COURSE SYLLABUS

FIRST SEMESTER: SCIENTIFIC COMMON CORE & INTRODUCTION

- **French as a foreign language – 80h**
  - Master and strengthen communication skills in fluid French: develop knowledge and know-how in French in order to establish or reinforce the student's autonomy in his/her new environment
  - Introduction to specific professional writing skills
  - Introduction to specific professional oral skills
  - Have a good command of French and technical vocabulary

- **Sports and cultural activities – 30h**

Discover France and the city's culture. Also includes sports activities. Students will get to know each other and will be able to interact within a group and take their marks.

- **Scientific courses: mathematics and chemistry – 32.25h**

At the end of this course, students will have acquired knowledge about digital simulation tools for partial derivatives equation solving and use them to solve real life issues, such as water treatment. They will be able to work in a safe and autonomous environment, in a laboratory, using chemical products; use solving software; make process macroscopic reports; use technical vocabulary in French and in solution chemistry

- **Unit operations of separation – 25h**

At the end of this course, students will understand and be able to explain:
  - physical phenomena at stake and show the different operations that will be studied
  - basic notions of the main unit operations linked to bubble, drop and particles quantity of movement in fluids

Students will be able to understand and explain the different unit operations; measure the key values that are the basis of unit operations dimensioning; use a technical vocabulary in French.

- **Chemical and biological reactors**

At the end of the course, the student will have studied and acquired knowledge about:
  - ideal reactors and heterogeneous reactors functioning
  - mass balance in ideal reactors and heterogeneous reactors

Students will be able to establish mass balances of ideal and heterogeneous reactors; use experimental data to determine reaction kinetics; calculate the dimension of reactors to be put in place; use a technical vocabulary in French.

- **Mass transfer and fluid mechanics – 44h**

At the end of the course, the student will have studied and acquired knowledge about multiphase contactors functioning and tools for numerical simulation of simple flows.
Students will be able to calculate the dimension of industrial installations such as distillation columns and use commercial tools for numerical simulation.

- **Urban Water Management – 40h**

At the end of the course, the student will have studied and will be able to explain:

- the notion of eco-systemic approach for water in urban centers and its various actors
- the specificity of water sectors in cities
- the issue of rain water and water networks

Students will be able to solve water constraints in production and water treatment; define key elements regarding network dimensioning.

- **Personal Project Training – 60h**

Principles of scientific approach, study and criticize past and present scientific works, find specialized groups, put in place in an autonomous way, a scientific and experimental approach in order to answer a question or an issue, give a scientific result, show its findings and redact a report.

SECOND SEMESTER: SEWAGE TREATMENT AND MANAGEMENT

- **Pollution analysis – 60h**

Course overview:

- Notions of quality, metrology, data processing for dimensioning and diagnosis of water treatment processes.
- Students will be able to choose and use the good method to identify components and/or types of pollution in complex environments, make a critical statement on the method used and the experimental results. They will know how to use pollution measurements in order to make a redox assessment and to use statistical treatment tools to analyze series of multi-variables data.

- **Water Treatment Biological Treatments – 64h**

Course overview:

- Biological catalysts and how they function, behavior of growing microbial cells and in production, description and modelling of biological reactors
- Sectors of waste water treatment, including carbon, nitrogen and phosphor elimination
- Methods of process dimensioning (activated sludge process and alternative systems)

Students will be able to:

- Identify the general metabolism functioning and kinetics of microbial growth and the metabolites production
- Establish stoichiometric equations and the speed of biological reactions, depending on environmental conditions
- Choose and design of the best reactor in order to product a specific reaction
- Evaluate needs and means, fluids and reagents of sewage water biological treatment
- Use dynamic simulation tools from water treatment sectors in order to optimize their dimensioning or their conduct.

- **<u>Soil and phreatic zones pollution – 30h</u>**

Course overview:

- Issue of layers and soil pollution
- Natural environments' hydrodynamics behavior
- Coupled transport process modelling in natural environments

Students will be able to use specific diagnosis methods and processes to solve these issues in cope with the legislation on waste in natural environments.

- **Water management and legislation on waste water – 30h**

Course overview:

- Rules and regulations on water management in developed and developing countries
- Sewage water management regulations and habits in France
- Environmental issues and risk evaluation principles (soil and layers pollution)

Skills acquired:

- Critical analysis of water issues, in a precise context (private sector', society', government's interests)
- Elaborate schemes that evaluate the impacts of human activity on aquatic environments and soils

- **Water treatment project – 70h**

At the end of this course unit, students will be able to choose the right water treatment process, following precise specifications. They will have an overview of notions based on study cases and will be able to explain the project and show its results.

- **Human Sciences – 60h**

English and French (FLE- French for foreigners) classes

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THIRD SEMESTER: WATER PRODUCTION & RESOURCE MANAGEMENT

- **Freshwater Purification**

Course overview: Legislation on freshwater; Freshwater purification sectors and the role of unit operations; Modern technologies and their function in the sector.
Students will be able to define a water purification unit, measure the most important operations and measure their energy consumption

- **New Water Resources Engineering – 80h**

Course overview:

- New water resources (salt water, brackish water, secondary effluents) and components of interest
- Specific water production units (desalination, reuse water, pure water, water for industry…)
- Principle and measurement of sorption unit operations
- Principle and measurement of advanced membrane separation unit operations (reverse osmosis, electrodialysis…)
- Principle and measurement of phase transition unit operations (degassing, decarbonatation, precipitation, crystallization…)

Students will be able to:

- Conceive and dimension urban water treatment units, water production and management (also in the industrial sector)
- Identify new resources
- Conceive and dimension the use of these resources
- Use and apply new knowledge to study cases

- **Management of Aquatic Environment – 40h**

Main concepts:

- Methodology to estimate reserves and protect underground water exploitation zones
- Management of rivers (environment, fishing, birds, tourism…)
- Continental water use in tropical environment (irrigation and fish breeding)
- Physical aspects of water cycle in surface hydrology (energy and radiation balance of a surface, evapotranspiration, precipitation, infiltration, runoff…)

Students will be able to find solutions to manage efficiently hydraulic networks (farming use, tourism…) taking into account quality, legislation and use.

- **<u>Resource protection – 40h</u>**

Course overview:

- Chemical products, waste and other materials: eco-toxicological risks and their consequences on ecosystems
- Underground water flows, interactions with surface and shore hydrology, resources exploitation issues

Aims for the student:

- Study and manage eco-toxicological risks and their consequences on the environment
- Quantify underground water flows, their interactions with surface and shore hydrology, pumping operations

- **<u>Project – 100h</u>**

Study and conception of a production unit specialized in drinkable water or in specific qualities or use of new resources.

- **<u>English – 30h</u>**