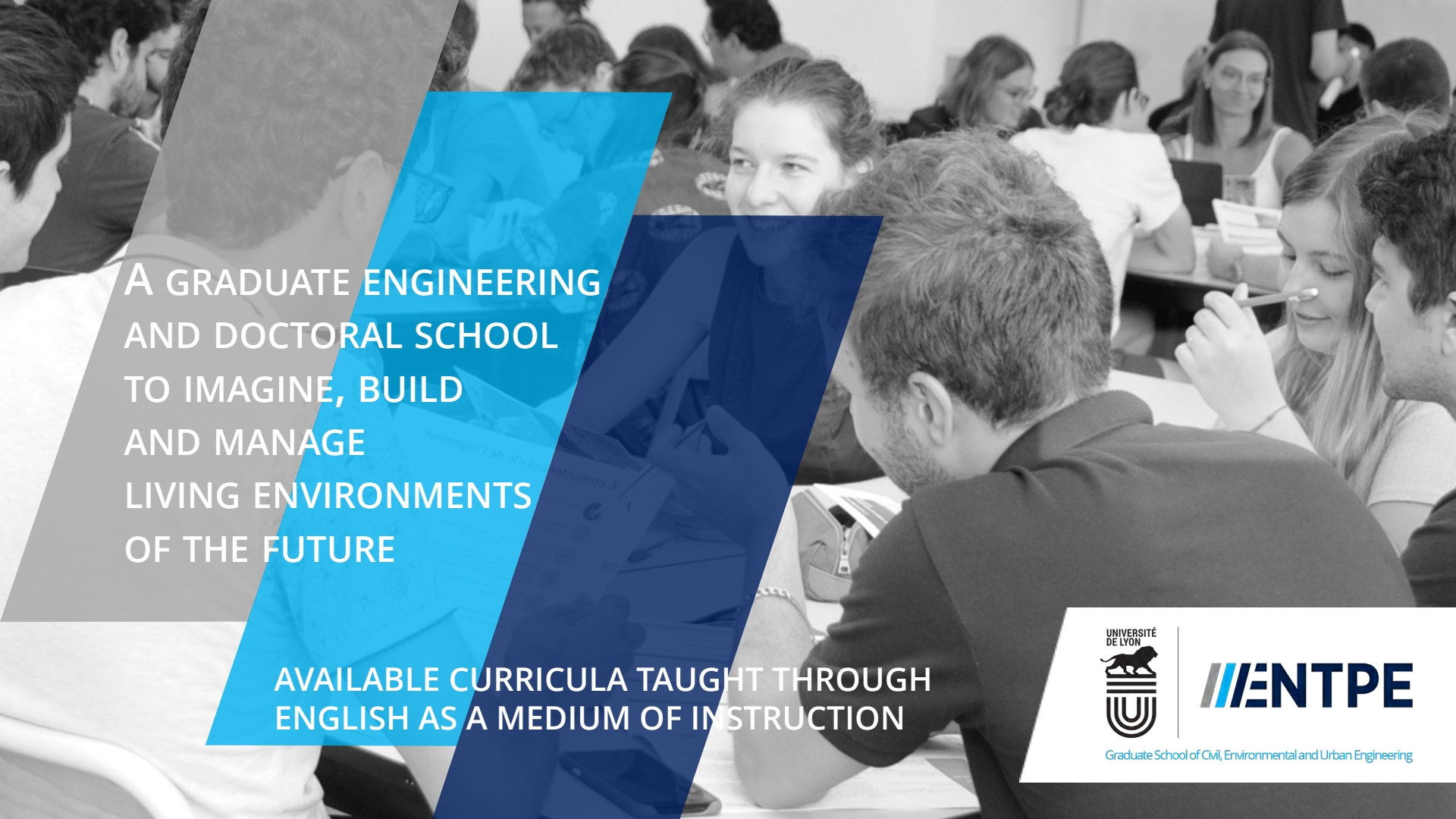

A GRADUATE ENGINEERING AND DOCTORAL SCHOOL TO IMAGINE, BUILD AND MANAGE LIVING ENVIRONMENTS OF THE FUTURE

AVAILABLE CURRICULA TAUGHT THROUGH ENGLISH AS A MEDIUM OF INSTRUCTION

UNIVERSITÉ DE LYON

ENTPE

Graduate School of Civil, Environmental and Urban Engineering

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INTRODUCTORY STATEMENT

The document presents two pathways available through English as a medium of instruction at ENTPE. English courses are open subject to the number of participants.

