

ENGINEERING MECHANICS

INTRODUCTION:

→ Mechanics is the branch of physical sciences which deals with the study of bodies such as Machines and structures at rest or in motion subjected to external ~~forces~~ mechanical disturbances such as force, momentum, &

→ Application of principle science to practical engineering problem is known as Engineering Mechanics. It is very essential for an engineer

- to
- planning
- designing
- construction.

→ Mechanics was coined by Aristotle (384-322BC)

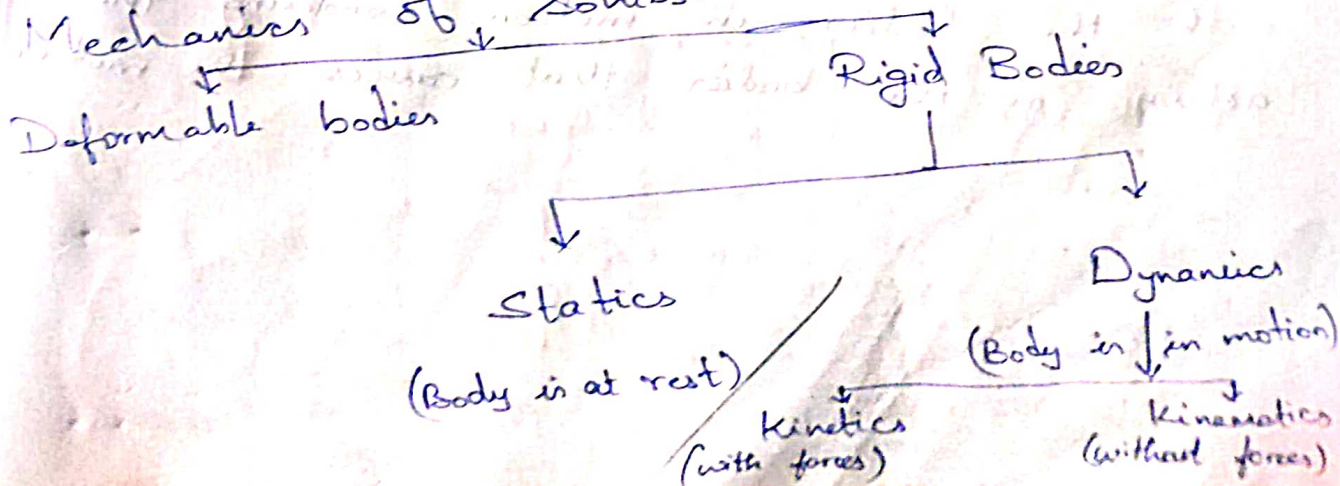
→ Real growth started with Newton (1686)

→ From 18th century it is called Newtonian Mechanics

TYPES OF MECHANICS:

1. Mechanics of Solids
2. Mechanics of fluids

Mechanics of Solids



Mechanics of Deformable bodies

Deformable bodies are those that deform (change in shape) under action of applied forces.

Mechanics of Rigid bodies

Rigid bodies are those that do not deform (change in shape, size) under action of applied forces.

(a) Statics : Study of rigid bodies that are in rest.

(b) Dynamics : Study of rigid bodies that are in motion.

☐ The motion may be linear (or) angular

Dynamics types:

(a) Kinematics:

It is a branch of dynamics which deals with the ~~relationships~~ bodies in motion without any reference to the forces that causes the motion.

(b) Kinetics:

It is a branch of dynamics which deals with the bodies in motion considering the forces acting on the bodies that causes the motion.

SYSTEM OF UNITS:

- represented in the order of length-mass-time

CGS System → Centimeter - Gram - Second

FPS System → Foot - Pound - Second

MKS System → Meter - Kilogram - Second

SI Units → Meter - Kilogram - Seconds System.

SI Units - International System of Units

Base Quantity (Fundamental Units)

Length - meter - m

Mass - kilogram - kg

Time - Second - s

Electric Current - Ampere - A

Temperature - Kelvin - K
Celsius - °C

$$\left\{ \begin{array}{l} 1^\circ\text{C} = 273.15\text{K} \end{array} \right.$$

Derived Quantity (Derived Units)

Area

Square meter

m^2

Volume

Cubic meter

m^3

Speed, Velocity

meter per second

m s^{-1} [m/s]

Acceleration

meter per second squared

m s^{-2} [m/s²]

Force, Weight

Newton

N

Pressure, Stress

Newton per square meter
(or) Pascal

$\text{N/m}^2 = \text{Pa}$

$1\text{N/m}^2 = 1\text{Pa}$

Torque, Moment, Couple

Force × perpendicular distance

Nm

Energy, Work,

Quantity of Heat

Density

Power

Angular velocity

Angular acceleration

Momentum, Impulse

Joule = 1 Nm
mass/volume

Watt = 1 J/s

radian per second

radian per second squared

mass \times velocity

J

kg/m³

W

rad/s

rad/s²

kg-m/s

Area moment of Inertia

Mass Moment of Inertia

formula depends on shape & cross section. deals later

m⁴

kg-m²

Prefixes:

10³ kilo k

10⁶ mega M

10⁹ giga G

10¹² tera T

10⁻³ milli m

10⁻⁶ micro μ Greek letter mu

10⁻⁹ nano n

10⁻¹² pico p

Physical Quantities:

Area \rightarrow Length \times Breadth

Volume \rightarrow Length \times Breadth \times Depth

Speed/Velocity \rightarrow Distance/Time

Acceleration \rightarrow velocity/Time

Force \rightarrow Mass \times acceleration due to gravity [g = 9.81 m/s²]

Work done \rightarrow Force \times distance

Torque \rightarrow Force \times \perp distance

Power \rightarrow Work done/Time

Pressure/stress \rightarrow Force/Area