

ME 141

Engineering Mechanics

Lecture 1: Introduction

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Reference Books:

1. Vector Mechanics for Engineers: Statics. And Dynamics

Ferdinand P. Beer and E. Russell Johnston, Jr.

2. Engineering Mechanics Statics and Dynamics

R. C. Hibbeler

Always collect latest editions

What is Mechanics ?

- Mechanics can be defined as that science which describes and predicts the conditions of rest or motion of bodies under the action of forces.
- Three branches of mechanics:
 - i) mechanics of *rigid bodies*
 - ii) mechanics of *deformable bodies*, and
 - iii) mechanics of *fluids*.

What is Mechanics ?

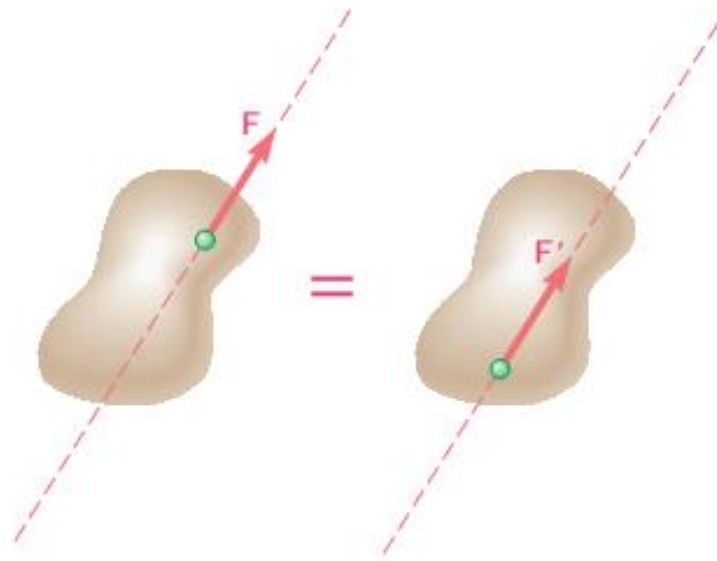
- The mechanics of rigid bodies is subdivided into two parts:
 1. Statics: It deals with bodies at rest.
 2. Dynamics: It deals with bodies in motion.

What is Mechanics ?

- The study of elementary mechanics rests on six fundamental principles based on experimental evidence:
 1. The Parallelogram Law for the Addition of Forces:
 2. The Principle of Transmissibility.
 3. Newton's 1st law of motion.
 4. Newton's 2nd law of motion.
 5. Newton's 3rd law of motion.
 6. Newton's Law of Gravitation.

Principle of transmissibility

- *The conditions of equilibrium or of motion of a rigid body will remain unchanged if a force acting at a given point of the rigid body is replaced by a force of the same magnitude and same direction, but acting at a different point, provided that the two forces have the **same line of action**.*



Some definitions

Particle:

- A particle has a mass but essentially has no size or shape.
- The use of the word “particle” does not imply that our study will be limited to that of small corpuscles. What it means is that the **size and shape of the bodies** under consideration will **not significantly affect** the solution of the problems treated and that all the forces acting on a given body will be assumed to be applied at the same point.
- Example: the size of the earth is insignificant compared to the size of its orbit, and therefore the earth can be modeled as a particle when studying its orbital motion.

Rigid body:

- A *rigid body* can be considered as a combination of a large number of particles in which all the particles remain at a fixed distance from one another, both before and after applying a load. This model is important because the material properties of any body that is assumed to be rigid will not have to be considered when studying the effects of forces acting on the body.