

SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35.

Accredited by NBA – AICTE and Accredited by NAAC – UGC with ‘A++’ Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai.

DEPARTMENT OF AUTOMOBILE ENGINEERING

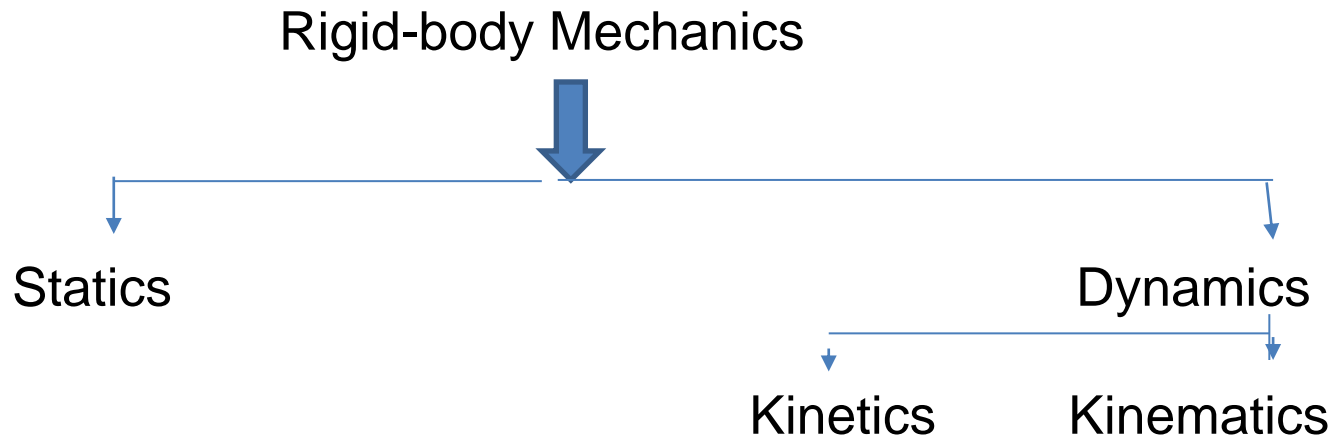
COURSE NAME : 23MET101 – ENGINEERING MECHANICS

I YEAR / I SEMESTER

Topic – Units and Dimensions

Mechanics

Mechanics is a branch of the physical sciences that is concerned with the state of rest or motion of bodies subjected to the action of forces.



STATICS

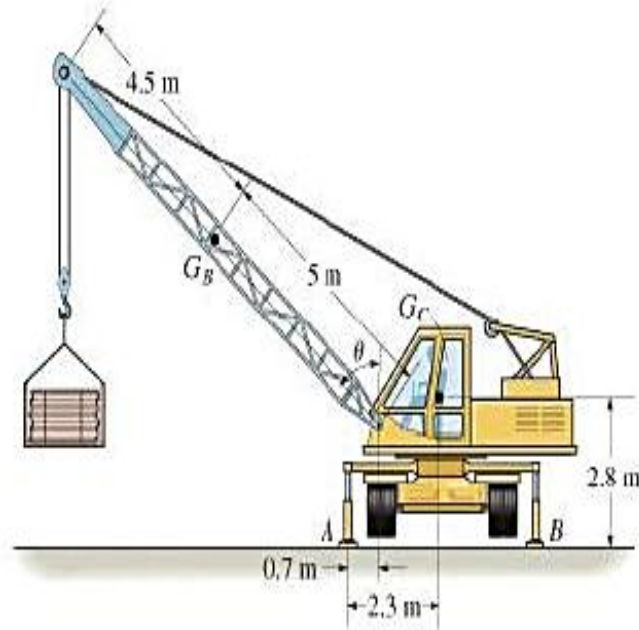
- It is that branch of Engineering Mechanics, which deals with the forces and their effects, while acting upon the bodies at rest.

DYNAMICS

1. It is that branch of Engineering Mechanics, which deals with the forces and their effects, while acting upon the bodies in motion.
2. The subject of Dynamics may be further sub-divided into the following two branches :
 1. Kinetics, and 2. Kinematics.

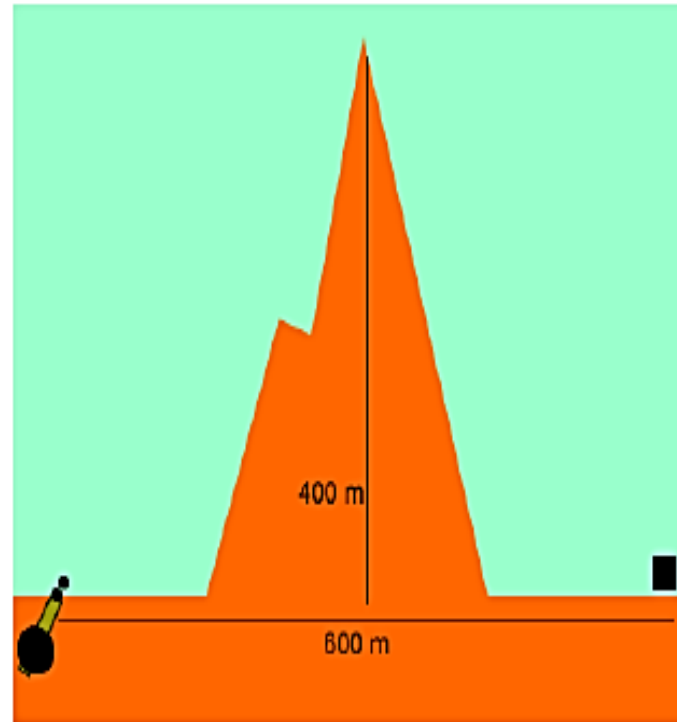
Rigid-body Mechanics

Statics: deals with equilibrium of bodies under action of forces (bodies may be either at rest or move with a constant velocity).



