglected. The geometry is not involved in the analysis.
- **Rigid Body** – consider as a combination of large number of particles in which all the particles remained at a fixed distance from one another before and after applying a load.
- **Concentrated Force** – represents the effect of a loading which is assumed to act at a point on a body.

Scalar and Vectors Quantities

Most physical quantities in mechanics can be expressed mathematically by means of scalar and vector quantities.

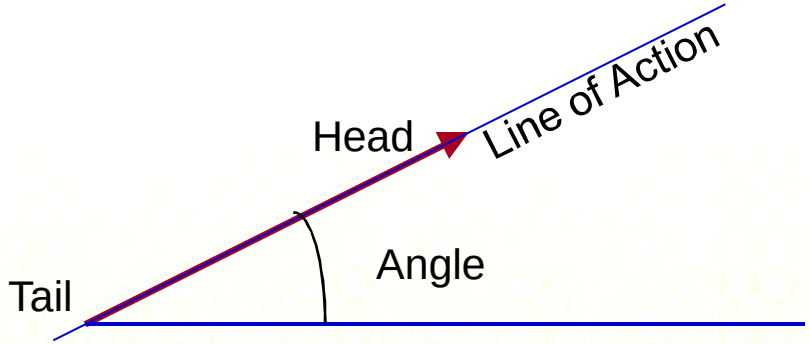
- **Scalar** – quantity that has magnitude but not direction.

  eg. **Mass** (m), **volume** (V), **length** (l)

- **Vector** – quantity that has both a magnitude and a direction.

  eg. **Force** (**F**), **moment** (**M**), **position** (**r**)

A vector is represented graphically by an **arrow**;



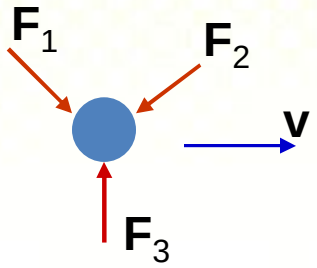
Magnitude – length
Direction – angle
Sense – arrow head

Force is a vector quantity – rules of **vector algebra** applies

Newton's Law of Motion

Rigid body mechanics is formulated on the basis of Newton's three laws of motion.

First Law:. A particle originally at rest, or moving in a straight line with constant velocity, will remain in this state provided the particle is not subjected to an unbalanced force



Equilibrium

Second Law: A particle acted upon by an unbalanced force **F** experiences an acceleration **a** that has the same direction as the force and a magnitude that is directly proportional to the force.

$$\mathbf{F} = m\mathbf{a}$$

Accelerated motion

Third Law: the mutual force of action and reaction between two particles are equal, opposite, and collinear.