English-speaking students interested in carrying out an academic mobility at ENTPE may build their learning agreement with the available courses below.

The course catalogue taught through English is designed for **Master/Post graduate students only** (i.e. Master 1 and Master 2 students).

It is offered in Semester 9 at ENTPE (please report to the **Curriculum Equivalence** below).

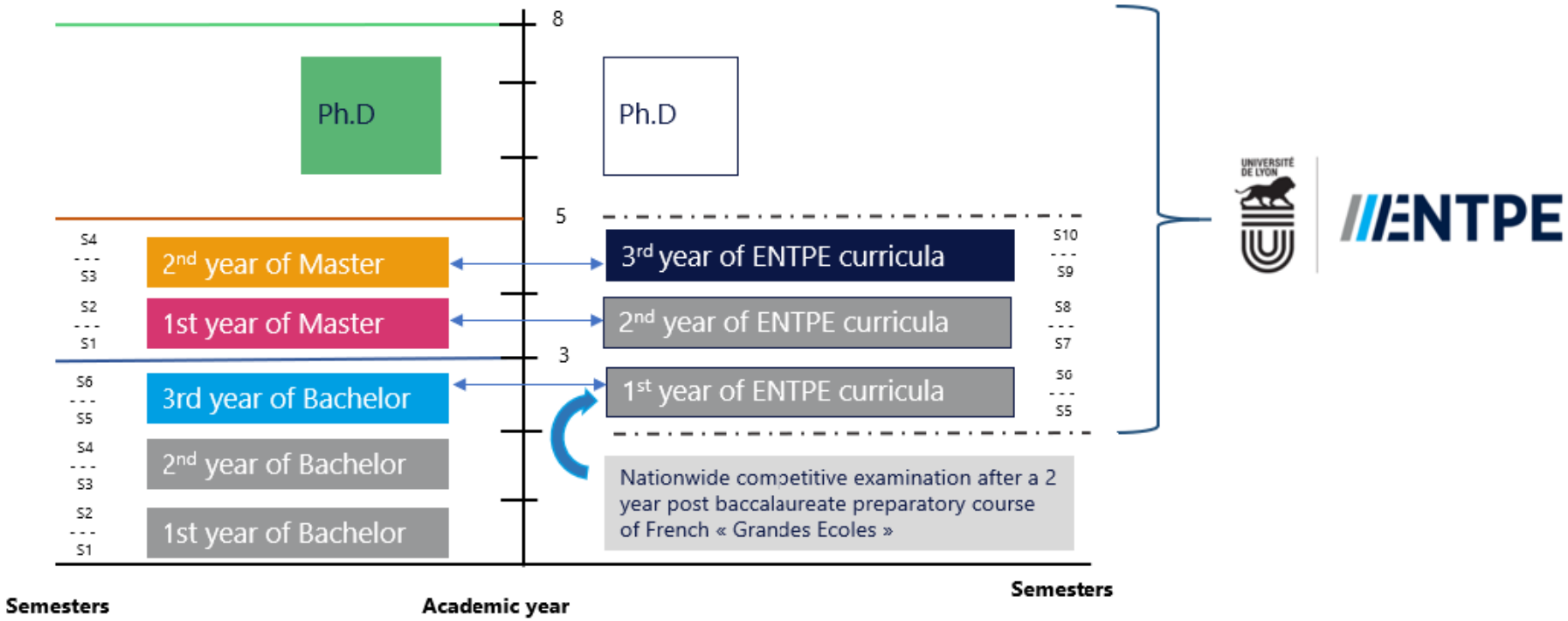
Semester 9 at ENTPE is from September to the end of January.

Thus, incoming students interested in carrying out academic mobility at ENTPE can choose between the two following options:

- One semester (Autumn semester from September to the end of January)
- Two semesters where students will be asked to complete a 20 week internship from early February. The internship carries 30 ECTS. This option is available for Master 2 students only.