Rigid-body Mechanics

- **Dynamics**: deals with motion of bodies (accelerated motion)



KINETICS

It is the branch of Dynamics, which deals with the bodies in motion due to the application of forces.

KINEMATICS

It is that branch of Dynamics, which deals with the bodies in motion, without any reference to the forces which are responsible for the motion.

SCALAR QUANTITIES

- The scalar quantities (or sometimes known as scalars) are those quantities which have magnitude □ only such as length, mass, time, distance, volume, density, temperature, speed etc.

VECTOR QUANTITIES

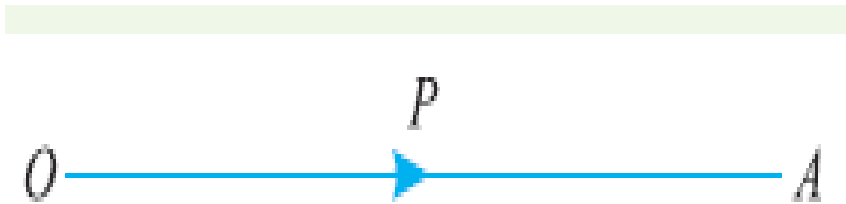


Fig. 1.2. Vector \vec{OA}

UNITS

1. FUNDAMENTAL UNITS
2. DERIVED UNITS

FUNDAMENTAL UNITS

1.10. FUNDAMENTAL UNITS

The measurement of physical quantities is one of the most important operations in engineering. Every quantity is measured in terms of some arbitrary, but internationally accepted units, called *fundamental units*.

All the physical quantities, met with in Engineering Mechanics, are expressed in terms of three fundamental quantities, *i.e.*

1. length,
2. mass and
3. time.

DERIVED UNITS

1.11. DERIVED UNITS

Sometimes, the units are also expressed in other units (which are derived from fundamental units) known as *derived units* e.g. units of area, velocity, acceleration, pressure etc.

SYSTEMS OF UNITS

1. C.G.S. units -Centimetre– gram– second system of units
2. F.P.S. units -Foot– pound–second system
3. M.K.S. units- metre, kilogram, and/ or second
4. S.I. units (INTERNATIONAL SYSTEM OF UNITS)

S.I. units (INTERNATIONAL SYSTEM OF UNITS)

A system of physical units (SI units) based on the metre, kilogram, second, ampere, kelvin, candela, and mole, together with a set of prefixes to indicate multiplication or division by a power of ten.

S.I. UNITS (INTERNATIONAL SYSTEM OF UNITS)

Density (Mass density)

kg / m^3

Force

N (Newton)

Pressure

N/mm^2 or N/m^2

Work done (in joules)

$\text{J} = \text{N}\cdot\text{m}$

Power in watts

$\text{W} = \text{J}/\text{s}$

International metre, kilogram and second are discussed here.


Standard Abbreviations

| | |
|------|---|
| m | for metre or metres |
| km | for kilometre or kilometres |
| kg | for kilogram or kilograms |
| t | for tonne or tonnes |
| s | for second or seconds |
| min | for minute or minutes |
| N | for newton or newtons |
| N-m | for newton \times metres (<i>i.e.</i> , work done) |
| kN-m | for kilonewton \times metres |
| rad | for radian or radians |
| rev | for revolution or revolutions |

Mechanics: Units

Four Fundamental Quantities

| Quantity | Dimensional Symbol | SI UNIT | |
|----------|--------------------|----------|--------|
| | | Unit | Symbol |
| Mass | M | Kilogram | Kg |
| Length | L | Meter | m |
| Time | T | Second | s |
| Force | F | Newton | N |



$$F = ma$$

$$\rightarrow N = \text{kg} \cdot \text{m}/\text{s}^2$$

$$W = mg$$

$$\rightarrow N = \text{kg} \cdot \text{m}/\text{s}^2$$

1 Newton is the force required to give a mass of 1 kg an acceleration of $1 \text{ m}/\text{s}^2$

Mechanics: Units Prefixes

| | Exponential Form | Prefix | SI Symbol |
|--------------------|------------------|--------|-----------|
| <i>Multiple</i> | | | |
| 1 000 000 000 | 10^9 | giga | G |
| 1 000 000 | 10^6 | mega | M |
| 1 000 | 10^3 | kilo | k |
| <i>Submultiple</i> | | | |
| 0.001 | 10^{-3} | milli | m |
| 0.000 001 | 10^{-6} | micro | μ |
| 0.000 000 001 | 10^{-9} | nano | n |

Thank You..