Introduction to Dynamics
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- Syllabus
  - Section 7 website
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- What is Mechanics (กลศาสตร์) ?
- What is Dynamics (พลศาสตร์) ?
What is Mechanics?

- A branch of physical science which deals with the effects of forces on objects

- Two parts: Statics (equilibrium of bodies) and Dynamics (motion of bodies)

- Applications:
  - Strength of structures and machines (houses, robots, cars, airplanes)
  - Vibrations (engine vibrations, bridges, wheels)
  - Fluid mechanics (airplanes, fluid machinery)
  - Electrical machines and apparatus (motors, transducers)
Mechanics Fields of Study

- **Statics**
  - Rigid bodies in equilibrium → Forces

- **Dynamics**
  - Rigid bodies in motions → Forces and motions

- **Strength of Materials (Mechanics of Materials)**
  - Deformable bodies in equilibrium → Strength and deformation

- **Fluid Mechanics**
  - Deformable bodies in motions → Pressure and flow

- **Mechanics of Machinery**
  - Dynamics of mechanism including linkages

- **Vibration**
  - Rigid and deformation bodies in repetitive motions
Applications of Dynamics

- Robot Arm
- Car Engine
- Vehicle
  - Dynamics
    - braking/accelerating
    - cornering
- Planetary Gear
Laws/Equations in Dynamics Class

- Newton’s Laws (3A, 6A)
- Work – Energy Equation (3B, 6B)
- Conservation of Energy (3B, 6B)
- Impulse – Momentum Equation (linear and angular) (3C, 6C)
Dynamics Class Topics

For Midterm

- Chapter 2: Kinematics of Particles
  - Displacement, velocity, acceleration of a particle in 1 and 2 dimensions

- Chapter 3: Kinetics of Particles
  - Newton’s laws
  - Work-Energy
  - Impulse-Momentum
    - impact
  in 1 and 2 dimensions
Dynamics Class Topics

For Final

- Chapter 5: Plane Kinematics of Rigid Bodies
- Chapter 6: Plane Kinetics of Rigid Bodies

_Not included in the exams but worth reading_

- Chapter 1: Introduction
- Chapter 4: Kinetics of Systems of Particles
Learning Strategies

**Recommendation:**

- If possible, read ahead
  - read ahead (+20% understanding), class (+30%), exercise (+40%)

- Two notebooks: for notes and exercises

- Exercise:
  - do exercise before looking at solutions
  - do in steps and make it easy to read
  - in case of getting stuck, ask or look at solutions
Exam Strategies

- Do step by step
- Write the laws to be used: 2\textsuperscript{nd} law…
- Draw Free Body Diagram
- Show coordinates: x, y…
- Define variables
- Show calculations
- State directions of vectors: vel, acc, force…
- Show units at numerical answers: N, m/s…
- Use common sense to check the answer
- Make it clean
Who is Newton?

- Born: 1643 in England
- Physicist, Mathematician, Astronomer, Philosopher etc.
- “Mathematical Principles of National Philosophy” known as “Principia” (1687)
  - Classical mechanics: Laws of Gravitation, Laws of Motion
- Calculus, Reflecting telescope, law of cooling, speed of sound, Newton’s method for finding roots of a function, power series etc.
Interesting Stuff

- Monument: Westminster Abbey, England
- Apple tree
- Stocks
  - Lost 20,000 GBP in stock in 1720s ($2.72M)
  - He stated "I can calculate the motions of heavenly bodies, but not the madness of people."

J. Newton