French as a foreign language electives are available on demand. The number of attributed ECTS varies depending on length and intensity of courses and needs of home university.

CURRICULUM EQUIVALENCE UNIVERSITIES/SCHOOLS OF ENGINEERING



Bologna Equivalence

AVAILABLE CURRICULA TAUGHT THROUGH ENGLISH AS A MEDIUM OF INSTRUCTION

Pathway	Semester*	Level of Studies	ECTS	Course
Civil Engineering	9	Post graduate	5	Civil engineering experiments in the lab: practical works
			5	Constitutive law for materials behaviour
			5	Nonlinear Dynamics and applications
			5	Dynamics of structures
			5	Building Acoustics
			5	Earthen materials for a sustainable and circular built environment
			5	Mechanics of Porous Media
Mobility Engineering and Planning	9	Post graduate	5	Understanding Policy Process
			5	Socio-anthropology of transition to low-carbon mobility
			5	Travel Demand Modelling
			5	Spatial Data Analysis
			5	Urban Dynamics and Mobility Systems
			5	Data Science and Machine Learning
			5	Traffic Flow Theory: fundamentals
			5	Intelligent Transportation Systems

**Semester 9 at ENTPE runs from September to the end of January.*

PATHWAY CIVIL ENGINEERING

COURSE: CIVIL ENGINEERING EXPERIMENTS IN THE LAB: PRACTICAL WORKS

Content: 9 practical works (4h each) = 36 hours + 36 hours of personal work + 1h oral presentation

ECTS: 5

Prerequisite: concepts of reinforced concrete, soil mechanics, géotechnique

Objectives:

- Perform classical laboratory tests used in civil engineering
- Analyse results to answer a practical problem
- Illustrate theoretical concepts in the field of soils mechanics, concrete, pavement engineering, structure dynamics:
    - Unit 1: Shear strength of soils
        - Direct shear test (Casagrande box) and permeability test
        - Triaxial test
    - Unit 2: Physical soils identification and soils settlement
        - Physical soils identification and classification
        - Soils settlement (Terzaghi's principle)
    - Unit 3: Earthwork and pavement engineering
        - Soils compaction
        - Bituminous materials characterization
    - Unit 4: Concrete
        - Fresh concrete behaviour
        - Reinforced concrete behaviour
    - Unit 5: Structure dynamics
- Make an oral presentation of the results of 2 tests

COURSE: CONSTITUTIVE LAW FOR MATERIALS BEHAVIOUR

Content: 9 lectures and exercises (3h each) = 27 hours + 2h test + 27 hours of personal work

ECTS: 5

Prerequisite: Continuum mechanics

Objectives:

In the framework of continuum mechanics, fundamental constitutive laws are studied. The mathematical expressions developed to model rheological materials' behaviour are detailed. The following topics are addressed:

- Continuum mechanics bases
- 1-dimension rheological models (spring, dashpot, slider)
- Elasticity in 3 dimension
- Visco-elasticity
- Elastoplastic theory

COURSE: NONLINEAR DYNAMICS AND APPLICATIONS

Content: This course is an introduction to the study of nonlinear phenomena. It offers theoretical (introduction to the theory of dynamical systems, the theory of bifurcations), analytical and numerical methods to study periodic, quasi-periodic, chaotic behaviours of nonlinear models which can describe different systems: mechanical systems (application to the vibrations of beams or cables, to hydrodynamic turbulence), chemical or biological kinetics (applications to process engineering, ecology and medicine), electronic circuits, micro electro-mechanical systems (ultimate mass detection, GPS), etc... It offers passive control applications using non-linearities in mechanics (buildings, cables, pendulums) or in acoustics. Actually, it has 27 hours.

ECTS: 5

Objectives:

1. Introduction: why nonlinear dynamics ?
2. Introduction to different dynamical systems: from linear to nonlinear
3. Analytical methods: perturbation, harmonic balance, multiple scale, averaging and complexification.
4. Periodic solutions: centre manifold, normal forms.
5. Periodic solutions and nonlinear modes: using centre manifold, normal forms and continuation techniques.
6. Linearized stability analyses and method of Floquet.
7. Application in passive control in mechanics and acoustics.

