
Civil and Water Engineering Department

The Civil and Water Engineering (GEGC) Department offers talented engineering students expert training in three different programs of study leading to an Engineering Degree. Graduates of ENSI Poitiers (School of Engineering of the University of Poitiers, France) are operational engineers in up-dated sustainable designing, operating and commercial activities in the following sectors: contaminated site and waste management, soil and water treatments, water production and management, surface (earthworks, transport infrastructures, building construction) and subsurface (geology, tunneling, foundations and mining) civil engineering activities. The scientific curriculum and coursework are combined with guaranteed hands-on professional experience via internships in industry, lectures and conferences given by visiting professionals and on-site visits.

The Water and Civil Engineering Department is centered around a core curriculum throughout the 3 years of academic study, with the 3 specific programs of study coursework beginning in the 2nd year:

- **Nuisances and Water Treatment (TEN)**
- **Geotechnics and Building Materials (GMC)**
- **Geotechnics and Underground Works (GTS)**

The TEN program of study trains engineers to be competent in protection and sustainable use of water resources, designing, building, management and operating water treatment plants, urban hydraulics, polluted soils and sites regeneration, sustainable waste management. This original program leads to a wide range of professional engineering opportunities allowing engineers to adapt to the environmental, urban and industrial mutations. Classes are organized around the following themes: hydro(geo)logy, characterization and quality of water, soil and air matrices, engineering for water management and treatment, and contaminated sites regeneration. TEN Graduates will find jobs in project management, in design offices, in building and operating, and in positions working with regional and local authorities.

The GTS program aims to specialize geotechnical engineering students in the fields of underground works (digging and support of underground works, drainage, waterproofing), the operation and development of the underground space (transport infrastructure, storage, hydraulic galleries, etc.) and the sizing of the underground structures. The GTS program offers training in the fields of i) geological and hydrogeological characterization of the subsoil, ii) geotechnical characterization of the subsoil for the choice of methods of excavation and support, iii) design, calculation and digital modeling of the infrastructures of the Civil engineering (roads, foundations) and more particularly underground works, iv) the exploitation of underground space for urban development (road and rail transport infrastructure) and environmental management (storage of radioactive waste) and natural resources (storage of gas, hydraulic galleries) and v) the choice and formulation of concrete and the study of concrete structures. The GTS course leads to the training of engineers whose specific skills include design, production and monitoring underground works projects. Generalist and specialized, the GTS program allows engineers to integrate in the various trades of Civil Engineering and territory layout. They find their place in project management, contracting authority and execution of works, within companies specializing in underground works.

This document presents the pedagogical organization and the detailed contents of the teachings of the the Civil and Water Engineering Department.

Note that:

- in the first year, all the teachings are common to the Department (TC ENSIP and TC GEGC);
- the second and third years have a common core part (TC GEGC) and parts dedicated to the 3 programs of study : TEN, GMC and GTS.

Teaching organization

Semester 5

UE051 – 10 ECTS – TC ENSIP	coef
Project steering (Methods and tools)	10
Mathematics 1	20
Statistics	10
Thermodynamics	40
Engineering and society	-
CAD/CADD - Building Information Modelling	20
UE052 – 10 ECTS – TC ENSIP	coef
Algorithmics and Programming	20
Digital skills	10
Fluid mechanics 1	15
Introduction to electrotechnology	20
Continuum mechanics	15
Introd. to sustainable development	-
English 1	20
UE053 – 10 ECTS – TC GEGC	coef
Chemistry of natural waters	40
Geology engineering	30
Geotechnics 1: basic notions	30

Semester 6

UE061 – 9 ECTS – TC ENSIP	coef
English 2	20
Application work 1st year	20
Mathematics 2	10
Signals	20
Introduction to numerical methods	10
Management 1	10
UE062 – 9 ECTS – TC ENSIP	coef
Introduction to databases	10
Science history and philosophy	10
Materials science	40
Fluid mechanics 2	30
Communication	10
Life cycle analysis	-
UE063 – 10 ECTS – TC EE	coef
Concrete and use	20
Geotechnics 2: applications	30
Hydrogeology	20
Pollutants in natural environments	30
UE064 – 2 ECTS – TC EE	
1st year internship	

Semester 7

UE071 – 10 ECTS – TCGEGC	coef
English 3	20
Meeting steering - Conflict management	10
Turbomachinery	10
Systems	40
Advanced office applications	10
Regulatory and technological monitoring	10

UE072 – 10 ECTS – TCGEGC	coef
Polluted soils and sites regeneration	20
Waste management and upgrading	20
Supervised project	10
Water resources and pollutants transfer	20
Soil investigation and management	30

UE073 – 10 ECTS – GMC-GTS	coef
Work environment 1	10
Rocks formation and identification	20
Geotechnics 3 : soil mechanics	50
Rocks mechanics 1 : structural geology	20

