



الجامعة الإسلامية - غزة
Islamic University - Gaza

Civil Engineering
Department

STATICS

ECIV 2311

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MECHANICS, UNITS, NUMERICAL CALCULATIONS & GENERAL PROCEDURE FOR ANALYSIS

Today's Objectives:

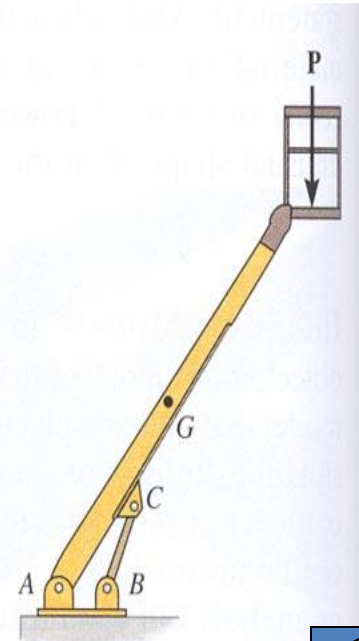
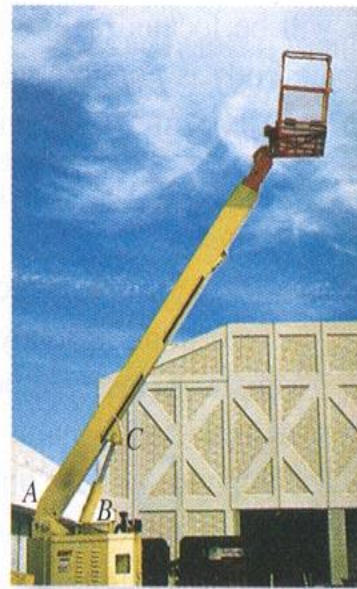
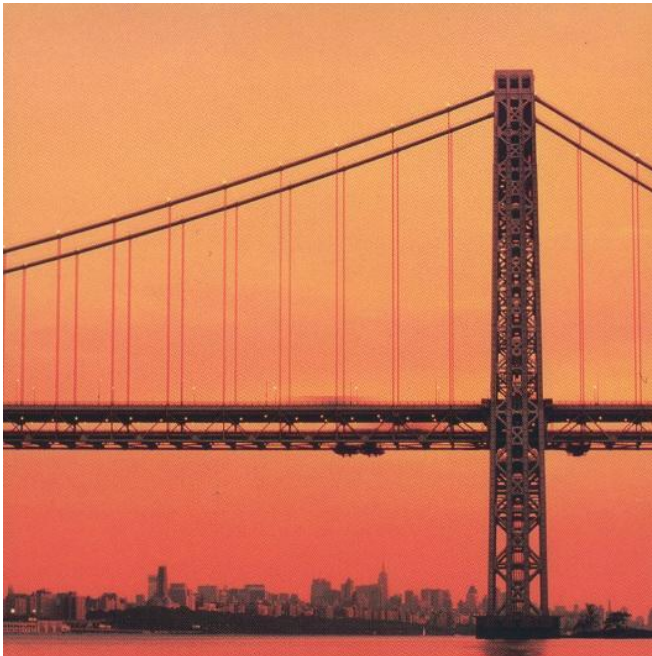
Students will be able to:

- a) Identify what is mechanics / statics.
- b) Learn about System of Units
- c) Numerical Calculations
- d) Problem Solving Strategy
- e) Attention Quiz