COURSE: DYNAMICS OF STRUCTURES

Content:

1- Equations of dynamical equilibrium
2- Vibration modal characteristics of continuous systems.
3- The Rayleigh-Ritz method.
4- Modal characteristics of discrete systems
5- Responses of a single degree-of-freedom systems
6- Responses of a multiple degree-of-freedom systems
7- Dynamical responses of a multiple story building
8- Modal analyses: theory and experiments
9- Introduction to nonlinear dynamics

ECTS: 5

Objectives:

The course is the scientific basis necessary for the exercise of the professional engineers in the field of the dynamics of various structures, subjected to different types of excitations (seismic, traffic, wind, etc.) or to dialogue with specialists in this field. It provides methods for other specialized courses such as acoustics, seismic engineering and nonlinear dynamics.

At the end of the course, students will have knowledge about modeling approaches (linearization of the problem) and the general formulation of continuous and discrete problems and know how to apply them to simple cases. Moreover, they will learn about basic concepts such as modes, modal basis, discrete/continuous problem, approximation, modal synthesis, damping and also the basic methods of solving discrete problems and identifying parameters.

COURSE: BUILDING ACOUSTICS

Content: 24h Participatory lecture including exercise + 1h30 test + 42h of personal work including a project in building acoustics/room acoustics with acoustic measurements in situ, diagnosis and modelling for proposing better acoustic performances.

ECTS: 5

Objectives:

The objective is to acquire knowledge relating to phenomena and methods of prediction in building acoustics and room acoustics (noise annoyance at home, airborne and impact sound insulation, sound absorption, optimization of acoustic materials and structures for buildings, room acoustics, sound quality criteria for room acoustics, intelligibility, cocktail party in rooms, room acoustics using a ray tracing software, acoustic performances of buildings using software accounting for flanking transmissions and junctions, acoustics of architectural projects, diagnosis and vigilance points of a project dealing with building acoustics/room acoustics, acoustics of architectural projects).

COURSE: EARTHEN MATERIALS FOR A SUSTAINABLE AND CIRCULAR BUILT ENVIRONMENT

Content: 20h Participatory lecture including exercises + 2h test + 4 practical works (3.5h each) = 36 hours, +24 hours of personal work

ECTS: 5

Objectives:

The objective of this course is to acquire bases in the understanding of the complexity of earth materials (and earthen architecture) to build structural walls to shift to a circular and sustainable built environment.

-fundamentals of the hydro-mechanical and hygrothermal behaviour of earth materials.

-principles for the design of sustainable and circular architecture

-design structural earth architecture with Eurocodes

-practical implementation of structural (rammed earth, compressed earth blocks and cob) and non-structural earth (plaster and mortars)

-practical assessment of the material properties

COURSE: MECHANICS OF POROUS MEDIA

Content: 24h Participatory lecture including exercises + 2h test + 24h home-long-exercise = 50 hours

Prerequisite: Continuum mechanics

ECTS: 5

Objectives:

The objective of this course is to acquire a solid basis in the understanding of the complex coupled behaviour of porous materials (soils, rocks, wood, biological tissues, etc.) and their applications in civil engineering.

The construction of the main constitutive equations is based on continuum mechanics, hydraulics, theory of mixtures and thermodynamic principles. The cases of thermo-poroelastic and poro-viscoelastic behaviour are treated in detail. Application of the system of equations developed in solving some typical engineering problems is based on Laplace Transform, leading to analytical solutions in cases with simplified geometries.

PATHWAY MOBILITY ENGINEERING AND PLANNING

COURSE: UNDERSTANDING POLICY PROCESS

ECTS: 5

Content:

This course focuses on the policy process by mobilizing different qualitative perspectives. Its main objective is to identify and discuss how we can empirically and theoretically grasp the different dimensions of the policy process: the problem agenda setting, the formulation of the policy solution, the decision-making process and the implementation dynamic. Since 1950's, these questions are in the research agenda. The course presents the different research questions developed through a chronological dynamic from the first theories about decisions to the most complex and contemporary approaches of the policy process.