UE073 – 10 ECTS – TEN	coef
Coagulation - flocculation	10
Decantation and flotation	10
Filtration	10
Environmental microbiology	10
Wastewater metrology	10
Reactors	10
Technologies for environmental analysis	10
Practical exercises 1	30

Semester 8

UE081 – 9 ECTS – TCGEGC	coef
Building Information Modelling	15
Hydraulics of networks 1	15
Road infrastructures 1	10
Metrology	10
Topography	20
Roadways and networks	10

UE082 – 9 ECTS – TC GEGC	coef
Building materials deterioration	10
English 4	20
Public contracting codes	10
Rainwater management	10
Cross project	20
Heat transfer	20

UE083 – 8 ECTS – GMC-GTS	coef
Geotechnical foundations	40
Road infrastructures 2	10
Rock mechanics 2 : rock masses	10
Field training : rock identification	30

UE083 – 8 ECTS – TEN	coef
Calcium carbonate equilibrium	10
Drinking water production	10
Chemical oxidation – disinfection	10
Precipitation carbonate removal	10
Practical exercises 2	25
Biological wastewater treatment with activated sludge and sizing	25
Activated carbon adsorption	-

UE084 – 4 ECTS – TC ENSIP

2nd year internship

Semester 9

UE091 – 10 ECTS – TC ENSI	coef		
English 5	20		
Management 2	10		
Quality	10		
Innovation Studies Research project	60		
UE092 – 10 ECTS – GMC	coef		
Work environment 2	30		
Concrete structures 1	50		
Concrete structures 2	20		
UE092 – 10 ECTS – GTS	coef		
Design of subsurface works	30		
Work environment 3	10		
Concrete structures 1	50		
Works in the underground	10		
UE092 – 10 ECTS – TEN	coef		
Drinking water	40		
(UV-disinfection and desalination)			
Hydraulics of networks 2	40		
Air pollution	20		
UE093 – 10 ECTS – GMC	coef		
Calculations and models			
in civil engineering	30		
Advanced geotechnics 1	50		
Advanced geotechnics 2	20		
UE093 – 10 ECTS – GTS	coef		
Calculations and models in civil			
engineering	30		
Underground: design and studies	20		
Advanced geotechnics 1	50		
UE093 – 10 ECTS – TEN	coef		
Water and health	20		
Domestic wastewater	50		
(Reuse)			
Natural aquatic systems	20		
Sludge treatment	10		

Semester 10

UE101 – 10 ECTS – GMC	coef	UE101 – 10 ECTS – TEN	coef
Quarries: investigation, operation		Water for industry	40
and blasting	20	Industrial wastewater	40
Geophysics and petrophysics	40	Database management	20
Road infrastructures 3	40		
UE101 – 10 ECTS – GTS	coef	UE102 – 20 ECTS – TC ENSIP	
Underground – works control	20	3rd year internship	
Geophysics and petrophysics	50		
Blasting in the underground	10		
Project	20		

Water and Civil Engineering Department

UE051 - Project steering (Methods and tools) - TC ENSIP / Semester S5

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 1.5/1.5/-/3

Description

to acquire the fundamental methods and tools for project management in order to successfully steer a project, and create a tool-box.

Expected skills

- become familiar with the key-concepts of project management
- identify the role and the responsibilities of a project manager
- steer a project by implementing an operational method and operational tools
- identify the key-steps of a project and its implementation process
- find solutions difficult situations in project management
- define the circumstances and players in a project

UE051 - Mathematics 1 - TC ENSIP / Semester S5

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/30/-/-

Description

This course is meant to review basic mathematical skills

Expected skills

- know how to use matrices and tensors
- be able to differentiate and integrate
- know how to apply major theorems

UE051 - Statistics - TC ENSIP / Semester S5

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/10.5/-/-

Description

This course is an introduction to statistics knowledge of which is essential for modern engineering jobs. After essential reviews, this course will present the mathematical framework (counting, discrete and continuous probability spaces), and then a few basic statistical tools for analysing experimental data and random functions (e.g. sampling theory, estimates, confidence interval, hypothesis testing).

Expected skills

- know the classical laws of counting
- know how to use a few statistical tools
- know the main random phenomena transferable to scientific disciplines

UE051 - Thermodynamics - TC ENSIP / Semester S5

Coef 40 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 9/21/15/-

Description

This course is meant to teach the fundamental tools required for approaching the different states of matter, and the energy exchanges which depend on them. We shall discuss: systems and principles, exchanges of matter, work, heat. Standard transformations: isothermal, isobaric, isentropic, cycles. Heat engines. S-T, H-T,

H-S diagrams and applications. Phase diagrams for pure substances. Real gases. Changes of phase. Phase-change materials. Bi-phase binary mixtures: isotherm and isobar diagrams. Ideal and real mixtures, and applications. Bi-phase ternary mixtures. Thermodynamic quantities of reactions, influence of temperature and pressure. Free enthalpy of a system and evolution. Characteristic quantities of chemical equilibrium. Applications to industrial processes.

