UNIT-1

L-1

Introduction to Engineering Mechanics

Lecture Objectives

- Identify the difference between various branches of mechanics
- Differentiate between vector and scaler quantities
- Understand basic laws of mechanics

Engineering Mechanics

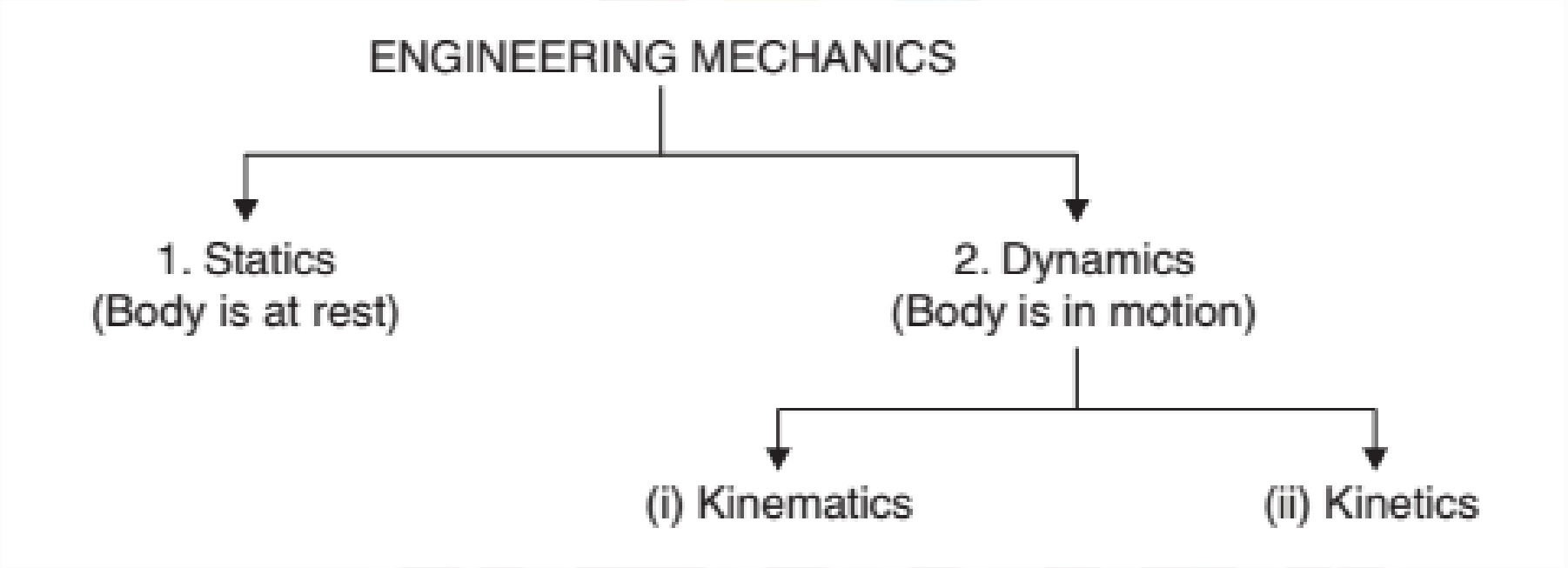
- Engineering mechanics is that branch of science which deals with the behavior of a body when the body is at rest or in motion.
- The engineering mechanics may be divided into statics and dynamics.
- The branch of science, which deals with the study of a body when the body is at rest, is known as statics
- The branch of science which deals with the study of a body when the body is in motion, is known as dynamics.
- Dynamics is further divided into kinematics and kinetics. The study of a body in motion, when the forces which cause the motion are not considered, is called kinematics and if the forces are also considered for the body in motion, that branch of science is called kinetics. The classification of Engineering Mechanics are shown

Continued

- Dynamics is further divided into kinematics and kinetics.
- The study of a body in motion, when the forces which cause the motion are not considered, is called kinematics
- When the forces are also considered for the body in motion, that branch of science is called kinetics. The classification of Engineering Mechanics are shown

Classification

- The classification of Engineering Mechanics are shown



Vector and Scaler Quantities

- Vector quantity : specified by magnitude and direction.
- Law of vector addition should be followed
- Scaler quantity: Specified by magnitude alone
- Question: Is electrical current a vector quantity?

Basics

- Mass: the quantity of matter possessed by the body is called mass. Units- Kilograms

- Time: It is measure of succession of events.

