



**NATIONAL UNIVERSITY OF ENGINEERING**  
**COLLEGE OF CIVIL ENGINEERING**  
**CIVIL ENGINEERING PROGRAM**

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**SYLLABUS - STATICS**

**I. GENERAL INFORMATION**

<b>CODE</b>	: EC111 Statics
<b>SEMESTER</b>	: 3
<b>CREDITS</b>	: 4
<b>HOURS PER WEEK</b>	: 5 (Theory – Practice)
<b>PREREQUISITES</b>	: Mathematics II, Physics I
<b>CONDITION</b>	: Compulsory
<b>DEPARTMENT</b>	: Structures

**II. COURSE DESCRIPTION**

This course introduces the main principles of Mechanics and its applications. Its general objective is the grasp of concepts such as force, torque, force system reduction, equilibrium applied to iso-static structures (lattices or reinforcements, casing and others), distributed forces. Centers of gravity. Moments and products of inertia in flat areas. Beams and its internal actions due to loads, axial and shear forces diagram, bending moment. Cables and friction.

**III. COURSE OUTCOMES**

1. Identify load systems interacting on a particle and a rigid body.
2. Reduce any load system to the simplest resultant acting on a particle or rigid body.
3. Determine the geometric and resistance characteristics of the structural element.
4. Apply methods for the calculation of internal forces for framework, frame and cable elements.
5. Make diagrams of axial force, shear force and bending moment in a beam statically determined.
6. Handle main principles of statics and apply them in the solution to problems of isostatic systems equilibrium, specifying the internal actions present in any section or component of the system being considered.

**IV. LEARNING UNITS**

**1. FORCE AND REDUCTION OF FORCE SYSTEMS / 18 HOURS**

General comments about Forces / Characteristics. Moment of a force regarding a point and an axis / pair of Forces / translation of a force / Equivalence of a system of forces / resultant of force systems: collinear, concurrent, parallel, coplanar and spatial / Torsion characteristics / Force systems distributed on a line / Force systems distributed on a surface (center of pressure) and a volume (Center of gravity).

**2. EQUILIBRIUM OF A PARTICLE AND A RIGID BODY / 24 HOURS**

Equilibrium / Reactions associated to support or end types / Equilibrium principles for a particle in the plane and in the space / Equilibrium principles in the plane and in the space for a rigid body / free body diagram / Reinforcements / Main elements / Shaping / reinforcement analysis / Node equilibrium method / Section method / Casing and frame / Force analysis in casings / Simple mechanisms.

### **3. CENTROIDS. INERTIA MOMENTS AND PRODUCTS / 18 HOURS**

Centroids of lines and areas and compound and simple volumes / Pappus' Theorems / Center of gravity / Inertia moments and products of inertia in flat areas / Inertia moments and products in compound areas / Radiuses of gyration / Parallel Axes Theorem (Steiner) / Inertia moments and products regarding inclines axes / Main inertia axes and moments / Determination of maximum and minimum inertia products axes / Mohr's circumference.

### **4. BEAMS AND INTERNAL ACTIONS IN THEM. CABLES. FRICTION / 24 HOURS**

Beams / classification according to the type of support / Definition of the internal actions in a section: Axial stress, shear stress and bending moment / Diagram of variation of these internal actions throughout the beam axis, under different load conditions / Relationships against load intensity, shear stress and bending moment / calculation of the maximum and minimum of these internal actions / flexible cables: cables with concentrated loads / Cables with distributed loads: parabolic and overhead power cables / Maximum and minimum cable stress / Cable length / friction. Types of friction: dynamic and static / Friction coefficient / Angle of repose / Roll angle.

### **V. LABORATORY AND PRACTICAL EXPERIENCES**

This course has no lab hours.

### **VI. METHODOLOGY**

An active method in the learning-teaching process is used in this course. Students participate in this method every class either individually or in work groups. The instructor exposes and gives examples to complement the students' activity, using the available audiovisual aids and afterward the virtual campus. The classroom work is complemented with quizzes and homework uploaded to the virtual that students do periodically and/or weekly.

### **VII. EVALUATION FORMULA**

The average grade PF is calculated as follows:

$$PF = 0.25 EP + 0.25 PP + 0.50 EF$$

EP: Mid-Term Exam

EF: Final Exam

PP: Average of six quizzes

### **VIII. BIBLIOGRAPHY**

**1. HIBBELER, R. C.**

Mechanical Engineering: Statics  
Prentice Hall Editorial, 10<sup>th</sup> Edition, 2008

**2. BEER, FERDINAND AND JOHNSTON JR. RUSSELL**

Vectorial Mechanics for Engineering  
Mc. Graw Hill Editorial, 7<sup>th</sup> Edition, 2007

**3. PYTEL, ANDREW AND JAAN, KIUSALAS**

Mechanical Engineering  
International Thomson Edition, 2<sup>nd</sup> Edition, 2000