

MECHANICS FOR ENGINEERS

Lesson-1

Engineering Mechanics

- It is that branch of Applied Science, which deals with the laws and principles of Mechanics, along with their applications to engineering problems. It studies the effects of forces on rigid bodies.
- It may be divided into the following two main groups:
 1. Statics, and
 2. Dynamics

Statics

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

Dynamics

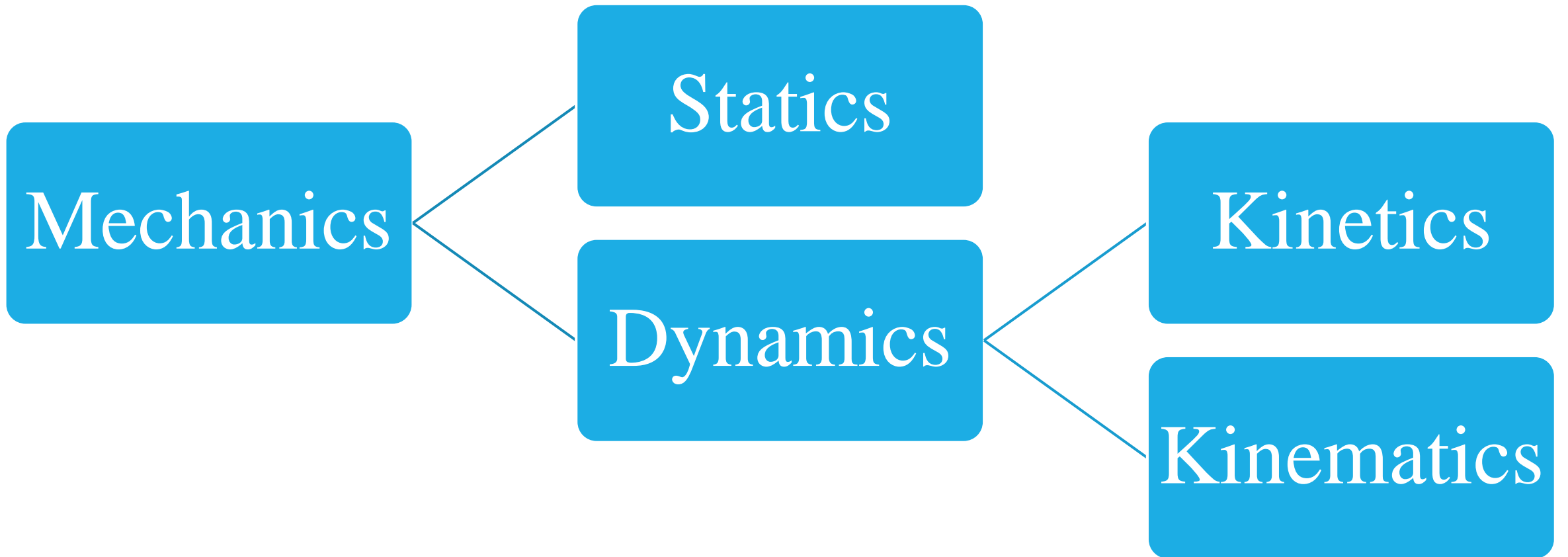
- It is that branch of Engineering Mechanics, which deals with the forces and their effects, while acting upon the bodies in motion. The subject of Dynamics may be further sub-divided into the following two branches:
 1. Kinetics and 2. Kinematics

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.



Matter, Particle and Body

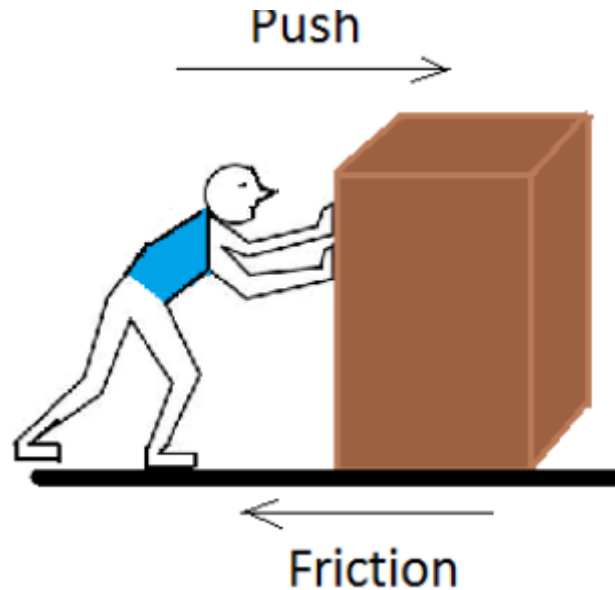
- ***Matter***: Matter is anything that occupies space, possesses mass and offers resistance to any external force.
- ***Particle***: A particle is an object that has infinitely small volume (occupies negligible space) but has a definite mass which can be considered to be concentrated at a point.

Matter, Particle and Body

- ***Body***: A body has a definite shape and consists of numbers of particles.
- ***Rigid body***: A rigid body exhibits no relative deformation between two parts when it is acted upon by a force system. It means the size and shape of the body does not change under the action of forces, how large they may be.
- ***Elastic body***: An elastic body undergoes deformation but regains its original shape and size after removal of the external forces.

