

SHAKE THE FUTURE.



ENGINEERING PROGRAMME

SPECIALISATION

CIVIL ENGINEERING
AUTUMN SEMESTER

MECHANICS AND PHYSICS OF MATERIALS

CIVIL ENGINEERING, ENGINEERING PROGRAMME SPECIALISATION

AUTUMN SEMESTER

Professor: Syed Yasir ALAM

Objectives

The diversity of disciplines in civil engineering today is accompanied by a move towards ever increasingly precise requirements and tool developments. The engineer in charge of monitoring projects needs to have a multidisciplinary background, to adopt a transversal approach to problem solving and to select the appropriate methods. To achieve these objectives, the engineer must work on two levels: fundamental physics and applied physics.

This course aims to introduce the essential elements of general physics relevant for addressing civil engineering problems. It provides a refresher on core knowledge and presents the fundamentals necessary to understand all the other courses of the Civil Engineering Specialisation.

Course contents

- Elements of thermodynamics.
- Mechanical behaviour of solids.
- Mechanics of porous media.
- Radiation and heat propagation.
- Acoustic waves.
- Wood material.

Course material

Traité de physique du bâtiment, Tome I, Connaissance de base, Centre Scientifique et Technique du Bâtiment, 1995.

Keywords

Mechanics, materials, environment, building.

Links with other programmes

All first semester courses of the Civil Engineering Specialisation.

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	14 hrs	16 hrs	0 hrs	0 hrs

STRUCTURAL CALCULATIONS

CIVIL ENGINEERING, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Emmanuel ROZIERE

Objectives

To master data and calculations in mechanics of materials, in order to understand the behaviour and design of engineering structures.

Course contents

- General elements: loads, mechanical connections, modelling assumptions, degree of static redundancy, Eurocodes
- Bending of beams
- Statically indeterminate structures: stress, displacement, continuous beams
- Force method
- Buckling

Course material

Keywords

Eurocodes, loads, mechanical connections, degree of static redundancy, bending, beams

Links with other programmes

Design of civil engineering structures (reinforced concrete, steel, foundations).

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	14 hrs	16 hrs	0 hrs	0 hrs

CONCRETE DESIGN AND DURABILITY

CIVIL ENGINEERING, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Ahmed LOUKILI

Objectives

Concrete is by far the most commonly used construction material in the world. The purpose of this course is to give future designers basic data on the physical, chemical and mechanical properties of the materials used in making concrete and teach them the basic rules for proper formulation.

Course contents

- Cement manufacturing,
- cement hydration,
- concrete formulation,
- durability

Course material

A. Neville Propriétés des bétons, in French.

Keywords

cement, concrete, formulations, mechanical properties

Links with other programmes

The contents of this course are used throughout the specialisation.

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	14 hrs	16 hrs	0 hrs	0 hrs

CASE STUDIES

CIVIL ENGINEERING, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Benoît HILLOULIN

Objectives

Implement, analyse and interpret standard laboratory tests on concrete (hydraulic cement).

Course contents

Lab 1 - Cement and Mortar

Lab 2 - Characterisation of concrete composition

Lab 3 - Concrete composition

Lab 4 - Preparing and adjusting concrete composition

Lab 5 - Simple bending test on reinforced concrete beams

Lab 6 - Determination of the mechanical characteristics of concrete using destructive and non-destructive methods

Course material

Keywords

Concrete - cement - hydraulic binder - tests

Links with other programmes

Civil engineering materials

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	0 hrs	0 hrs	32 hrs	0 hrs

MODELLING IN CIVIL ENGINEERING

CIVIL ENGINEERING, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Syed Yasir ALAM

Objectives

Design methods for traditional civil engineering works are based on analytical developments. These techniques are discussed in other courses of the specialisation. For exceptional structures, design must take into account complex physical phenomena for which classical analytical methods are poorly suited. This course supplements the numerical techniques studied in the first year programme, and proposes an application to Civil Engineering works such as buildings, bridges, tunnels, retaining walls, embankments, dams, barriers, reinforced concrete structures, special foundations, etc.

Course contents

The course provides a review of different modelling techniques applied in Civil Engineering: Structural analysis using Robot Structural Analysis, Finite Element Analysis using Cast3M code and finally, Building Information Modelling (BIM) using Revit.