Expected skills

- analyze and quantify energy exchanges
- characterize the states of matter, changes of state, phase-change materials
- give the selection criteria for phase-change materials
- use binary diagrams,
- explain and use chemical equilibria
- differentiate an ideal system from a real system, and to use the corresponding thermodynamic relations (fugacity, activity, chemical potential, etc.)
- know the characteristics of the different states of matter, Clapeyron's relations
- use binary diagrams
- qualify the evolution of a chemical equilibrium

UE051 - Building Information Modelling - TC ENSIP / Semester S5

Coef - – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 3/3/-/9

Description

Use of AUTOCAD and REVIT softwares for building projects

Expected skills

- have the basics of technical drawing
- identify the main graphical representations of building projects
- use 2D (AUTOCAD) and 3D – BIM (REVIT) software

UE051 - Science history and philosophy - TC ENSIP / Semester S5

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 9/-/-/-

Description

Presentation lectures on the History of sciences

Expected skills

UE051 - Engineering and society - TC ENSIP / Semester S5

Coef - – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 3/-/-/-

Description

Expected skills

UE052 - Algorithmics and Programming - TC ENSIP / Semester S5

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/13.5/15/-

Description

After a few reviews on coding (numbers, images, sound), the different algorithmic structures will be reviewed (variables, test, loops, functions).

Then, relying on Python (programming language), several general concepts will be discussed: recursion, calculating complexity, use of complex types (lists, associative arrays, sets). A few standard exercises are solved during tutorial classes. During practical classes, certain exercises seen during tutorial classes are programmed, then different topics can be discussed: fractal images, cryptography, image processing, cellular automata, etc. [Link to course and practical class documents](#)

Expected skills

- numerical coding of data
- designing simple algorithms
- solving various problems through programming

UE052 - Digital skills - TC ENSIP / Semester S5

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/3/-/-

Description

This module follows the development of the PIX national volume in order to provide a solid basis of digital skills. Work related to bibliographic searching and monitoring, and to the management and or protection of personal data will be discussed face-to-face. Working alone, the students will deal with questions of digital identity, licenses, and creating digital documents.

Expected skills

- know the problems relating to the accessibility of digital tools
- know how to control their traces and manage the personal data in order to protect their privacy and that of the others. to adopt an informed practice: confidentiality parameters, regular monitoring of traces through alerts and other tools, etc.
- carry out a search and information monitoring, using a search engine, within a social network, by subscribing to streams or newsletters, or any other means.
- control their private, institutional or professional digital identity.
- know the questions on author rights, licenses, and to apply them.
- structure and format a document
- produce a composite document
- use data in spreadsheets

UE052 - Fluid mechanics 1 - TC ENSIP / Semester S5

Coef 15 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 9/10.5/-/-

Description

The integral form of the fundamental conservation equations of a fluid's movement (mass conservation, momentum conservation and energy conservation) will be presented. The first applications which derive from there will be discussed: statics for a fluid at rest, local theorems for perfect fluids (Euler's equation, Bernoulli's equation), flow-rate and velocity measurements. The momentum-flow theorem will be established, and its use to estimate resultant forces applied by fluids on surfaces, will be presented.

Expected skills

- learn the fundamental elements and general concepts of fluid mechanics
- know how to apply the general laws to a moving fluid
- master the essential elements for studying the movements of an ideal fluid

UE052 - Introduction to electrotechnology - TC ENSIP / Semester S5

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 9/9/15/-

Description

The course will present the main power generation methods (power plant), will describe high voltage transformation methods for transport, and will introduce a few operating principles (induction motor and DC motors). An introduction on power electronic components will be given in order to be able to discuss rectification in the continuation of the program.

Expected skills

- solve simple electricity problems with strong currents
- know the principles for the generation (alternator, power plant), the transport (transformation, power factor) and the use of electricity (rotating machines) under strong currents

UE052 - Continuum mechanics - TC ENSIP / Semester S5

Coef 15 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 9/12/-/-

Description

- Define and establish links between the conceptual objects required for a balance equation
- describe the evolution in time and space of a continuous deformable medium: to explain and make the link between the concepts of a material system, particle speed, and the concepts of transport, displacement, deformation.
- put in mathematical form the conservation of mass principle and to link it to the particle velocity field.
- describe the forces applied to a continuous medium, locally and overall.
- link the causes to the effects of a transformation, i.e. to express the dynamics fundamental principle as a momentum balance 2.1.
- handle the mathematical tools concerning conservation equations within the context of continuum mechanics
- operate with vectors, second-order tensors, and momenta
- handle many variable functions, and functions with scalar, vector and tensor variables in order to put hypotheses and boundary conditions into mathematical form,
- calculate multiple integrals in order to determine flow-rates, resultant forces, etc.
- apply and invert partial differential operators for expressing stress, velocity, pressure, fields etc.