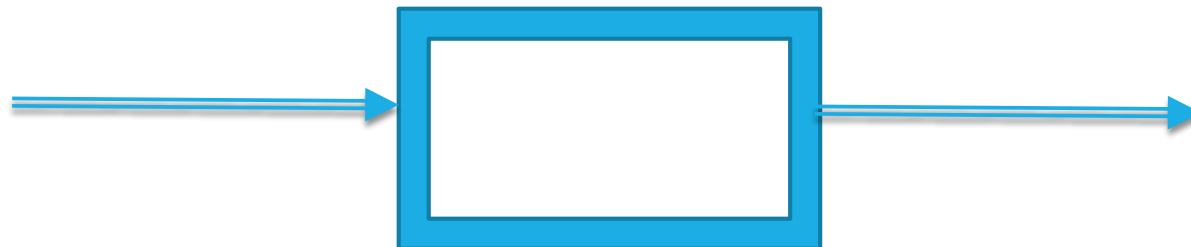
Force

- Force is an external agency that tends to change the state of rest or of uniform motion of a body. It is a vector quantity and its unit is Newton (N).



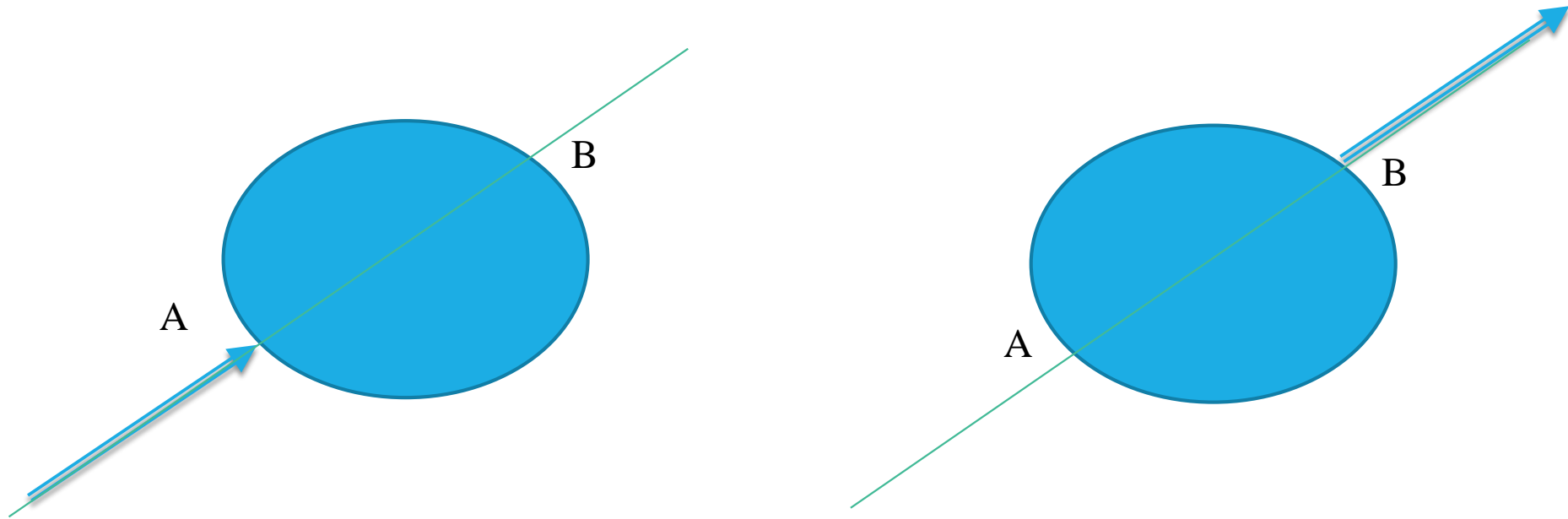
Specification of a Force

- Magnitude of the force (i.e., 100 N, 50 N, 20 kN, 5 kN, etc.)
- The direction of the line, along which the force acts (i.e., along OX, OY, at 30° North of East etc.). It is also known as line of action of the force.
- Nature of the force (i.e., whether the force is push or pull). This is denoted by placing an arrow head on the line of action of the force.
- The point at which (or through which) the force acts on the body.



Principle of Transmissibility of Forces

- It states, “If a force acts at any point on a rigid body, it may also be considered to act at any other point on its line of action, provided this point is rigidly connected with the body.”



System of Forces

- When two or more forces act on a body, they are called to form a system of forces. Following systems of forces are important from the subject point of view:
- **Coplanar forces:** The forces, whose lines of action lie on the same plane, are known as coplanar forces.
- **Collinear forces:** The forces, whose lines of action lie on the same line, are known as collinear forces.
- **Concurrent forces:** The forces, which meet at one point, are known as concurrent forces. The concurrent forces may or may not be collinear.

System of Forces(Contd...)

- **Coplanar concurrent forces:** The forces, which meet at one point and their lines of action also lie on the same plane, are known as coplanar concurrent forces.
- **Coplanar non-concurrent forces:** The forces, which do not meet at one point, but their lines of action lie on the same plane, are known as coplanar non-concurrent forces.

System of Forces(Contd...)

- **Non-coplanar concurrent forces:** The forces, which meet at one point, but their lines of action do not lie on the same plane, are known as non-coplanar concurrent forces.
- **Non-coplanar non-concurrent forces:** The forces, which do not meet at one point and their lines of action do not lie on the same plane, are called non-coplanar non-concurrent forces.