The course provides, on the one hand, in-depth theoretical knowledge of different modelling strategies and, on the other, provides practical experience to apply these techniques to Civil Engineering Structures using numerical tools.

Course material

Different online sources to understand codes and programs are provided.

Keywords

Structural Analysis, Numerical Modelling, Finite Element Analysis, Building Information Modelling, Design of Structures

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	4 hrs	0 hrs	28 hrs	0 hrs

PROJECT 1

CIVIL ENGINEERING, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Frederic GRONDIN

Objectives

To design a civil engineering work based on a real call for tender.

- To illustrate or present one particular aspect of the civil engineering field, in addition to courses, and make the most of lecture and visit opportunities.

- To present the information centres and organizations involved in construction and the environment.

To prepare engineering students to join a company by discovering the principal stages in a building project (construction and civil engineering works), related terminologies, materials and techniques, launch and costing.

Students will also study in groups a set technological subject by reading reports, contacting companies and or suppliers. This work is the subject of a written report and oral presentation to all the students.

Course contents

In groups of 4 or 5, students role play a company responding to a call for tender. Students are required to propose solutions regarding the works design (architects drawing, integrating the work within its environment, technical solutions, etc.), calculate the work (from foundations to superstructure), draw up construction methods and quote the price for the work. The different projects are ultimately presented to a panel of judges made up of Ecole Centrale teachers and Bouygues Construction staff.

- Lectures: parasismic engineering, foundation works, documentary techniques, projects, architecture, water

- Visits: construction sites, water treatment plant, quarries, sea and river works.

Course material

- Joint Technical Report, professional rules, Technical Evaluation Document

- Supplier documentation.

Keywords

Links with other programmes

All civil engineering specialisation courses.

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	0 hrs	0 hrs	0 hrs	32 hrs

REINFORCED CONCRETE

CIVIL ENGINEERING, ENGINEERING PROGRAMME SPECIALISATION

AUTUMN SEMESTER

Professor: Ahmed LOUKILI

Objectives

Reinforced concrete structures: introduction to the calculation, verification and dimensioning of reinforced concrete elements (Eurocode2).

Course contents

- General information on the design of reinforced concrete structures.
- Works security concepts.
- Evaluation of the stresses, limit load and operation.
- Principle justifications of the ultimate limit state (ULS) and service (ELS).
- Calculation of elements in simple compression and bending.
- Justification of the steel-concrete adhesive bonding, anchorage and training.
- Construction provisions.

Course material

- Les bétons, base de données pour les formulations (Editions. Eyrolles)
- BAEL91 and Eurocode 2
- Béton Armé Guide de calcul (J. LAMIRAULT, H.RENAUD - Editions Foucher)

Keywords

Reinforcing concrete, reinforced concrete, limit state, Eurocode

Links with other programmes

Civil engineering materials, structural calculations, structural design 1

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	22 hrs	8 hrs	0 hrs	0 hrs

GEOTECHNICAL ENGINEERING

CIVIL ENGINEERING, ENGINEERING PROGRAMME SPECIALISATION

AUTUMN SEMESTER

Professor: Giulio SCIARRA

Objectives

To introduce the fundamental concepts of foundation engineering and design: supporting structures, shallow and deep foundations.

Course contents

Foundation settlement
Plastic equilibrium
Lateral earth pressure and retaining walls
Shallow foundations
Pile foundations
Reinforced earth structures

Course material

Keywords

Lateral earth pressure, shallow foundations, deep foundations, settlement, bearing capacity

Links with other programmes

Case studies.

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	22 hrs	8 hrs	0 hrs	0 hrs

SOIL AND ROCK MECHANICS

CIVIL ENGINEERING, ENGINEERING PROGRAMME SPECIALISATION
AUTUMN SEMESTER

Professor: Giulio SCIARRA

Objectives

Understand the behaviour and properties of soils and rocks.

Course contents

- Constitution and physical properties of soils
- Continuum mechanics applied to soils
- Soil hydraulics
- Consolidation theory
- Shear resistance of soils
- Auscultation of the ground: presentation of the different types of rocky materials
- Mechanical behavior of rocks and rock masses
- Classification of rocks and rock masses

Course material

Keywords

Mechanics of Soil, Mechanics of Rocks, Soil hydraulics

Links with other programmes

Case Studies

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	3	14 hrs	16 hrs	0 hrs	0 hrs