COURSE: SOCIO-ANTHROPOLOGY OF TRANSITION TO LOW-CARBON MOBILITY

ECTS: 5

Content:

Transition to low-carbon mobility is at the agenda of most countries due to the necessity to fight climate change and to find alternative path to the use of fossil fuels. In this class, building on the literature on transitioning, path dependency, mobility and energy justice and the anthropology of the future, we will investigate what a just transition can be and for whom. By doing so we will investigate the contrasted situations emerging from the countries belonging to the EU and within one country in term of dependency to automobility and fossil fuels in order to reflect on what a just mobility transition can be and on the need to build different scenario of transition to low-carbon mobility.

COURSE: TRAVEL DEMAND MODELLING

ECTS: 5

Content:

This course is an introduction to travel demand modelling and transportation models. Transportation models are tools that help decision makers plan and evaluate various transportation projects and policies. The course provides the theoretical background and methodological developments of these models and proposes various exercises to apply these methods in operational contexts. The content of this course covers six topics:

1. Introduction to the economical foundations of transportation models.
2. Data requirements for travel demand modelling: travel supply and travel demand.
3. Transportation network modelling: traffic and transit networks.
4. Level of service modelling: network congestion, travel times, accessibility.
5. Travel demand modelling: demand generation, distribution, modal split and assignment.
6. Prospective analysis: scenario definition and evaluation.

This course will provide students with a deep understanding of travel demand modelling and transportation models, their assumptions, inputs, outputs, benefits and limitations.

COURSE: SPATIAL DATA ANALYSIS

ECTS: 5

Content:

Decision making in the fields of transport and planning requires the production of relevant information, even more so when presented with a spatial dimension. To address this need, this course mainly focuses on giving the tools for processing, analysing and visualizing spatial data related to transport and planning. After introducing basic and fundamental elements related to Geographic Information System (GIS) and data formats, we will focus extensively on practicing GIS, as well as statistics and modelling with spatial data. Throughout this course, students will be asked to work autonomously in groups on a subject of their choosing and mobilize methods also learned in other courses in order to exercise their capacity to find relevant data and methodologies to process them.

COURSE: URBAN DYNAMICS AND MOBILITY SYSTEMS

ECTS: 5

Content:

This course deals with the interactions between urban dynamics and mobility systems. It aims at understanding the evolutions of urban and mobility systems through the presentation of different models that have structured and organised urban mobility practices from the seventies to the present. It should enable students to familiarise themselves with the main debates in urban studies on sustainable urban mobility transitions. The course is organised around an alternation between theoretical lectures and field visits. The topics studied are: main centralities and car system; secondary centralities and micro- mobilities; suburban areas and railway system; planetary urbanization and post-networked mobility.

COURSE: DATA SCIENCE AND MACHINE LEARNING

ECTS: 5

Content:

The Data Science and Machine Learning (DSML) course aims to present the data analysis process by focusing on the understanding and application of the most popular machine learning techniques to real-world datasets.
The course introduces data processing tools and a large variety of supervised and unsupervised methods for automatically identifying hidden data structures as well as to develop forecasting models that can be used to make predictions from historical data.
Real-world datasets will be explored by leveraging Python libraries for data processing and machine learning (e.g. numpy, pandas, matplotlib, scikit-learn, tensor flow, etc.).

COURSE: TRAFFIC FLOW THEORY: FUNDAMENTALS

ECTS: 5

Content:

This course introduces the basic concepts of traffic flow theory and familiarizes students with some simple solution methods. The main focus is about first order macroscopic traffic flow model and how to apply them to a corridor including on and off-ramps. A key problem that is studied is waves in traffic and their meanings. The concept of traffic assignment on networks and equilibrium states are also discussed. Finally, the subject is placed in a broader vision of traffic engineering and control.

COURSE: INTELLIGENT TRANSPORTATION SYSTEMS

ECTS: 5

Content:

The Intelligent Transportation System (ITS) course aims to present various areas of current innovation tendencies both of vehicles and infrastructures. Many illustrations are given: Green Lights Optimisation Speed Advisory (GLOSA), Automated Cruise Control (ACC) and its connected version (CACC), trucks platooning on highways. Students are requested to produce a study about one specific system modeling.

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