ME 165
Basic Mechanical Engineering

Lecture 01

Introduction

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Course Outcomes

- **Upon the successful completion of the course, you should be able to-**

✓ **Recognize** the significance of using engineering mechanics in modern lives in various forms

✓ **Distinguish** between different types of mechanics especially the theories and problems of statics and dynamics in various kinds of real-life situations

✓ **Calculate** the magnitude and directions of forces in a system using engineering mechanics theories

✓ **Explain** the working principles of statics and dynamics

✓ **Assess** the nature and impact of the engineering mechanics and also how to utilize procedure of mechanics in many applications

Course Content (Partial)

- Statics of Particles and Rigid Bodies
- Forces in Trusses and Frames
- Relative Motion
- Kinematics of Particles

References

- **Vector Mechanics for Engineers (Statics & Dynamics)**

  - Ferdinand P. Beer and E. Russell Johnston

- **Engineering Mechanics (Statics & Dynamics)**

  - R. C. Hibbeler

✓ **Class Materials**

Course Assessment

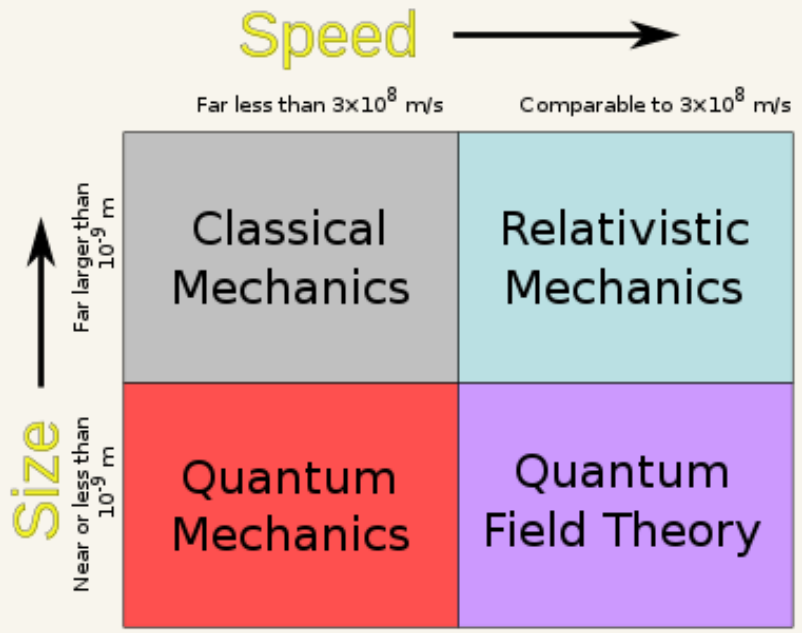
Attendance & Class Performance	**10%**
Class Tests & Assignments	**20%**
Term Final Exam	**70%**
Total	**100%**

Definition of Mechanics

Mechanics: A branch of physics which describes and predicts the conditions of rest or motion of bodies under the action of forces.

Classical Mechanics → Macroscopic objects

Quantum Mechanics → Atoms and sub-atomics particles



Classification of Classical Mechanics

A) Mechanics of Rigid Bodies:

i) Statics

ii) Dynamics:

a) Kinematics;

b) Kinetics;

B) Mechanics of **Deformable bodies**

C) Mechanics of **Fluids:**

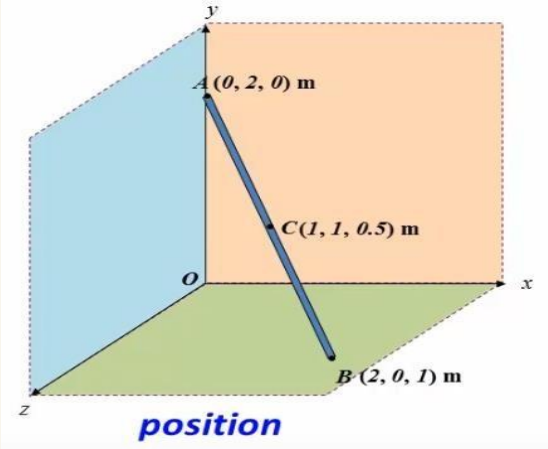
i) Incompressible;

ii) Compressible;

Fundamental Concepts of Mechanics

Space: Associated with the notion of the position of a point.

Time: Describes succession of events.



Statics: **time-independent**

Dynamics: **time-dependent**

Fundamental Concepts of Mechanics

- **Mass Vs Weight**

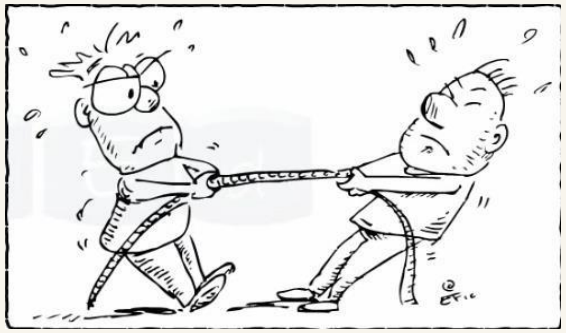
Force: An action of one body on another body.

