



The Following courses are part of the Exchange program in Civil Engineering between the UC and Cornell University, and of the fourth year of the Bachelor in Civil Engineering. They can be available to exchange students and can also be combined with regular courses in Spanish.

## Unit courses (6 ECTS)

### Engineering Economics and Management G1569 - Spring

At the end of this subject the student will be able: To rigorously formalize the decisions inherent to his technical work to justify and to defend the elections he proposes. To include in his analytical framework economic concepts as inflation, taxation, depreciation, financial planning, economic optimization. To analyse and discuss the selections made by others. To understand the economic consequences derived from his personal decisions about savings, investment, retirement...

### Geotechnical Engineering: Foundations, Excavations and Tunnels G1465 - Spring

This course examines site characterization and geotechnical aspects of the design and construction of foundation systems, earth retaining structures, slopes and tunnels. Application of soil mechanics in the analyses and design of these geotechnical structures is presented. Topics include: site investigation (with emphasis on in situ testing), rock mechanics, deep foundations (piles), earth retaining structures, excavations and fills: slope stability, tunnels in rock and soft ground.

### Introduction to Business Administration G1447 - Spring

At the end of the subject the student, will first be able to understand the basic economic restrictions affecting the engineer's work, being familiar with macroeconomic conditions of the society, and with microeconomic mechanisms explaining individual behaviour. Second, he will be familiar with the basic economic analytic instruments used in business as accounting, finance, operational research and engineering economic analysis. Finally, he will understand the basic organizative framework rules governing complex organizations and managing human resources.

### Structural Analysis G1450 - Spring

The main objective of this course is to present both the conceptual analysis of structures and its computational approach based on matrix analysis and finite elements. Topics include: analysis of trusses; analysis of frames; virtual work and unit load method; basic concepts of structural stability; influence lines and introduction to the finite element method.

### Construction Materials G2011 - Spring

The aim of this course is to provide the student with the basis to understand the different models of mechanical behaviour of materials used for structural purposes. The main objectives are three. First, get the knowledge of the experimental techniques that allow the determination of the properties of construction materials. Second, know the types of structural steels and the existing strategies to modify their mechanical properties. Finally, review the different manufacturing and installation processes of constructions materials and, in particular, the methods of design, production and placement of concrete.

### Heat Transfer G1501 - Spring

The main objectives of this course are to present the fundamentals of heat transfer, to obtain a deep view of the heat transfer processes, in steady and unsteady conditions and in one and more dimensions and to learn about the theory and different practical approaches –including numerical heat transfer analysis- of the sources of heat transfer: conduction, convection and radiation. The students will also obtain the ability to solve heat exchangers and extended surfaces problems and to obtain the necessary skills to carry out engineering design involving heat transfer

### Environmental Engineering G1468 - Spring

The course provides the students with the basic knowledge to understand and solve Environmental Engineering issues. It introduces the basic biological, chemical and physical processes of relevance in the field, stressing the mass balance and transport concepts. These principles are analysed and applied to the main areas of Environmental Engineering: air and noise pollution, solid waste management, water treatment, water quality and wastewater treatment.

### Energy Systems G1467 - Spring

This course introduces energy systems with emphasis on design and costs. The course presents a systems approach to energy needs, covering carbon-based, nuclear, and renewable energy sources, including solar energy, small scale hydropower, wind, bio-conversion processes, and house energy balances.

### Uncertainty Analysis in Engineering G1503 - Spring

The course introduces the analysis of variability and uncertainty in science and engineering. Techniques for measuring, describing, and controlling variability are considered. This includes descriptive statistics and data analysis, concepts of probability, the main probability distributions, extreme value analysis, point and confidence interval estimation, hypothesis testing and experimental design. An introduction to multiple regression is briefly outlined. Examples are mostly drawn from civil, environmental, and industrial engineering.

### Fluid Mechanics G1445 - Spring

This course covers hydrostatics, the basic equations of incompressible fluid flow, potential flow and dynamic pressure forces, viscous flow and shear forces, steady pipe flow, turbulence, dimensional analysis, laminar and turbulence boundary layer, flows around obstacles, and open-channel flow. The course includes small-group laboratory assignments.

### Coastal Engineering G1466 - Spring

The aim of this course is to provide the student with the knowledge for the design, construction and management of coastal works, and more specifically those devoted to coastal protection against erosion and beach nourishment and restoration. The course is divided into three main sections: understanding of coastal processes and the conceptual models and formulations used in engineering designs, hot topics related with shore protection and coastal management.

### Construction of Civil Infrastructure G1464 - Spring

This course offers the student a review of the main engineering concepts related with the construction of civil infrastructure: types of civil infrastructures, machinery used in civil engineering, construction procedures and management systems in construction engineering. At the end of the course, the student will learn to allocate resources during the construction process with effectiveness and efficiency, to use interdisciplinary approach as basic mechanism of value-creating in construction engineering, to respect the built heritage and the cultural expression in construction, and to be sensitive to problems of safety and health in construction.

