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, d

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

Deformable bodies

Rigid Bodies

Statics (Body is at rest)

Dynamics (Body is in motion)

Kinetics (with forces)

Kinematics (without forces)

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 ~~rotational~~ bodies in motion without any refrence to the 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 - Paund - Second

MKS System → Meter - Kilogram - Second

SI Units → Meter - Kilogram - Seconds System.

SI Unit - Internation System of Units

Base Quantity (Fudemental Units)

Length	meter	m
Mass	kilogram	kg
Time	Second	s
Electric Current	Ampere	A
Temperature	Kelvin	K
	°Celcius	°C

$1°C = 273.15K$

Derived Quantity (Derived Units)

Area	square meter	m^2
Volume	Cubic meter	m^3
Speed, Velocity	meter per second	ms^{-1} [m/s]
Acceleration	meter per second squared	ms^{-2} [m/s^2]
Force, Weight	Newton	N
Pressure, stress	Newton per square meter or Pascal	$N/m^2 = Pa$ $1N/m^2 = 1Pa$
Torque, Moment, Couple	Force × perpendicular distance	Nm

Energy, Work, Quantity of Heat	Joule = 1 Nm	J
Density	mass / volume	kg/m^3
Power	Watt = 1 J/s	W
Angular velocity	radian per second	rad/s
Angular acceleration	radian per second square	rad/s^2
Momentum, Impulse	mass × velocity	Kg-m/s

Area moment of Inertia	formula depends on shape of cross section. deals later	m^4
Mass Moment of Inertia		$Kg-m^2$

Prefixes:

10^3	kilo	k	10^{-3}	milli	m
10^6	mega	M	10^{-6}	micro	μ (Greek letter m)
10^9	giga	G	10^{-9}	nano	n
10^{12}	tera	T	10^{-12}	pico	p

Physical Quantities:

Area → Length × Breadth

Volume → Length × Breadth × Depth

Speed / Velocity → Distance / Time

Acceleration → Velocity / Time

Force → Mass × acceleration due to gravity [$g = 9.81\ m/s^2$]

Work done → Force × distance

Torque → Force × ⊥r distance

Power → Work done / Time

Pressure / stress → Force / Area