Expected skills

- interpret and handle the terms of a balance equation
- describe the movement of a continuous medium
- deal with the concepts of deformation, stress, kinematics, mass conservation
- know how to establish a momentum balance, to write the balance equation

UE052 - Introduction to sustainable development - TC ENSIP / Semester S6

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 2/-/-/-

Description

Sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. "The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice." (www.un.org)

Expected skills

UE052 - English 1 - TC ENSIP / Semester S5

Coef - – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/18/-/-

Description

This course teaches general English. After having distributed the students into level groups following a test, the work is aimed at achieving a B1 - B2 level, as defined by the CEFRL scale (Common European Framework of Reference for Languages: Learning, Teaching, Assessment) in the 5 language skills. Depending on levels, work is based on linguistic reviews and/or deepening the knowledge of the English-speaking world.

Expected skills

- express yourself fluently
- use the right intonation, the right tonic accent and the right phonemes
- use the grammar concepts required for a proper understanding
- use the vocabulary for the TOEIC
- be able to speak and write
- know about the English-speaking world

UE053 – Chemistry of natural waters - TC GEGC / Semester S5

Coef 40 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 18/21/20/-

Description

This course will present the main parameters for characterizing natural waters: dissolved salts and gases, suspended matter, natural organic matter. These different parameters will be introduced through a prior presentation of the great biogeochemical processes at the origin of the composition and evolution of natural waters (alteration-precipitation, biological processes, air- water exchanges). We shall focus on the calcium carbonate equilibria and their role in the chemistry of natural waters, natural organic materials, the chemistry of metal and redox reactions. This module is an occasion to use the main methods for water analysis (pH, alkalinity, hardness, dissolved oxygen, redox potential, conductivity, etc.), and to introduce methods such as chromatography and atomic spectroscopy. The different physical and chemical parameters and their evolution will also be presented within the framework of case studies (eutrophic lake and quarry acid lakes) illustrating theoretical concepts. This course is also an occasion to introduce the Visual MINTEQ software for solving chemical equilibria.

Expected skills

- know the characterization parameters of a water and know how to analyze a natural water
- solve chemical equilibria in solution
- use speciation software
- interpret and comment critically on results

UE053 – Geology Engineering - TC GEGC / Semester S5

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 12/9/12/-

Description

Geology concepts concern first the principle of rock classification, their formation, and the study of the main families of minerals which form them. Minerals are studied through the analysis of crystalline systems (symmetry elements), and their chemical compositions (structural formulae and solid solutions). Secondly, understanding spatial distribution is discussed through the study of France's geology and the analysis of geological maps, in particular by using Infoterre.

Expected skills

- Identify the main types of rocks and the minerals which form them
- know their chemical composition and the conditions of formation
- know the great geological formations in France
- carry out a geological cross-section from the analysis of a geological map
- Infoterre for a search of geological data

UE053 – Geotechnics1: basic notions - TC EE / Semester S5

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 12/12/9/-

Description

Natural material structure: densities, porosities, particle size distribution. Soil identification and classification. Water characteristics and soil clayeyness. Water in soils concepts of in situ exploration, mechanical probing, in situ testing (dynamic penetrometer, pressuremeter).

Expected skills

- know how to characterize a natural material and its state: to measure and calculate porosities, void ratios, concentrations of water, clay, etc.
- carry out the main tests for GTR classification
- understand the importance of water in the behavior of geomaterials

UE061 - English 2 - TC ENSIP / Semester S6

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/13.5/12.5/-

Description

This course is almost exclusively dedicated to speaking activities: presentations, debates and communication activities. Work will be done on scientific English: the presentations and debates are based on scientific research on science history and philosophy in English-speaking countries, and notes have to be taken; individual exam at the end of the year.

Expected skills

- interact fluently
- know about the English-speaking world
- write a summary note using English-speaking media

UE061 - Application work - TC ENSIP / Semester S6

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/-/5

Description

Supervised by a tutor, students, in groups, carry out personal work on very varied subjects that they propose themselves, or proposed by the teacher. Besides a bibliographic part, and possibly a theoretical part, the application work includes a practical part.

Expected skills

- learn how to manage a project
- understand group management
- write a report
- present in front of a jury

UE061 - Mathematics 2 - TC ENSIP / Semester S6

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/21/-/-

Description

This course is aimed at laying the basis of skills in the field of differential equations and partial differential equations, and at discovering distributions. The classical methods for analytical solving of ODEs and PDEs are studied, in particular using Fourier series, Fourier transformations and Laplace transformations. Distributions (Dirac, Heaviside) will also be learned.

