

## Engineering Computation

The student should be familiar with basic tools in Mathematics and Physics as learned at the High School level and in the first year of Engineering Schools.

A fundamental course on the followings topics will be required:

- Linear algebra with linear vector spaces, matrix notation, linear equations, analytic geometry.
- Calculus with functions of one and several variables, differentiation and integration, basic concepts on differential equations and elementary numerical methods.
- Some computer programming experience in Matlab or similar environments.

## Strength of Materials

The student should be familiar with basic mathematical and mechanical tools:

- Mathematics: differential and integral calculus
- Physics (Mechanics): vector analysis, rigid body statics, center of mass and gravity. Moments of inertia.

## Introduction to Geotechnical Engineering

The student should be familiar with basic mathematical and mechanical tools: differential and integral calculus, and differential equations, that are taught to students in the first years of engineering schools.

A fundamental course on the followings topics will be required:

- Linear algebra
- Calculus
- Physics
- Mechanics
- Geology (desirable)

The student must have basic understanding of the basic and fundamental concepts of the following topics:

- Basic integral and differential calculus, vector notation and operation, ordinary differential equations
- Principles of statics - force and moment equilibrium
- Basic continuum mechanics: concepts of stress and strain
- Basic fluid mechanics: concepts of fluid pressure, hydraulic head.

## **Fluid Mechanics**

The student should be familiar with basic mathematical tools: differential and integral calculus, differential equations, statistical concepts that are taught to students in the first years of engineering schools.

A fundamental course on the followings topics will be required:

- Linear algebra
- Calculus
- Physics
- Mechanics

The student must have basic understanding of the basic and fundamental concepts of the following topics:

- Basic integral and differential calculus, vector notation and operation, ordinary differential equations
- Principles of statics - force and moment equilibrium
- Principles of kinematics - velocity and acceleration in absolute and relative frames
- Principles of dynamics - Newton's Laws of Motion, torque and angular acceleration, 1st Law of Thermodynamics

## **Coastal Engineering**

The student should be familiar with basic mathematical concepts on differential equations and should have a sound mathematical background on statistics and fluid mechanics.

A fundamental course on the followings topics will be required:

- Statistics
- Calculus
- Physics
- Fluid Mechanics

The student must have basic understanding of the basic and fundamental concepts of the following topics:

- Basic integral and differential calculus, ordinary differential equations
- Principles of kinematics - velocity and acceleration in absolute and relative frames
- Principles of dynamics - Newton's Laws of Motion.
- Probability density functions, Cumulative distribution function, Return period
- Navier-Stokes equations

## **Structural Analysis**

A course on Strength of Materials must be required.

## **Geotechnical Engineering: Foundations, excavations and tunnels**

The student should be familiar with basic mathematical and mechanical tools: differential and integral calculus, and differential equations, that are taught to students in the first years of engineering schools.

A fundamental course on the followings topics will be required:

- Linear algebra
- Calculus
- Physics
- Mechanics
- Geology (desirable)

The student must have basic understanding of the basic and fundamental concepts of the following topics:

- Basic integral and differential calculus, vector notation and operation, ordinary differential equations
- Principles of statics - force and moment equilibrium
- Basic continuum mechanics: concepts of stress and strain
- Basic fluid mechanics: concepts of fluid pressure, hydraulic head.

## **Mechanical Properties of Materials**

The student should be familiar with elementary mathematical tools: differential and integral calculus, differential equations, matrix notation.

A fundamental course of Physics / Mechanics will be required:

The student must have basic understanding of fundamental concepts of the following topics:

- Integral and differential calculus, vector notation and operation, ordinary differential equations.
- Principles of statics - force and moment equilibrium
- Principles of dynamics - Newton's Laws of Motion.
- Notions of structural analysis: equilibrium, compatibility, elastic behaviour (Hooke's Law).

## Uncertainty Analysis Engineering

The student should primarily be familiar with first-year calculus. Knowledge of first-year algebra, geometry and computing and a little of multivariate calculus is also useful.

## Hydrology

The student should be familiar with basic tools in Statistics, Physics Hydrogeology and differential and integral calculus.

## Construction of Civil Infrastructure

The students have to command the competences needed to face the 2<sup>nd</sup> semester of 2<sup>nd</sup> year of the Degree in Civil Engineering of the ETSICCP at Santander.

The student should be familiar with basic civil engineering concepts that will be developed during the course: types of civil infrastructures, machinery used in civil engineering, construction procedures and management systems in construction engineering.

## Energy Systems

The student should be familiar with basic mathematical tools: differential and integral calculus and differential equations concepts that are taught to students in the first years of engineering schools.

A fundamental course on the followings topics will be required:

- Linear algebra.
- Calculus.
- Physics.

The student must have basic understanding of the following topics:

- Basic integral and differential calculus, vector notation and operation, ordinary differential equations.
- Electromagnetism.

# Environmental Engineering

The student should have a basic knowledge of mathematics, physics and chemistry at the level of the first years of engineering schools.

Basic courses on the following topics will be required:

- Linear algebra and geometry
- Calculus
- Physics

The student must understand and use the following topics:

- Basic geometry (calculation of volume, area, perimeter), ordinary differential equations, basic differential and integral calculus
- Newton's laws of motion
- Law of conservation of mass
- Bernoulli's principle

## Heat Transfer

The student should be familiar with basic mathematical tools: differential and integral calculus, differential equations concepts that are taught to students in the first years of engineering schools.

A fundamental course on the followings topics will be required:

- Calculus
- Physics
- Thermodynamics
- Mechanics

The student must have basic understanding of the basic and fundamental concepts of the following topics:

- Basic integral and differential calculus, vector notation and operation, ordinary differential equations.
- Principles of statics - force and moment equilibrium.
- Principles of dynamics - Newton's Laws of Motion.
- Principles of Thermodynamics and mechanisms of heat transfer