Technical, economical, social and environmental fundamentals of the built environment

01	The natural and the built environment	
Compulsory	Semester : M1S1	ECTS credits : 5
	Lectures : 66h	Recommended personal work : 59h

Expected Learning Outcomes

The student should be able to

- Define key concepts related to ecosystems, biodiversity and the built environment
- Describe the human needs and the functional requirements taken into account in the development of the built environment
- Describe the connection between the historical development of the society, infrastructure ant the built environment and current and future developments
- Explain the natural conditions (ground, water and ecosystems) that constitute the foundations for the built environment and explain the relations and the interactions between the built and the natural environment
- Explain political and regulatory aspects and how regulations and the different stake holders influence on the development of the built environment
- Identify and characterize the natural resources (raw materials, energy, water, …) that are used to produce common construction materials and products
- Identify and characterize the different parts of the life cycle of a facility (duration, cost, energy consumption, water consumption, …)

Content

Introduction to Ecosystems and Biodiversity	6,0
Building with Nature / Human impact assesment	12,0
Life cycle of Facilities	12,0
Urban and Land Planning Law and Politics	12,0
Construction Materials and Products	9,0
History of Construction	6,0
Climate Analysis	3,0
Hygrothermal Comfort	6,0

Related SDGs

Glossary

Architectural sociology – a sub-field of sociology that focuses on societal functioning and relations based on their built environment and architecture

Biodiversity – the variety of ecosystems, species and genes in a particular habitat

Built environment - manmade surroundings that provide the setting for human activity, ranging from the large-scale civic surroundings to the personal places

Ecosystem – all the organisms and the physical environment with which they interact

Ecosystem services – benefits that flow from nature to people, can be provisioning (food, clean air, water, materials, …), regulating (water regulation, water purification, air purification), supporting (nutrient cycling, photosynthesis, soil formation) or cultural (recreation, health, cultural heritage, …) (European Commission)

Green infrastructures - A strategically planned network of natural and semi-natural areas with other environmental features, designed and managed to deliver a wide range of ecosystem services, while also enhancing biodiversity (European Commission)

02	Structure Design	
Compulsory	Semester : M1S1	ECTS credits : 5
	Lectures : 66h	Recommended personal work : 59h

Expected Learning Outcomes

The student should be able to

- Explain the function of common structural elements and be able to illustrate this with drawings and sketches
- Define and assess governing limit states for concrete, steel and composite steel concrete structural members
- Design reinforced concrete stairs, cantilevers, deep beams and walls according to Eurocode 2 provisions
- Describe the principles of pre- and post-stressed concrete beams and slabs
- Explain common pathologies in pre-stressed concrete and how to prevent and repair
- Identify the different components of a pre-stressed concrete structural system
- Design pre-stressed concrete beams and slabs according to Eurocode 2 provisions
- Design steel beams and columns according to Eurocode 3 provisions
- Describe basic bolted and welded steel assemblies
- Design bolted steel assemblies according to Eurocode 3 provisions
- Assess global stability and bracing of steel structural systems
- Define composite action and the effect composite action has on component behaviour
- Describe the basic steel-concrete structural systems
- Design composite decking according to Eurocode 4 provisions

Content

Introduction to structure design principles	6,0
Reinforced concrete	15,0
Pre-stressed concrete	12,0
Steel structures	18,0
Composite Structure	15,0

Prerequisites

Strength of materials. Eurocode 0 and 1. Basic verifications of reinforced concrete beams, slabs and columns according to Eurocode 2.

Related SDGs

03	Construction and procurement	
Compulsory	Semester : M1S1	ECTS credits : 5
	Lectures : 66h	Recommended personal work : 59h

Expected Learning Outcomes

The student should be able to

- Describe the different types of public tendering procedures existing within the EU
- Explain when and how the EU procurement rules applies and when national procurement rules apply
- Restate the main provisions of national tender rules in France and one other EU member state
- Express the main differences between public and private procurement
- Identify the stakeholders involved in a construction project and define their roles and responsibilities
- Illustrate the different aspects of financial control, operations management and risk assessment on a real construction project
- Identify and describe the different types of construction equipment and tools using standard terminology
- Identify and compare different environmental certifications

Content

Public procurement Law	6,0
Environmental Impact Assessment (RBR2020, LEED, BREEAM,…)	3,0
Législations, certifications et labels environnementaux (HQE, BBC, BEPOS - législations/certif FR)	3,0
Construction Management / financial control of construction product	9,0
Design and construction site management / Operation Management	9,0
Construction Technology (for Buildings)	9,0
Construction Technology (for linear infrastructure)	9,0
Construction Technology (for infrastructure facilities)	9,0
Management of works and constructions within international context / Ingénierie et Affaires Internationales	9,0

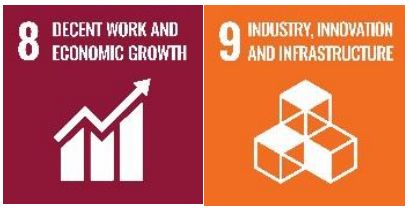
Related SDGs

04	Construction economics	
Compulsory	Semester : M1S1	ECTS credits : 5
	Lectures : 69h	Recommended personal work : 59h

Content

The AEC sector in a macro-economical context	6,0
Project Management	9,0
General Accounting	18,0
Management accounting	12,0
Pricing	12,0
Contract law	12,0

Related SDGs



05	Applied geotechnical engineering	
Compulsory	Semester : M1S1	ECTS credits : 5
	Lectures : 66h	Recommended personal work : 59h

Expected Learning Outcomes

The student should be able to

- Given a problem, chose the appropriate soil mechanical model for the design of a construction
- Read and understand a geotechnical report
- Analyse and design pile foundations according to the provisions of Eurocode 7
- Calculate the lateral earth pressure acting on earth retaining walls and sheet plie walls
- Design sheet pile walls considering geotechnical and structural failure
- Analyze and specify maximum allowed excavation depth and maximum slope inclination with respect to stability, hydraulic failure and heave
- Analyze, design and evaluate embankments and slopes with respect to stability
- Describe common soil reinforcement technics and chose and design soil reinforcement for a given situation
- Evaluate the geothermal potential of a site and describe and quantify different systems for geothermal heating/cooling and heat storage

Content

Geotechnics for construction	12
Deep fondations	12
Earth retaining structures	12
Slope stability	12
Soil reinforcement	12
Energy and soil	6

Prerequisites

- Interpretation of geological and geotechnical data
- Interpretation of hydrological data
- Physical and chemical properties of soils and rocks
- Classification criteria for soils and rocks
- Technical characterisation of soils and rocks
- Analysis and design of shallow foundations with respect to settlement and stability

Related SDGs

Glossary

Heave – The upward movement of an underlaying soil layer due to the addition of moisture to an unsaturated expansive soil

06	Research and engineering project	
Compulsory	Semester : M1S1	ECTS credits : 5
	Lectures : 30h	Recommended personal work : 59h

Expected Learning Outcomes

The student should be able to

- Define an appropriate research question
- Write a literature survey related to a specific research question
- Formulate assumptions
- Design and perform relevant experiments (in laboratory or by numerical simulation) in order to confirm or invalidate assumptions
- Perform basic statistical analysis of experimental results
- Apply resent findings to a concrete engineering design problem
- Write a research report according to given editorial specifications
- Review the work of another project group

Content

Research and engineering project	30,0

Prerequisites

Related SDGs