ENGINEERING MECHANICS – STATICS

Subject

- Course
  - Engineering Mechanics – Statics
- Class Room:
  - Group 101 room K-516
    - Saturday, Monday and Wednesday 8:00 – 9:00
  - Group 102 room K-517
    - Sunday and Tuesday 12:30 – 14:00
  - Group 103 room K-507
    - Sunday and Tuesday 9:30 – 11:00
- Tutor:
  - M.Sc. Malek Abuwarda
    - www.iugaza.edu.ps/emp/mabuwarda

Subject

- Grads:
  - Assignments 30%
  - Midterm exam 30%
  - Final exam 40%
- Course Materials
  - Lecture notes
    - Power points slides
    - Handout sheets
  - Textbooks
    - Engineering Mechanics: Statics 10th edition by R.C. Hibbeler

Instructional Objectives

- After completing the course, you should be able to:
  - Analyze forces and find out the resultant forces in two and three dimension
  - Differentiate between various type of supports and draw free-body-diagram
  - Compute the reaction force, internal forces and bending moment at a specific point on a simple structure (beam, frame, truss)
  - Draw bending moment and shear force diagram to a simple structure.
  - Obtain centre of mass and centroid for deferent engineering shapes & moment of inertia for deferent sections

Course Outline

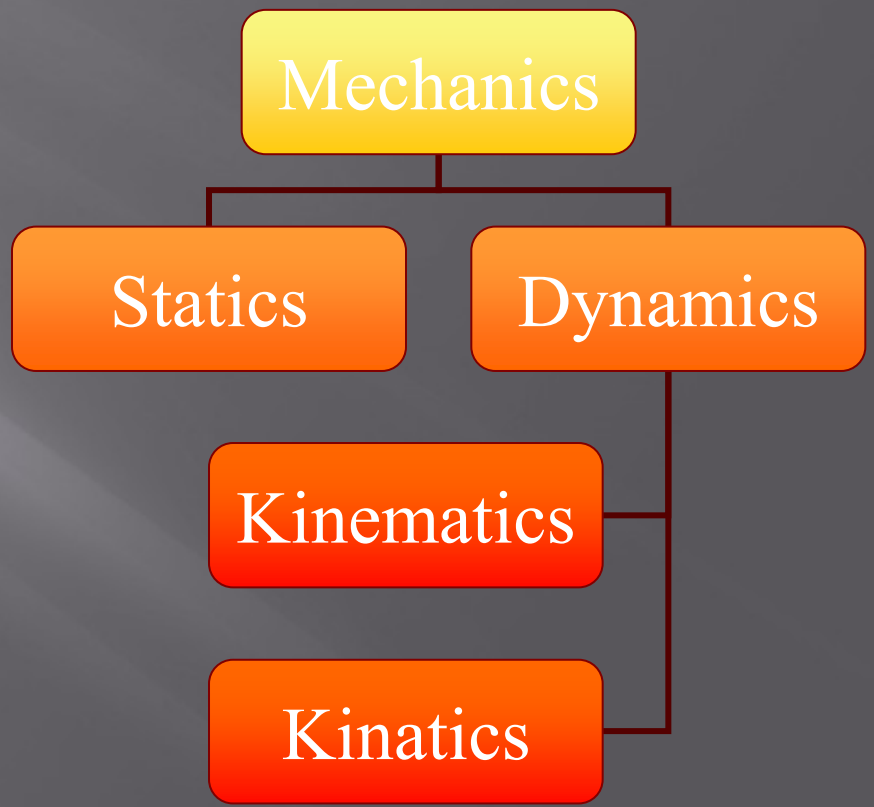
- Introduction to Statics
- Force System
  - Two-dimensional force systems
  - Three-dimensional force systems
- Equilibriums
  - Equilibrium in two dimensions
  - Equilibrium in three dimensions
- Structural Analysis
  - Trusses
    - Plane trusses
    - Space trusses
  - Frames and mechanics

Course Outline

- Distributed Forces
  - Centers of Mass and Centroids
  - Beams-External Effects
  - Beams-Internal effects
  - Fluid Statics
- Area Moments of Inertia

Introduction to Mechanics

- **What is mechanics?**
  - Physical science deals with the state of rest or motion of bodies under the action of force
- **Why we study mechanics?**
  - This science form the groundwork for further study in the design and analysis of structures



Basic Terms

- Essential ba[illegible]d
  - **Statics:** dealing with the equilibrium of a rigid-body at rest
  - **Rigid body:** the relative movement between its parts are negligible
  - **Dynamics:** dealing with a rigid-body in motion
  - **Length:** applied to the linear dimension of a strait line or curved line
  - **Area:** the two dimensional size of shape or surface
  - **Volume:** the three dimensional size of the space occupied by substance
  - **Force:** the action of one body on another whether it's a push or a pull force
  - **Mass:** the amount of matter in a body
  - **Weight:** the force with which a body is attracted toward the centre of the Earth
  - **Particle:** a body of negligible dimension

Units of Measurement

- Four fundamental quantities in mechanics
  - Mass
  - Length
  - Time
  - Force
- Two different systems of units we dealing with during the course
  - U.S. Customary or British System of Units (FPS)
    - Length in feet (ft)
    - Time in Seconds (s)
    - Force in Pounds (lb)
  - International System of Units or Metric Units (SI)
    - Length in metre (m)
    - Time in Seconds (s)
    - Force in Newton (N)

Units of Measurement

- Summery of the four fundamental quantities in the two system

Quantity	SI Units		US Units	
	Unit	Symbol	Unit	Symbol
Mass	kilogram	kg	slug	-
Length	meter	m	foot	ft
Time	second	s	second	sec
Force	newton	N	pound	lb

Units of Measurement

- Metric System (SI)
  - SI System offers major advantages relative to the FPS system
    - Widely used throughout the world
    - Use one basic unit for length ☞ meter; while FPS uses many basic units ☞ inch, foot, yard, mile
    - SI based on multiples of 10, which makes it easier to use & learn whereas FPS is complicated, for example
      - SI system ➔1 meter = 100 centimeters, 1 kilometer = 1000 meters, etc
      - FPS system➔ 1 foot = 12 inches, 1 yard = 3 feet, 1 mile = 5280 feet, etc
- Metric System (SI)
  - Newton's second law F = m.a
    - Thus the force (N) = mass (kg) × acceleration (m/s^2)
  - Therefore 1 Newton is the force required to give a mass of 1 kg an acceleration of 1 m/s^2

Units of Measurement

- U.S. Customary System (FPS)
  - Force (lb) = mass (slugs) × acceleration (ft/sec^2)
    - Thus (slugs) = lb.sec^2/ft
  - Therefore 1 slug is the mass which is given an acceleration of 1 ft/sec^2 when acted upon by a force of 1 lb
- Conversion of Units
  - C

Quantity	FPS	Equals	SI
Force	**1 lb**		**4.448 N**
Mass	**1 slug**		**14.593 kg**
Length	**1 ft**		**0.304 m**

- The standard value of g (gravitational acceleration)
  - SI units g = 9.806 m/s2
  - FPS units g = 32.174 ft/sec2