



JECRC Foundation



**JAIPUR ENGINEERING COLLEGE
AND RESEARCH CENTRE**

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTER

Year & Sem. – II & III Civil

Subject –Engineering Mechanics

Unit– 1

Presented by – Sumit Saini (Assistant Professor)

Mechanics Concept And Applied Mechanics

- The branch of physical science that deals with the state of rest or the state of the motion is termed as Mechanics.
- Starting from the analysis of the rigid bodies under gravitational force and simple applied forces the mechanics has grown to the analysis of robotics, aircrafts, spacecrafts under dynamic forces, atmospheric forces, temperature forces etc.

Mechanics Concept And Applied Mechanics

- The mechanics is developed by these researchers may be grouped as
 1. Classical mechanics
 2. Relativistic mechanics
 3. Wave mechanics.

Classification of Mechanics

- Base on the body to which the mechanics is applied, the engineering mechanics is classified as
 - i. Mechanics of Solids, and
 - ii. Mechanics of Fluids.
- The solid mechanics is the further classified as the mechanics of rigid bodies and mechanics of deformable bodies.

Classification of Engineering Mechanics

- The body which will not deform or the body in which deformation can be neglected in the analysis, are called as Rigid bodies.
- The mechanics of the rigid bodies dealing with the bodies at rest is termed as Statics and that dealing with bodies in motion is called Dynamics.
- The dynamics dealing with the problems without referring to the forces causing the motion of the body is termed as Kinematics and if it deals with the forces causing motion also, is called Kinetics.

Basic Terminologies In Mechanics

- **Mass**
- The quantity of the matter possessed by a body is called mass.
- When a body is taken out in a spacecraft, the mass will not change but its weight may change due to change in gravitational force.
- **Time**
- Time is the measure of succession of events.
- The successive event selected is the rotation of earth about its own axis and this is called a day.

- **Space**
- The geometric region in which study of body is involved is called space.

- **Displacement**
- Displacement is defined as the distance moved by a body/particle in the specified direction.

- **Velocity**
- The rate of change of displacement with
- respect to time is defined as velocity.

- **Acceleration**

- Acceleration is the rate of change of velocity with respect to time.

- Thus $a = dv/dt$, where v is velocity

- **Momentum**

- The product of mass and velocity is called momentum. Thus

- Momentum = Mass \times Velocity

- **Rigid Body**

- A body is said to be rigid, if the relative positions of any two particles in it do not change under the action of the forces.

Laws of Mechanics

- The following are the fundamental laws of mechanics:
 1. Newton's first law
 2. Newton's second law
 3. Newton's third law
 4. Newton's law of gravitation
 5. Law of transmissibility of forces, and
 6. Parallelogram law of forces.

- **Newton's First Law**

- It states that every body continues in its state of rest or of uniform motion in a straight line unless it is compelled by an external agency acting on it.
- This leads to the definition of force as the external agency which changes or tends to change the state of rest or uniform linear motion of the body.

- **Newton's Second Law**

- It states that the rate of change of momentum of a body is directly proportional to the impressed force and it takes place in the direction of the force acting on it.
- Thus according to this law,

$$\text{Force} \propto \text{mass} \times \text{acceleration}$$

$$F \propto m \times a$$

- **Newton's Third Law**

- It states that for every action there is an equal and opposite reaction.
- Consider the two bodies in contact with each other. Let one body applies a force F on another. According to this law the second body develops a reactive force R which is equal in magnitude to force F and acts in the line same as F but in the opposite direction.

- **Newton's Law of Gravitation**

- Everybody attracts the other body. The force of attraction between any two bodies is directly proportional to their masses and inversely proportional to the square of the distance between them. According to this law the force of attraction between the bodies of mass m_1 and mass m_2 at a distance d as shown in Fig. is

$$F = G \frac{m_1 m_2}{d^2}$$

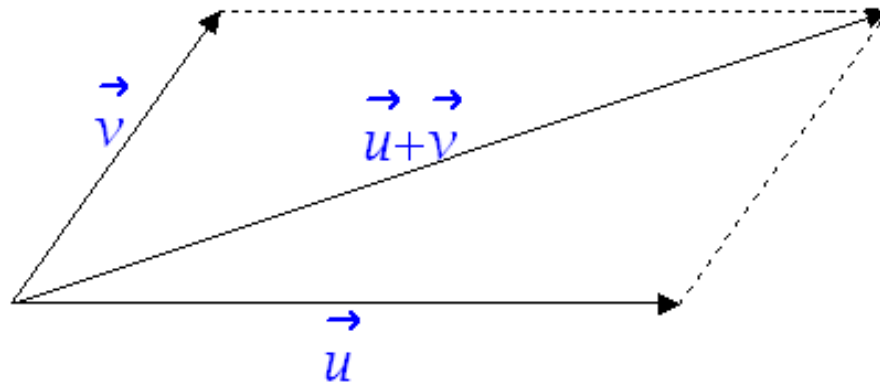
- **Law of Transmissibility of Force**

- According to this law the state of rest or motion of the rigid body is unaltered if a force acting on the body is replaced by another force of the same magnitude and direction but acting anywhere on the body along the line of action of the replaced force.

- **Parallelogram Law of Forces**

- The parallelogram law of forces enables us to determine the single force called resultant force.

- This law states that if two forces acting simultaneously on a body at a point are presented in magnitude and direction by the two adjacent sides of a parallelogram, their resultant is represented in magnitude and direction by the diagonal of the parallelogram which passes through the point of intersection of the two sides representing the forces.



Units

- Length (L), Mass (M) and Time (S) are the fundamental units in mechanics. The units of all other quantities may be expressed in terms of these basic units. The three commonly used systems in engineering are
 - Meter-Kilogramme-Second (MKS) system
 - Centimeter- Gramme-Second (CGS) system
 - Foot-Pound-Second (FPS) system.

Units

Quantity	Unit	Notation
Area	Square meter	m ²
Volume	Cubic meter	m ³
Velocity	Meter per second	m/sec
Acceleration	Metre per second per second	m/sec ²

IMAGE REFERENCES

Sr. No.

Source/Links

1

<http://hom.wikidot.com/local--files/roberval/ParallelogramLaw.PNG>

CONTENT REFERENCES

- A TEXT BOOK OF ENGINEERING MECHANICS ,
R.S.KHURMI , S.CHAND & COMPANY PVT. LTD.
- A TEXT BOOK OF ENGINEERING MECHANICS , Dr.
R.K.BANSAL , LAXMI PUBLICATION