Expected skills

- know how to solve a differential equation
- know how to solve a partial differential equation
- know how to use Fourier series, Fourier transformations and Laplace transformations

UE061 - Signals - TC ENSIP / Semester S6

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/24/12/-

Description

Signal processing mathematical tools will be introduced and studied (decomposing into Fourier series, Fourier transform, Dirac's unit impulse symbol and comb, time and frequency convolutions, sampled signal models, Shannon's theorem, notion of anti-aliasing filter), and will lead to the fast Fourier transform and spectral analysis by computer. The information transmission-reception and signal frequency change methods are also discussed.

Expected skills

- classify signals
- calculate the Fourier transform of an analytical signal, and represent its spectrum
- transpose a signal spectrum at different frequencies
- understand a modulation or spectral analysis block diagram

UE061 - Introduction to numerical methods - TC ENSIP / Semester S6

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/12/12/-

Description

This course is an introduction to numerical methods, essential for studying many physical phenomena. The teaching is divided into three parts: a theoretical course (theorems and mathematical tools), exercises and practical classes (application under MatLab). These three components are constantly called upon to interact. We shall discuss, in particular, suitable methods for solving equations, linear systems, polynomial interpolation, numerical integration and ordinary differential equations.

Expected skills

- master the course (theorems and definitions)
- know the main numerical methods introduced as exercises, and to study their properties
- have the ability to propose algorithms for solving problems in pseudo-code and under MatLab

UE061 - Management 1 - TC ENSIP / Semester S6

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/15/-/-

Description

This course will make the students discover the inter-relations between functions of a company: commercial, financial and accounting, and to develop a strategic behaviour. It is also an awareness-raising regarding company problems, through management simulation: grouped together in a management team, the students manage restaurants, taking rich marketing decisions and including many commercial investigations. Arkhé's teaching software will be used.

Expected skills

know the inter-relations between company functions

UE062 - Introduction to databases - TC ENSIP / Semester S6

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/4.5/6/-

Description

This course is an introduction to relational databases. After a general presentation justifying the introduction of DBMSs, the association entity and relational models will be described. The fundamental elements of SQL will then be discussed from the point of view of modelling and requests.

Expected skills

- understanding of the relational schema of a database, the relation between tables, primary and foreign keys
- algebraic and SQL expression of requests on a given scheme
- interrogating a database.

UE062 - Life cycle analysis - TC ENSIP / Semester S5

Coef - – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 3/3/-/-

Description

Introduces the students to quantitative assessment methods for the environmental impacts of various activities (product, service, building).

Expected skills

- know how to use ACV-dedicated tools: EQUER building ACV software
- be able to apply their knowledge during practical classes, and a workshop on carrying out an ecological assessment of an individual house

UE062 - Science history and philosophy - TC ENSIP / Semester S6

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/-/-/-

Description

After presenting the objectives of the history of science course, an illustrated bibliography of the history, philosophy and epistemology of science, will be proposed. Relations between science and techniques, science and religion, and science and politics, will be discussed. Chapter 1 begins with the place of women, the grand ideas in philosophy and epistemology of science, and thinking about the notion of scientific progress. Chapter 2 discusses the scientific revolution during the XVII-th century. Chapter 3 deals with the history of thermodynamics, in particular through the reading of Sadi Carnot's work. Chapter 4 is dedicated to the life and work of Albert Einstein. Chapter 5 tells the story of the thinking which led to major ideas of the Big Bang theory. The last chapter on the voyage and work of Charles Darwin is subject to a presentation in English, in the presence of an English teacher.

Expected skills

- explain the development of scientific concepts
- justify the scientific developments thorough eras, knowledge and needs
- explain scientific progress in terms of success and errors

UE062 - Materials science - TC ENSIP / Semester S6

Coef 35 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 12/21/15/-

Description

After having described the main mechanical systems, their links, and having justified the form of the screw of the mechanical actions transmissible by each of them, the main principle of rigid body dynamics is reviewed and applied. Hypotheses are then made in order to characterize a deformable solid (elastic deformation field) and to define the beam in the sense of materials science. Writing the cohesion screw in the straight section of a beam leads to studying stress and deformation for the main simple forces (extension, compression, shearing, torsion, in plane bending). Iron-carbon alloy will be studied, from steelmaking to the mechanical characteristics of metallurgical products. The main mechanical tests will be presented. The simplified theoretical study of materials is supplemented by an experimental approach:

- traction and hardness testing of alloys, relating to heat treatments,
- relations between stresses and deformations,
- numerical calculation tool (RDM 6).

Expected skills

- design machine parts and structure elements
- write explicitly the design criteria for resistance and deformation
- calculate the components of the screws of mechanical actions transmissible via mechanical links
- calculate the components of the cohesion screw of the straight section of a beam
- measure and inspect the mechanical characteristics of metal samples

- transpose graphically and in numerical form a simple technical choice (use of AUTOCAD software)

UE062 - Fluid mechanics 2 - TC ENSIP / Semester S6

Coef 25 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 12/12/15/-

Description

The extension of the application of general laws and principles of mechanics to the motion of a real (viscous) fluid, will be presented. The mathematical modelling associated with Stoke's hypothesis which enables the stress tensor and the deformation velocities to be linked, will be shown. The local form of conservation equations for an incompressible fluid will be established (Navier-Stokes equations), and the exact main solutions of the equations will be presented (Poiseuille and Couette flows). The approaches for determining linear and singular head losses in pipe flow, will be developed (generalised Bernoulli's principle). Finally, concepts of dimensional analysis (PI theorem) and similarity, will be introduced.

