



NATIONAL UNIVERSITY OF ENGINEERING COLLEGE OF CIVIL ENGINEERING

CIVIL ENGINEERING PROGRAM

SYLLABUS - STATICS

I. GENERAL INFORMATION

CODE	: EC111
SEMESTER	: 3
CREDITS	: 5
HOURS PER WEEK	: 6 (4 Theory – 2 Practice)
PREREQUISITES	: Mathematics II, Physics I
CONDITION	: Compulsory
DEPARTMENT	: Structures
INSTRUCTOR	: E. Gamio, L. Huaman, S. Herrera, J. Ferreyra
INSTRUCTOR E-MAIL	: ferreyrajuan@gmail.com

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 isostatic 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, 10th Edition, 2008

2. BEER, FERDINAND AND JOHNSTON JR. RUSSELL

Vectorial Mechanics for Engineering
Mc. Graw Hill Editorial, 7th Edition, 2007

3. PYTEL, ANDREW AND JAAN, KIUSALAS

Mechanical Engineering
International Thomson Edition, 2nd Edition, 2000

IX. COURSE CONTRIBUTIONS TO STUDENT OUTCOMES ATTAINMENT

Course contributions to Student Outcomes are shown in the following table:

K = Key

R = Related

Empty box = Does not apply

	Outcome	Contribution
Engineering Design	Design civil works satisfying requirements and needs as well as given constraints and limitations.	K
Problem solving	Identify, formulate and solve engineering problems properly using the methods, techniques and tools of civil engineering.	K
Sciences Application	Apply the knowledge and skills of mathematics, sciences and engineering to solve civil engineering problems.	K
Experimentation	Conceive and conduct experiments, analyze data and interpret results	
Modern Engineering	Use and apply techniques, methods and tools of modern engineering necessary for the practice of civil engineering.	R
Engineering Impact	Understand the impact of engineering solutions on people and society in local and global contexts.	R
Project Management	Plan and manage civil engineering projects taking into account efficiency and productivity criteria.	
Environmental Appraisal	Takes into account the importance of preserving and improving the environment in the development of their personal and professional activities.	
Lifelong Learning	Recognize the need to keep their knowledge and skills up to date according to advances of civil engineering and engage in lifelong learning.	R
Contemporary Issues	Know and analyze relevant contemporary issues in local, national and global contexts.	
Ethics and Professional Responsibility	Evaluate their decisions and actions from a moral perspective and assume responsibility for the executed projects.	
Communication	Communicate clearly and effectively in oral, written and graphical formats, interacting with different types of audiences.	
Teamworking	Appraise the importance of teamworking and participate actively and effectively in multidisciplinary teams.	