Characteristics of Force:

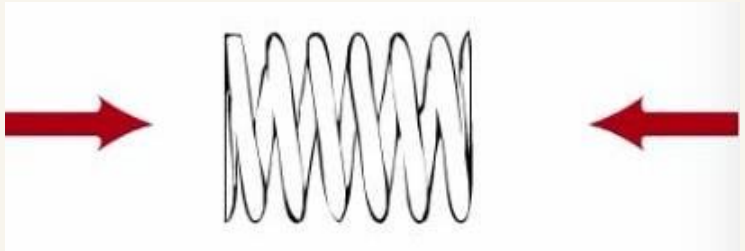
- ✓**Magnitude**
- ✓**Point of application**
- ✓**Line of action**
- ✓**Direction**

Fundamental Concepts of Mechanics

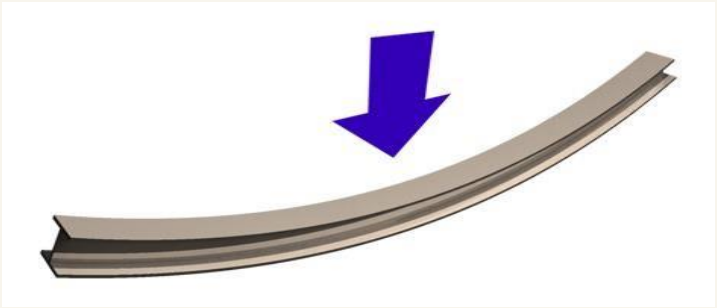
Tensile Force:



Compressive Force:

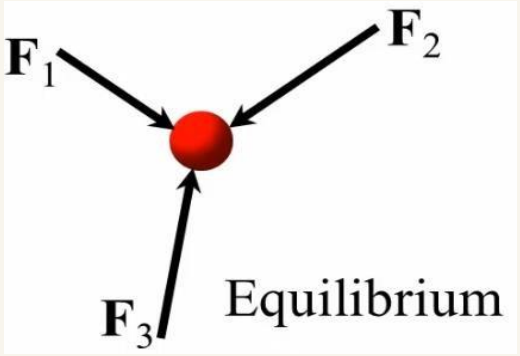


Bending Force:



Fundamental Principles of Mechanics

Newton's 1st Law of Motion:



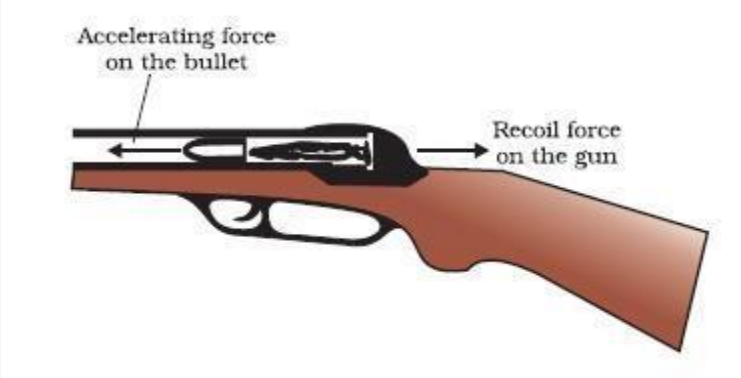
$$\mathbf{F}_R = \mathbf{0}$$

$$\mathbf{a} = \frac{\mathbf{F}_R}{m} = \mathbf{0}$$

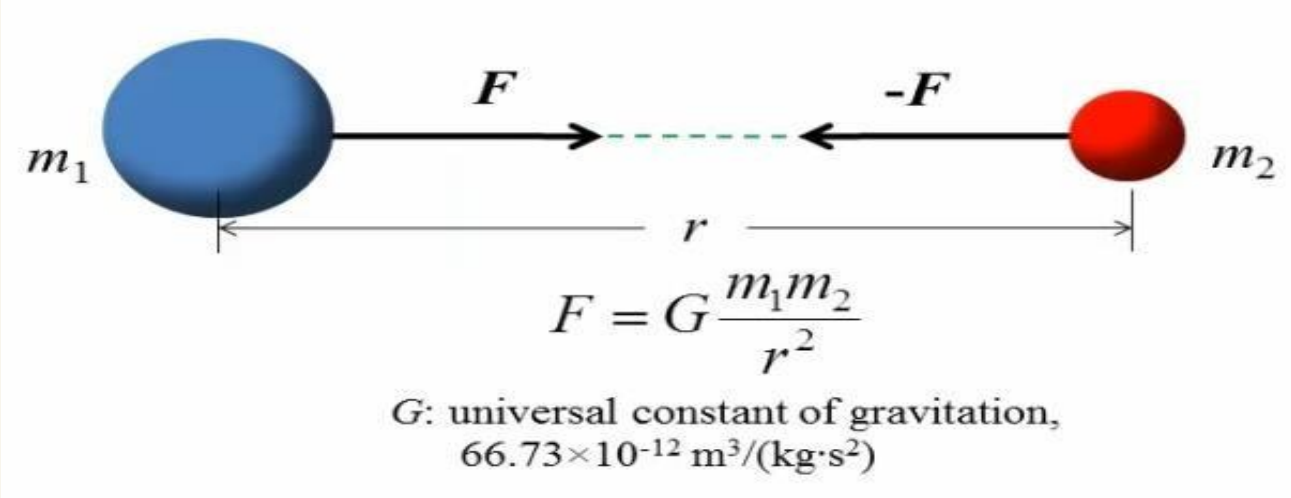
Newton's 2nd Law of Motion:

Fundamental Principles of Mechanics

Newton's 3rd Law of Motion:



Newton's Law of Gravitation:



$$F = G\frac{m_1 m_2}{r^2}$$

G: universal constant of gravitation,
$66.73\times10^{-12}\ m^3/(kg\cdot s^2)$

Assumptions or Idealizations

- **Particle**
- **Rigid Body**
- **Concentrated or Point Load**