1 Second ≡ Duration of 9192631770 period of radiation of cesium-133 atom

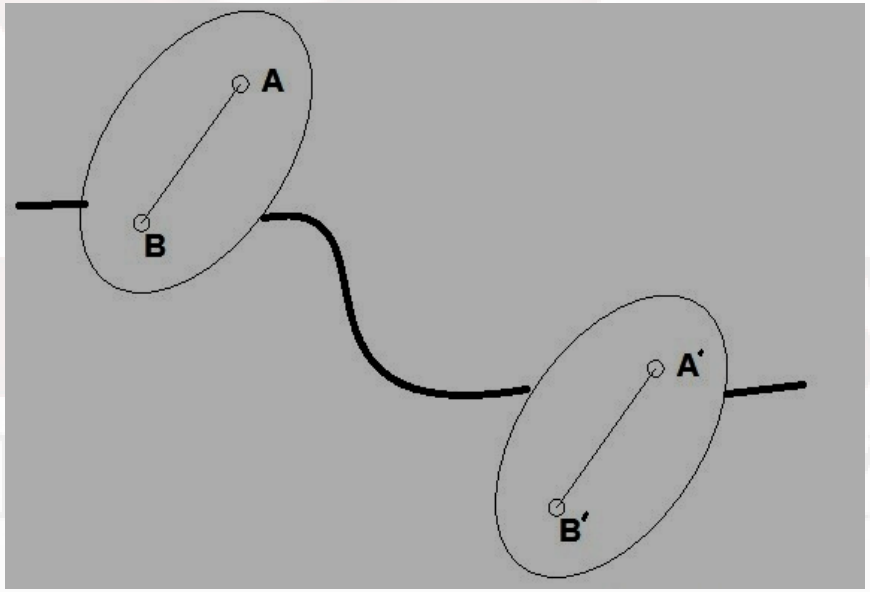
- Length: 1 meter ≡ 1690763.73 wavelengths of Krypton-86 atom

Displacement, Velocity and Acceleration

- Displacement: distance moved by a body or particle in a specified direction.
- Displacement (x)= Final position – initial position
- Velocity (v): $v = \frac{dx}{dt}$
- Acceleration (a): $a = \frac{d^2x}{dt^2} = \frac{dv}{dt}$
- Momentum = mass x velocity

Rigid bodies

- Rigid Bodies: The body which will not deform or the body in which the deformation can be neglected in analysis are called rigid bodies.
- A body is said to be rigid, if the relative position of any two particles do not change under the action of force.



Continuum

- It is a basic assumption
- It is not possible to solve any engineering problem by treating a body aa a conglomeration of such discrete particles such as atoms and molecules.
- The body is assumed to consist of continuous distribution of matter
- it is treated as a continuum which refers to continuous distribution of matter.

Particle

- Particle is an object which has only mass and no size.
- A particle is a rigid body.
- Such a body can not exist theoretically.
- however for the problems involving distance considerably larger compared to size of the body, it can be considered as a particle without sacrificing accuracy.
- A Bomber plane is a particle for a gunner operating from the ground

Summary

- Engineering problems can be solved by treating matter as continuum.
- A rigid body can be considered as a particle without sacrificing accuracy provided the distance involved are much larger than size of the body.

Question

- Give five practical examples in which a rigid body can be assumed to be a particle.

Text Book

Text Book:

- Engineering Mechanics by S. S. Bhavikatti and K G Rajashekharappa, Seventh Multi Color edition, 2019. New Age International Publisher, Delhi, ISBN: 978-93-87788-49-7
- Engineering Mechanics by R. K. Bansal, Fourth edition, 2014. Laxmi Publications, Delhi, ISBN: 978-81-318-0078-2

Reference Books:

- J. V. Rao, D. H. Young, S. Timoshenko, Sukumar Pati (2013), Engineering Mechanics, Tata McGraw Hill Education. ISBN: 978-1-259-06266-7.
- P. Ferdinand, E. Beer and J. Russell (2010), Vector Mechanics for Engineers, 9th Edition, McGraw-Hill International Edition. ISBN: 978-0-079-12637-5
- Irving H. Shames (2012), Engineering Mechanics – Statics and Dynamics, 4th Edition, Prentice-Hall of India Private limited. ISBN: 978-8-131-72883-3

Thanks!