Expected skills

- know the basic mathematical modelling apt to provide solutions for different fluid flow problems
- know how to solve basic problems of incompressible fluid flows
- calculate head losses
- define all characteristics of a hydraulic network

UE062 - Communication 2 - TC ENSIP / Semester S6

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/15/-

Description

This teaching is aimed at making adaptation in companies easier, while allowing for an effective search for work. Through speaking exercises in front of a group (work on the voice, language, posture) and drafting and correcting CVs and motivation letters. Moreover, using, as a support, application work (written dossier, speaking training and oral presentation) enables students to make videos as a tool for self-assessment, to master various supports and to manage stress.

Expected skills

- communicate a message to different discussion partners
- use tools essential for looking for work or internships

UE063 – Concrete and application - TC GEGC / Semester S6

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 19.5/6/8/-

Description

Concrete is a construction material composed of cement, aggregates, water, addition, adjuvant and fibers. The first two sections of this course concern the description of different constituents of concrete. For each constituent, the composition, manufacture, properties, standardization and fields of use are described. Concrete is an industrial material that must have consistent properties to be used in the construction of engineering structures and to ensure their durability. The third section concerns the European standardization of concrete materials. The NF EN 206-1 standard defines the different types of concrete that can be used on construction sites, the specifications of concretes according to the environment classes of the future structures, the classifications of concretes according to their properties, and the conformity of concretes. The formulation of a concrete depends on the targeted properties in the fresh state and in the hardened state. In the fresh state, the concrete consistency affects its workability, characterizing its capacity to fill the forms and to coat the steel. In the hardened state, the concrete porosity affects its mechanical resistance and its durability. In the fourth section, the description of different properties allows to explain the formulation of ordinary concrete base on the Dreux Gorisse method. The elements of reinforced and/or pre-stressed concrete structures can be made in factories (precast elements) or onsite (cast-in-place elements). In both cases, the concrete is poured into a mold, called formwork, which gives the concrete its final shape. The different techniques of concrete implementation are presented in the last section.

Expected skills

- Select and control the different constituents of a concrete
- Formulate and control a concrete according to specifications while respecting the standardization
- Follow up on the manufacture, implementation and control of concrete on construction sites

UE063 – Geotechnics 2: applications - TC GEGC / Semester S6

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 7.5/15/12/-

Description

This course deals with a set of themes related to environmental geotechnics: the risk of earth movements, the seismic risk, the risk of clay swelling and shrinkage and the risk of torrential phenomena. The first part of the course introduces the notions of hazard and vulnerability to define the concept of risk. The principles of management and prevention of the natural risks studied here are then exposed.

Expected skills

- know the different principles associated with a risk analysis and risk management
- know the main risks in environmental geotechnics

UE063 - Hydrology - TC GEGC / Semester S6

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 12/13.5/-/-

Description

Water cycle: water resources on Earth and the different uses of water. Annual hydrological balance: rainfall - flow relationships and sizing of structures. Modeling of a rainfall event for the sizing of overflows, stormwater networks and flood risks. Hydrodynamic principles: physical properties of water, typology of aquifers, hydrostatics in saturated and unsaturated porous media, analysis of piezometric maps, Darcy's law.

Expected skills

- use Darcy's law in simple cases (homogeneous media)
- measure the permeability of porous media
- three-dimensional flows: well and flow network hydraulics
- carry out hydrological balances
- interpret hydrogeological maps

UE063 – Pollutants in natural environments - TC GEGC / Semester S6

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 12/6/14/-

Description

This course describes the large pollutant classes of anthropic origin found in different water and soil compartments of the natural environment. After a description of the type and origin of pollution supported by examples, we shall present the transfer and evolution modes (by hydrolysis, photolysis or biodegradation) for pollutants in a natural environment. The impact of pollution in terms of environmental and health hazards is also described, along with the regulations associated with environmental monitoring.

Expected skills

- know the origin and the modes of evolution of pollutants in different environments
- assess the impact of pollutions on environments, and their uses

UE064 - 1st year internship - TC ENSIP / Semester S6

Coef 100 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/-/-

Expected skills

Acquire professional skills (especially in health and safety at work)

UE071 - English 3 - TC ENSIP / Semester S7

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/24/-/-

Description

Groups 2 and 3: preparation for TOEIC (Listening, Reading) Group 1: briefly review the TOEIC Development of language skills in English for the professional world: CV drafting, and even motivation letter models.

