LECTURE # 1

In this lecture you will learn about:

- Basic Concepts (Mechanics, Applied Mechanics, Statics & Dynamics, Physical Quantities, Rigid Body and Particle).
- Length, Mass And Time.
- Scalars.
- Vectors.
- Properties of Vectors.

Course Name:

"Applied Mechanics"

Course Code: CT-144

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MECHANICS

The branch of science which deals with the forces and their effects on the bodies on which they act is called mechanics

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APPLIED MECHANICS

Applied mechanics also known as engineering mechanics is the branch of engineering which deals with the laws of mechanics as applied to the solution of engineering problems.

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APPLICATION OF APPLIED MECHANICS

Some of the important practical applications of the principals and laws of mechanics are given below:

1. The motion of vehicles such as trains, buses etc.
2. The design of building and forces on columns and walls.

BRANCH OF APPLIED MECHANICS

The subject of applied mechanics is broadly divided into the following two branches:

Statics

The branch of applied mechanics which deals with the forces and their effects while acting upon bodies which are at rest is called statics.

Dynamics

The branch of applied mechanics which deals with the forces and their effects while acting upon bodies which are in motion is called dynamics.

DYNAMICS

It is further divided into two types:

Kinetics

The branch of dynamics which deals with the relationship between motion of bodies and forces causing motion is called kinetics.

Kinematics

The branch of dynamics which deals with motion of bodies without considering the forces which cause motion is called kinematics.

UNIT/QUANTITY

It is **standard** for the measurement of **physical quantities.**

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BASIC UNIT/ FUNDAMENTAL UNITS/ BASIC QUANTITIES:

Basic quantities / Basic Unit:

The quantities which **do not depend upon** other quantities for their measurement is known as basic quantities and their corresponding units are known as the basic units.

Example

Length, Mass, Time, Temperature, Electric current, plane angle etc.

DERIVED QUANTITIES/ DERIVED UNIT

The quantities which **depend upon** one or more basic quantities for their measurement is known as derived quantities and their corresponding units are known as the derived units.

Example

Velocity, Acceleration, Force, Work & Energy, Power etc.

DERIVED QUANTITIES/ DERIVED UNIT

Derived quantities	Symbol	Unit
Velocity	V	m/s
Acceleration	a	m/s^2
Force	F	N
Work & Energy	W	J
Power	P	W

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BASIC UNIT/ FUNDAMENTAL UNITS/ BASIC QUANTITIES

Basic quantities	Symbol	Unit
Length	l	Meter (m)
Mass	m	Kg
Time	t	s or sec
Temperature	T	K
Electric current	I	A
Plane angle	θ	rad

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BASIC QUANTITIES

The four basic quantities in mechanics are

- Length
- Mass
- Time
- Force

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LENGTH, MASS AND TIME

LENGTH

Is used to locate the position of a point and to describe the size of physical system.

MASS

Is a measure of quantity of matter

TIME

Is a succession of events. It is important in “Dynamics”

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SYSTEMS OF UNITS

There are four systems of units recognized universally:

C.G.S. Systems: In this system, the units of length, mass and time are centimetre, gram and second respectively.

F.P.S. Systems: In this system, the units of length, mass and time are foot, pound and second respectively.

M.K.S. Systems: In this system, the units of length, mass and time are metre, kilogram and second respectively.

S.I. Systems: In this systems, the units of length, mass and time are metre(m), kilogram(kg) and second(s) respectively. The S.I. units of various derived units are as under:

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BODY

A body is defined as an **object**, which **cannot** retain its shape and size under the action of a force system.

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RIGID BODY

A rigid body is defined as a body, which **can retain** its shape and size even if subjected to external forces.

In practice, there is small deformation of body under the action of a force system. Such deformation is neglected and the body is treated as rigid body.

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PARTICLE

A particle is defined as a **very small amount of matter**, which may be assumed to occupy a single point in space.

Practically, any object having very small dimensions as compared to its range of motion can be called as a Particle.

Example

Stars, planets, Rockets, Bullets etc.

SCALAR QUANTITY

It is the quantity having **magnitude only**. It has no direction.

Example

Mass, speed etc.

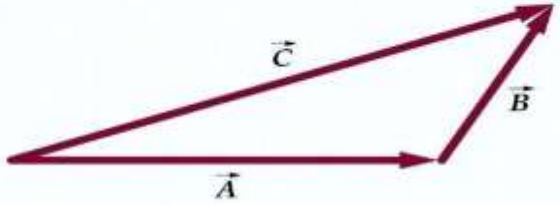
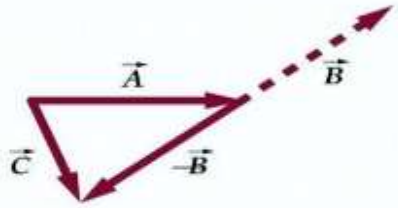
VECTOR QUANTITY

It is the quantity having **magnitude and direction**. It is shown by vector.

Example

Force, Velocity, acceleration etc.

PROPERTIES OF VECTOR

Property	Explanation	Figure	Component representation
Equality	$\vec{A} = \vec{B}$ if $\lvert\vec{A}\rvert = \lvert\vec{B}\rvert$ and their directions are the same		$A_x = B_x$ $A_y = B_y$ $A_z = B_z$
Addition	$\vec{C} = \vec{A} + \vec{B}$		$C_x = A_x + B_x$ $C_y = A_y + B_y$ $C_z = A_z + B_z$
Negative of a vector	$\vec{A} = -\vec{B}$ if $\lvert\vec{B}\rvert = \lvert\vec{A}\rvert$ and their directions are opposite		$A_x = -B_x$ $A_y = -B_y$ $A_z = -B_z$
Subtraction	$\vec{C} = \vec{A} - \vec{B}$		$C_x = A_x - B_x$ $C_y = A_y - B_y$ $C_z = A_z - B_z$
Multiplication by a scalar	$\vec{B} = s\vec{A}$ has magnitude $\lvert\vec{B}\rvert = \lvert s\rvert\lvert\vec{A}\rvert$ and has the same direction as $\vec{A}$ if s is positive or $-\vec{A}$ if s is negative		$B_x = sA_x$ $B_y = sA_y$ $B_z = sA_z$

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Thank You