



# Mechanics of Materials II:

## Thin-Walled Pressure Vessels and Torsion

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## **Module 1 Learning Outcomes**

- Describe the importance of studying Mechanics of Materials
- Outline the general analysis approach
- List the major topics in the course

## Engineering Mechanics/Engineering Science

Math

Physics

Basic Sciences



Mechanical Engineering

Civil Engineering

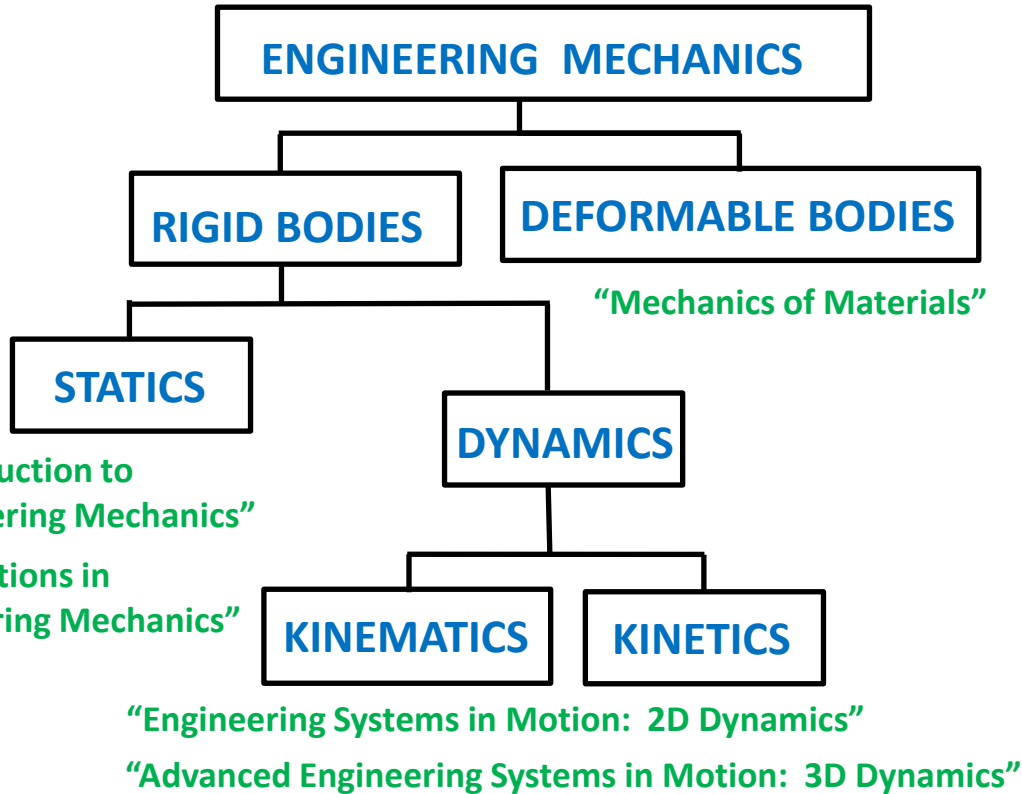
Aerospace Engineering

Material Science Engineering

Other Engineering

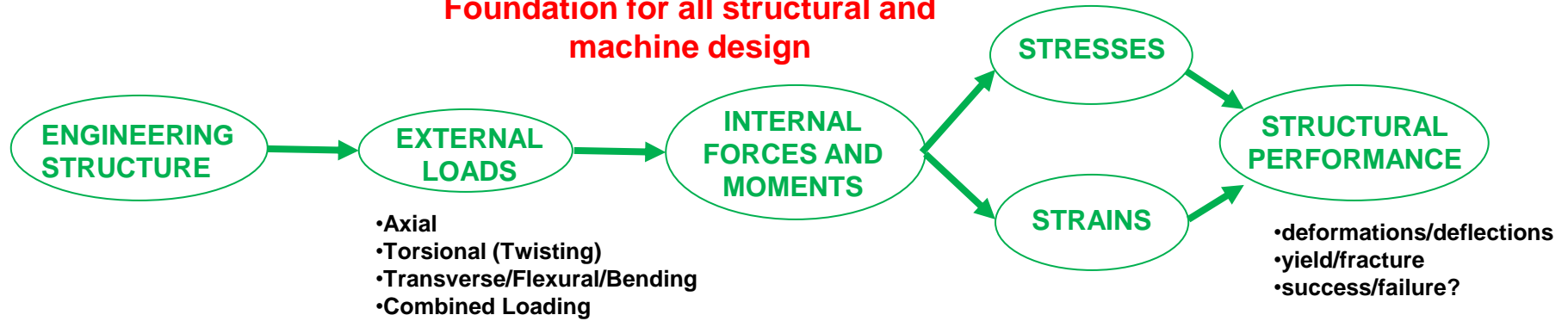
**“How the physical  
world works”**

**“Application of  
science to fill a  
human need”**



# Mechanics of Materials

Foundation for all structural and  
machine design



## Mechanics of Materials I:

### Fundamentals of Stress & Strain and Axial Loading

- ☐ Internal Forces due to External Loads
- ☐ Axial Centric Loads
- ☐ Normal Stress and Shear Stress
- ☐ General State of Stress at a Point (3D)
- ☐ Plane Stress (2D)
- ☐ Normal Strain and Shear Strain
- ☐ Stress-Strain Diagrams
- ☐ Mechanical Properties of Materials
- ☐ Linear Elastic Behavior, Hooke's Law, and Poisson's Ratio
- ☐ Stresses on Inclined Planes
- ☐ Principal Stresses and Max Shear Stress
- ☐ Mohr's Circle for Plane Stress
- ☐ Stress Concentrations
- ☐ Mohr's Circle for Plane Strain
- ☐ Strain Transformation and Measuring Strains
- ☐ Generalized Hooke's Law for Isotropic Materials
- ☐ Factor of Safety and Allowable Stresses/Loads
- ☐ Nonlinear Behavior and Plasticity
- ☐ Statically Indeterminate Structures
- ☐ Thermal and Pre-strain Effects

## **Mechanics of Materials II: Thin-Walled Pressure Vessels and Torsion**

- ☐ **Thin-Walled Pressure Vessels - Internal Pressure**
- ☐ **Torsional Shearing Stress and Strain**
- ☐ **Elastic Torsion Formula**
- ☐ **Elastic Torsion of Straight, Cylindrical Shafts**
- ☐ **Inelastic Torsion of Straight, Cylindrical Shafts**
- ☐ **Statically Indeterminate Torsion Members**

## Mechanics of Materials III: Beam Bending

- ☐ Elastic Flexural Stresses and Strains
- ☐ Elastic Flexural Formula
- ☐ Properties of Sections
- ☐ Inelastic Bending
- ☐ Shear Force and Bending Moment Diagrams
- ☐ Shear Stress in Beams
- ☐ Principal Stresses in Bending



## **Mechanics of Materials IV: Deflections, Buckling, Combined Loading, & Failure Theories**

- ☐ **Beam Curvature**
- ☐ **Singularity Functions for Beam Deflections**
- ☐ **Beam Deflections by Superposition**
- ☐ **Statically Indeterminate Beams**
- ☐ **Column Buckling**
- ☐ **Combined Static Loading**
- ☐ **Theories of Failure**

**My emphasis will be on  
understanding the principles of  
mechanics of materials rather  
than on extensive  
computational/computer work**

**Let's get started!**