Expected skills

- Deepening expression and understanding skills through varied, cultural subjects
 - Writing professional documents in English
-

UE071 - Meeting steering - Conflict management - TC ENSIP / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/8/-/-

Description

Concepts and definitions, the different types of meeting, meeting and interview, success conditions, quality of persons involved.

Expected skills

- be able to steer a meeting
 - be able to identify personalities present
 - know the constituent elements of a crisis, the contextual elements favouring them, and the possible response strategies
-

UE071 - Turbomachinery - TC ENSIP / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/12/-/-

Description

This first part of the turbomachinery course is an introduction which addresses both specialities GEGC and E in the same way. After a presentation describing the universe of turbomachinery and the basic concepts (Euler's theorem, velocity triangle), the operation of a centrifugal pump (or fan), is described in detail. Similitude theory and Rateau's coefficients for being able to choose a pump (for example) in an installation, are then introduced. The course will finish with a brief description of axial machinery, illustrated by the study of a fan or a pump of

this type. It should be noted that a practical class on centrifugal pumps is included in the series of practical classes relating to the course on heat engines.

Expected skills

- to master the basic vocabulary and concepts of this discipline
- to acquire the essential tools for designing elementary turbomachinery
- to master the choice and the installation of a pump or a fan in a circuit
- to acquire the English vocabulary specific to the subject

UE071 - Systems - TC ENSIP / Semester S7

Coef 40 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/33/15/-

Description

This course provides an introduction to linear systems, transfer functions, and Laplace transforms. It covers stability and feedback, and provides basic design tools for specifications of transient response. It also briefly covers frequency-domain techniques. More specifically, after defining then studying the properties of the Laplace transform, its application to solving differential equations is introduced. Transient and frequency response analysis (Bode plot, Black locus and Nyquist locus) of linear systems is then considered. First- and second-order systems as well as the study of integrator system and systems with delay, is more particularly studied. After having defined the notion of closed loop system, then performance criteria for 1st and 2nd order closed loop systems, system stability is studied via Nyquist's criterion, by defining gain and phase margins. The lead-lag compensator is also introduced. Standard methods for PID controller tuning are introduced in the last part of this lecture.

Expected skills

- know how to apply the performance criteria of closed-loop systems,
- know how to study system stability,
- know how to apply the principle of stabilising corrections
- know how to tune a PID controller for 1st and 2nd order systems (whether with delay or without) by focusing on tracking and disturbance rejection performances
- understand a simple control scheme

UE071 - Health and safety at work 2 - TC ENSIP / Semester S7

Coef – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 3/3/-/-

Description

Using the Impact MOOC from Ecole des Mines in NANTES

Expected skills

- identify, in the company, the economic, legal, social and human issues for health and safety at work
- integrate health and safety at work to the management of its activities and to the steering of its projects
- contribute the management of health and safety at work in a company

UE071 – Regulatory and technological monitoring - TC GEGC / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/-/9

Description

This teaching aims at learning how to write a scientific report using e-tools for bibliography and patent analysis. Rules for citation will be given as well as standards for writing reports.

Expected skills

- use bibliographic tools (Zotero, Mendeley, ect.)
- know rules for citation of references
- Use tools for bibliographic search

UE071 – Advanced office applications - TC GEGC / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/-/12

Description

This course first describes the use of a spreadsheet for data analysis: presenting results, dynamic cross tables, using a solver, etc.

Expected skills

- to use office tools for presenting data or calculations

UE072– Polluted soils and sites regeneration - TC GEGC / Semester S7 Coef

20– Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 16.5/7.5/-/3

Description

After having presented the regulations on the management of polluted sites, this course will describe diagnostic and monitoring methods for polluted sites (drilling techniques, sampling and analyzing of different phases, site instrumentation and equipment, etc.) This course then lists the different treatments (biological, physical, chemical or thermal) used in the case of polluted sites and soils. We shall present in detail widely used methods, and we shall introduce methods under development. The focus will be on the existing link between the technology chosen and the pollution to be treated. Finally, the course is illustrated by several case studies.

Expected skills

- Use a methodology for assessing the state of a polluted soil or site
- Design treatment programs for polluted soils or remediation methods for polluted sites

UE072 – Waste management and upgrading - TC GEGC / Semester S7

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 18/6/-/-

Description

After having presented the environmental and societal context of waste management, the course discusses their classification, and provides characterizing elements. The policy and regulatory framework of waste management will be presented, along with the collection, recycling and re- purposing depending on the type of material concerned. Finally, the course describes the design and the functioning of recycling, incineration, composting, anaerobic digestion facilities and storage areas for waste, from the perspective of reducing their environmental impacts. The treatment methods for hazardous waste will also be discussed.

