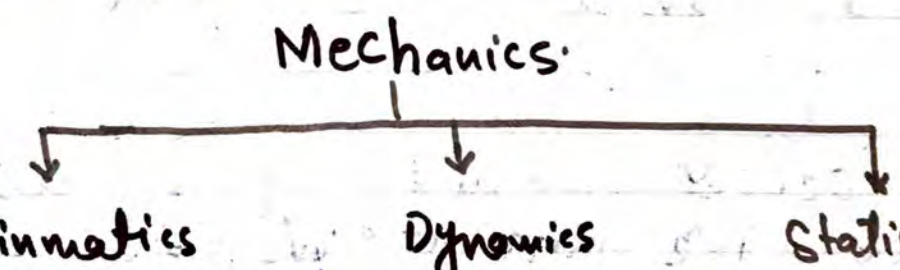
CHAPTER ①

Survey of Elementary Physics.

* Classical mechanics:-

Historically mechanics was the earliest Branch of Physics to Be developed, so at Present it is known as classical mechanics. The whole Structure of Physics is Based upon it.

* **mechanics:-** The study of forces and its effect on objects is known as mechanics. mechanics can Be divided into three disciples as follows.



* **Kinmatics:-** In it we describe the motion of matrial Body in terms of Quantities, such as displacement, velocity, with out Cosidring the Cause of motion. In fact it is the Geometrical description of the motion of the Body. The Possible motion may Be Trationals, Rotationals and ~~Rotational~~.

* **Dynamics:-** In dynamics we study the laws and the equation of

of motion containing force which governs different type of motion.

4 statics :- Statics is a Branch of mechanics dealing with forces on an object or in a system which is in equilibrium. if the forces on an object are in a system cause no change of momentum. The object & the system is in equilibrium. Statics is the study of such cases.

The study of mechanics may be sub divided according to kind of system to be study. The simplest physical system is a single particle. we will first consider a single particle e.g the rigid body may be treated as a special kind of system of particles. The most useful tool of classical mechanics, is newton's law of motion. Most of the problem of mechanics are solved by these laws, however there are problems which can not be tackled by newton laws. These problems are solved by other formulation of mechanics such a Lagrange equations and Hamiltonians equation. we shall study these formulation of classical mechanics latter on.

Mechanics of a Particle:-

Let $\vec{r}$ Be The Position vector of a Particle for some given origion. If v is its velocity, then

$$\vec{v} = \frac{d\vec{r}}{dt}$$

and

$$\vec{a} = \frac{d\vec{v}}{dt} = \frac{d^2\vec{r}}{dt^2}$$

Linear Momentum:-

Linear momentum of a Particle is defined as The Product of its mass & velocity. It is denoted By $\vec{P}$

$$\vec{P} = m\vec{v}$$

Newton 2nd law of motion:-

As we know that

$$F = \frac{dP}{dt} \qquad \text{But } P = mv$$

$$= \frac{d}{dt}(mv)$$

$$= m\frac{dv}{dt}$$

But $\frac{dv}{dt} = a$.

$$F = ma \qquad \text{as } \vec{a} = \frac{d^2\vec{r}}{dt^2}$$

or $$F = m\frac{d^2r}{dt^2}$$

For example In a force field a Particle of mass 5 units is along a space curve whose Position vector is given as function of time as follows:

H.W] $\vec{r} = (4t^3 + t)i + (2t^4 - t^2 + 8)j - 12t^2k$ -

we know that

(a) $v = \frac{dx}{dt} = (8t+1)i + (12t^3 - 2t)j + 4k$

and

(b) $a = \frac{dv}{dt} = 8i + (36t^2 - 2)j + 4k$

As $F = ma$

(c) $F = m(8i + (36t-2)j + 4k$

and also know that

$$F = \frac{dP}{dt}$$

$$\int dP = \int F\,dt$$

$$P = m\left(\int (8i)dt + \int (36t-2)j\,dt - 24\int t\,dt\right)$$

$$= m\left(8ti + \left(\frac{36t^2}{2} - 2t\right)j - 24\frac{t}{2}k\right)$$

(d) $P = m(8ti + (18t^2 - 2t)j - 12tk$

4. Inertial frame of Refrence:-

A Refrence frame in which The equation $\vec{F} = \frac{dP}{dt} = m\frac{dv}{dt}$ (2nd law of motion) is valid is called intertial or Galalien frame of reference. for all Particles Purpose The refrance frame fixed on earth is a closed Approximation to an Inertial system. if The syetm is fixed on earth then

along increasing value of r, ϕ & z. Direction of a_r, a_ϕ varies but a_z remain Constant. These three vectors are mutually ⊥ar

Diffrental Volume:- Diffrental increase in r, ϕ & z will respectively Be dr, $d\phi$ & dz.

Note: Increse along r is dr and increase in z is dz. and due to increase of $d\phi$ increse of r will Be $r\,d\phi$. In This Case Projection is always equal to r. So diffrental increse in volume element will Be $r\,d\phi\,dr\,dz$.

Relation of Cartesian & Cylindrical:-

$$x = r\cos\phi$$
$$y = r\sin\phi$$
$$z = z$$

Torque:- if a Body is fixed at Pt O, about which it Can rotate. A force F Applied on the Body will rotate it about O. The rotational tendency of ~~two~~ the Body due to the Force F or the turning effect of force F is called moment of the force about Pt. O. The moment of force is also known as Torque ($\vec{N}$) mathmatically

$$\vec{T} = \vec{r} \times \vec{F}$$