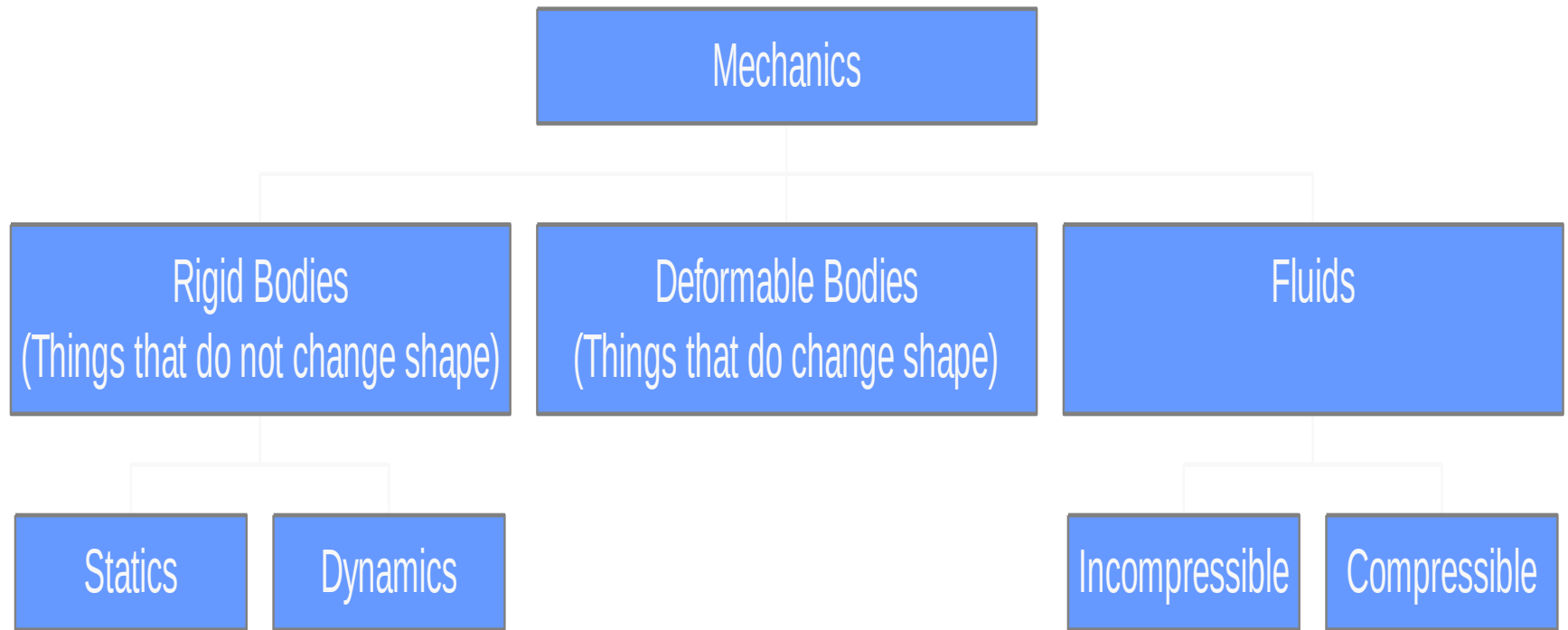


WHAT IS MECHANICS?

- Study of what happens to a “thing” (the technical name is “BODY”) when FORCES are applied to it.
- Either the body or the forces could be large or small.



BRANCHES OF MECHANICS



WHAT MAY HAPPEN IF STATICS IS NOT APPLIED PROPERLY?



UNITS OF MEASUREMENT

(Section 1.3)

- Four fundamental physical quantities.
 - Length
 - Mass
 - Time
 - Force
- Newton's 2nd Law relates them: $F = m * a$
- We use this equation to develop systems of units.
- Units are arbitrary names we give to the physical quantities.



UNIT SYSTEMS

- Force, mass and acceleration are called the base units.
- The fourth unit, time is derived from the acceleration term.
- We will work with two unit systems in statics:
 - International System (SI)
 - U.S. Customary (USCS)



Table 1-1 in the textbook summarizes these unit systems.

Name	Length	Time	Mass	Force
International System of Units (SI)	meter (m)	second (s)	kilogram (kg)	newton* (N) $\left(\frac{\text{kg} \cdot \text{m}}{\text{s}^2}\right)$
U.S. Customary (FPS)	foot (ft)	second (s)	slug* $\left(\frac{\text{lb} \cdot \text{s}^2}{\text{ft}}\right)$	pound (lb)

*Derived unit.



COMMON CONVERSION FACTORS

- Work problems in the units given unless otherwise instructed!
 - $1 \text{ ft} = 0.3048 \text{ m}$
 - $1 \text{ lb} = 4.4482 \text{ N}$
 - $1 \text{ slug} = 14.5938 \text{ kg}$
- Example: Convert a torque value of $47 \text{ in} \cdot \text{lb}$ into SI units.
 - Answer is $5.31026116 \text{ N} \cdot \text{m}$?



THE INTERNATIONAL SYSTEM OF UNITS

(Section 1.4)

- No Plurals (e.g., $m = 5 \text{ kg}$ not kgs)
- Separate Units with a $\cdot$ (e.g., meter second = $m \cdot s$)
- Most symbols are in lowercase.
 - Some exceptions are **N**, **Pa**, **M** and **G**.
- Exponential powers apply to units, e.g., $\text{cm} \cdot \text{cm} = \text{cm}^2$
- Compound prefixes should not be used.
- Other rules are given in your textbook.



NUMERICAL CALCULATIONS

(Section 1.5)

- Must have dimensional “homogeneity.” Dimensions have to be the same on both sides of the equal sign, (e.g. distance = speed $\times$ time.)
- Use an appropriate number of significant figures (3 for answer, at least 4 for intermediate calculations). [Why?](#)
- Be consistent when rounding off.
 - greater than 5, round up (3528 $\rightarrow$ 3530)
 - smaller than 5, round down (0.03521 $\rightarrow$ 0.0352)
 - equal to 5, see your textbook.



PROBLEM SOLVING STRATEGY:

IPE, A 3 Step Approach

- 1. Interpret:** Read carefully and determine what is given and what is to be found/ delivered. Ask, if not clear. If necessary, make assumptions and indicate them.
- 2. Plan:** Think about major steps (or a road map) that you will take to solve a given problem. Think of alternative/creative solutions and choose the best one.
- 3. Execute:** Carry out your steps. Use appropriate diagrams and equations. Estimate your answers. Avoid simple calculation mistakes. Reflect on / revise your work.



QUIZ

1. The subject of mechanics deals with what happens to a body when _____ is / are applied to it.

- A) magnetic field B) heat C) forces
D) neutrons E) lasers

2. _____ still remains the basis of most of today's engineering sciences.

- A) Newtonian Mechanics B) Relativistic Mechanics
C) Greek Mechanics C) Euclidean Mechanics



End of the Lecture

