PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
SCHOOL OF ENGINEERING
DEPARTMENT OF STRUCTURAL AND GEOTECHNICAL ENGINEERING
ABET COURSE SYLLABI

ICE1513 STATICS AND DYNAMICS

Credits and contact hours: 10 UC credits /10 hours (3 h. Lectures; 1,5 h. Labs; 5,5 h. Independent learning experiences)

Instructor's name: To be defined

Course coordinator's name None

Textbook: Hibbeler, R. (2006) Engineering mechanics: statics & dynamics. 11th ed. Prentice Hall.

Course Catalog Description: The course presents the fundamentals for the studies of the statics and dynamics of discrete, rigid and deformable mechanical and structural systems. It's based on the implementation of the three fundamentals of classical mechanics: kinematics, equilibrium and constitutive laws. The course starts with the detailed study of particle, particle systems and bodies kinematics. The laws and fundamental constitutive equations that relate the kinematics and the forces acting over the bodies, and the fundamental principles of mechanical energy are then stated. Using the kinematics and constitutive laws, different tools for the formulation of the balance of mechanical and structural systems are studied, with emphasis on the energy and virtual work principles.

Prerequisite Courses: MAT1610 Calculus I

Co-requisite Courses: MAT1203 Linear Algebra

Status in the Curriculum: Required

Course Learning Outcomes:

1. Building physical and mathematical models of mechanical and discrete structural systems.
2. Formulate motion equations and equilibrium of systems using kinematics, constitutive laws and equilibrium conditions.
3. Solving static and dynamic equilibrium of systems.
4. Formulating the equilibrium of systems using the energy and virtual work principles.
5. Knowing the concept of kinematic restrictions and bonding forces.
6. Transforming forces and displacements onto different coordinate systems.
7. Knowing algorithmic and numerical approaches to efficiently solve classical mechanics problems.

Relation of Course to ABET Criteria: a. Knowledge of mathematics, science and engineering

Topics covered:

1. Discrete systems
   1.1. Discrete mechanical system concept, particles and rigid bodies.
   1.2. Discrete model of a mechanical system.
   1.3. Particles, loads and restrictions graphic representation and general terms.
   1.4. Unit systems, coordinates, degrees of freedom.
   1.5. Linear and non-linear coordinate transformation.
   1.6. Scalar and vector fields.
2. Forces systems.
   2.1. Concept, systems, breakdown and projection.
   2.2. Forces moment.
   2.3. Resultants of forces and moments systems.
3. Kinematics of deformation and movement.
   3.1. Particle movement.
   3.2. Kinematic restrictions and deformation.
   3.3. Matrix restrictions and computer formulation.
   3.4. Small and finite deformations.
4. Fundamental Laws and equations.
   4.1. Newton's Laws, linear momentum, Newton's universal gravitation, Kepler's Laws of planetary movement.
   4.2. Particle motion equation.
   4.3. D'Alambert's principle.
   4.4. Track of a particle under a central force effect.
   4.5. Non-conservative forces, friction, mechanical energy.
   4.6. Mass center and moments of inertia.
   4.7. Motion equations of particle systems and flat bodies.
   4.8. Work and Energy principles, mechanical energy preservation.
   4.9. Power and efficiency.
   4.10. Angular Momentum and its conservation, impulse and momentum principle.
   4.11. Virtual work principle.
5. Constitutive Relations
   5.1. Elasticity and Hooke's Law.
6. Equilibrium.
   6.1. Direct static system equilibrium.
   6.2. Algorithmic formulation and numerical resolution.
   6.3. Stability, real applications: structures and mechanisms.