### Programming G2008 - Spring

This course provides the students with the basic fundamentals of computers and operating systems. It shows them how to solve problems with computers by learning programming environments with application in civil engineering and using techniques and tools that allow effective data management.



# Study in English at UC Civil Engineering



## Mechanical Properties of Materials, Processing and Design

G1449 - Spring

The aim of this course is to provide the student with the basis to understand the different models of mechanical behaviour of materials used for structural purposes. The course is divided into two sections: The first part is focused on understanding the linear-elastic, plastic and viscous behaviour of materials. The second one pays attention to the application of fracture mechanics.

## Calculus

G2007 - Fall

Introduction to an important part of the main mathematical tools that students will need throughout their studies. The objectives are: to start with the language and mathematical reasoning; get started on the potential of calculus as modelling tool; acquire an operational handling of mathematical functions and their main properties; know and manage the basic elements of differential and integral applications to problems in physics and engineering

## Engineering Computation

G1462 - Fall

The main objective of the course is to introduce numerical methods as a fundamental tool for engineering disciplines. We plan to review some main topics of Numerical Algebra (matrix calculations, systems of equations, ...) and Numerical Calculus (root finding, interpolation, differentiation and integration, numerical methods for initial and boundary value problems in differential equations, ...), working with computational efficiency and controlling the errors. Computer tools and programming will be important; we will use software widely used in engineering and science (MATLAB, ...).

## Introduction to Geotechnical Engineering

G1446 - Fall

Origin and description of soil and rock. Ground water: hydrostatic condition, steady-state subsurface fluid flow. Soil stresses: stress components and parameters. Principle of effective stresses. Geostatic condition: stress history, overconsolidation, lateral stresses. Confined compression of soils: oedometer test, consolidation and settlements. Soil strength and deformability: drained and undrained strength, laboratory tests: direct shear test, triaxial test, unconfined compression test. Shallow foundations.

## Geology

G1627 - Fall

This subject covers the main properties of rocks with an emphasis on problems and applications to engineering projects. Rocks and discontinuities are the key elements of rock mass and the subject will cover the principles of bedrock classification based on these criteria. There is also an introduction to Geomorphology and its application to engineering projects. The course includes practical activities focused mainly on geological maps but also aerial photography and identification of rock samples.

## Hydrology

G1448 - Fall

This course studies the hydrological cycle and phenomena involved in it. It discusses methods for measuring flow in a section of a watercourse; hydrographs are studied and the methods for their determination and for their transit through stretches of rivers and reservoirs and are determined maximum flows in both the general case and in cases such as urban hydrology and drainage of roads. Finally, we study basic aspects of Hydrogeology and movement in porous media.

## Strength of Materials

G1463 - Fall

The course presents the basic concepts related to the analysis and design of structural members subject to tension, compression, torsion and bending. Specific topics include: stress and strain, deformations and displacements, elasticity and plasticity, stresses in beams, deflections of beams, internal forces diagrams, statically indeterminate beams, composite beams, energy methods.

The courses of the **Master's Degree in civil Engineering, Canal and Port Engineering** are also open to exchange students and it is possible to combine them with other regular courses in Spanish. Unit courses (4.5 ECTS).

## Continuum Mechanics M2173 – Fall

The main objectives of the course are the understanding and mastery of the basic fundamentals of nonlinear Continuum Mechanics and its application to solid and fluid mechanics. Specifically, we will analyse the description of the deformation in a continuous medium as well as the stress state. Next, we will examine the restrictions imposed by the physical conservation laws (linear momentum, angular momentum and energy). Finally, we will apply these concepts to different constitutive equations: Elasticity, Plasticity and Fluid Mechanics.

## Economic Analysis in Engineering M2177 – Fall

The main objectives of the course are: Master the economic language applied to engineering, incorporating the tools of economic analysis into their discourse. Determine the advantages and disadvantages of different organisational models specific to companies. Compare different financial situations of the company, as well as investment possibilities, analysing their suitability and viability. Describe the functioning of the economic sectors closest to engineering and model the economic behaviour of the technical decisions of the company. economic behaviour of the technical decisions of the engineer.

## Coastal and Port Engineering M2176 – Fall

After taking this course, students will be able to identify the characteristics of the different types of maritime structures, as well as to design the most common maritime protections used in port and coastal engineering. In addition, students will have the knowledge to assess coastal risks, specially, those linked to coastal flooding and erosion, as well as the knowledge to design, implement and manage coastal actions aimed at the restoration and regeneration of beaches, and the reduction of coastal risks.

## Coastal Processes

M2174 – Spring

The main objective of the course is to provide a solid foundation in the understanding and modelling of the relevant coastal processes as a first step towards engineering applications.

## Computing in civil engineering

M2442 – Both semesters

The students will learn the computer techniques and tools (machine learning, predictive regression, classification and clustering models, Visual Programming) to solve problems in the field of civil engineering.



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