Expected skills

- know how to design and size environment-friendly treatment programs, to assess a corporate or community policy relating to waste management, and to analyze its conformity with the regulations, and its environmental and economic relevance be able to design a wind turbine

UE072 – Supervised project - TC GEGC / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/-/12

Description

Visits of industrial facilities for waste treatment and re-purposing (waste recycling, composting, storage or energy recovery) or for polluted soil decontamination, illustrate the concepts discussed during the course, and provides in-depth knowledge through case studies and independent individual work.

Expected skills

- learn how to write a visit report,
- identify infrastructures and understand the operations in industrial facilities

UE072 – Water resources and pollutants transfer - TC GEGC / Semester S7

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 13.5/12/-/-

Description

Establishing steady and transient flow equations, hydrodynamic characteristics (transmissivity and storativity), flow networks, structure hydraulics, superposition principle, initiation to hydrodynamic modelling, initiation to pollutant transfer into groundwater.

Expected skills

- Graphically draw flow networks
- Analyze hydraulic tests (test pumping and hydraulic shocks) in simple cases (homogeneous porous media)
- Understand the diffusion equation
- Estimate hydro-dispersive characteristics

UE072 – Soil investigation and management - TC GEGC / Semester S7

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 15/9/-/12

Description

The teaching concerns the physical, chemical, physical-chemical and biological properties of soil, aiming at understanding its functioning and its management as resource. This multi-disciplinary teaching is structured in 4 main topics: soil constituents and formation, soil constituent organization and reactivity, water in soil and shrink-swell problems in soil. This teaching also discusses on-site description of soils and soil analysis interpretation. The concepts developed during this course are put in practice through a project on a reasoned choice of building plot implantation at a municipality level.

Expected skills

- Identify soils on site, and to give their main characteristics
- Interpret soil analyses
- Differentiate the main physical, chemical and physical-chemical factors and processes governing soil functioning

UE073 Work environment 1 – GMC-GTS / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 9/-/-/-

Description

Presentation of the professional environment and of the different steps of a building and planning project (e.g.: the law regarding public contracting authorities [law MOP] Presentation and definition of the parties involved in the project: general contractor, client, companies, subcontractors.

Expected skills

- Understand the role of the different participants in implementing a building project - To determine a project phasing

UE073 Rock formation and identification – GMC-GTS / Semester S7

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 18/-/-/18

Description

This teaching concerns the identification and description of igneous, metamorphic and sedimentary rocks: petrography (macroscopic and microscopic identification), mineralogy, texture. We shall present the genesis of endogenous rocks from petrography and petrochemistry, and from associated deposits. We shall present metamorphic rocks taking into account parageneses and structural evolutions. They are interpreted in terms of overall dynamics.

Sedimentary rocks will be understood from sedimentary processes. The teaching includes: rock classification and identification, reconstruction of sedimentation media and identification of formations.

Expected skills

- Macroscopically identify different rocks
- Associate modes of formation with forms of deposits
- Provide petrographic analysis

UE073 Geotechnics 3 – GMC-GTS / Semester S7

Coef 50 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 16.5/16.5/22.5/-

Description

This course focuses on soil mechanics and rheology. Concepts of shift, deformation, main deformation and stress. Reminders from continuum mechanics; (Vertical and horizontal) stress expression in a rock mass. Drawing MOHR's circles. Soil resistance to shearing (CASAGRANDE's shear box, triaxial shear testing apparatus). Definition of the intrinsic curve and of MOHR-COULOMB criterion. Extension of BOUSSINESQ's results. Concepts of soil compressibility and consolidation. Practical determination of subsidence (elasticity and odometer test). Soil bearing capacity. Subsidence calculation by pressiometer testing. Slope and embankment stability using TALREN (software). Sizing shallow foundations with FOXTA (software).

Expected skills

- Understand soil mechanics in saturated media
- Know and master laboratory tests
- Know and use Eurocode 7 (shallow foundations)

UE073 Rocks mechanics 1: structural geology – GMC-GTS / Semester S7

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 13.5/9/-/3

Description

Basics of rock mechanics: stresses, deformations, rheology, rupture and fractures. Application to geological structures: brittle tectonics (faults) and ductile tectonics (folds). Application of structure stability to rock, in particular with a mini-project.

Expected skills

- Interpret a landscape and geological structures
- Understand the mechanical behavior of rocks, at different time and space scales
- Understand the link between structural geology and structure behavior in a rock

UE073 Coagulation-flocculation - TEN / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/3/-/-

Description

This course will present coagulation-flocculation, preliminary step to the liquid/solid separation operations. We shall show the treatment goals, we shall specify the fields of application, and we shall present the implementation into a water treatment outlet. The theory of coagulation and flocculation is described in detail, and the different usable reagents; the associated technical aspect is also developed along with the presentation of the technologies implemented.

Expected skills

- Know the main physical-chemical aspects involved during the coagulation and flocculation steps
- Choose the appropriate reagent and to define a level of treatment depending on the raw water quality

UE073 Decantation and flotation - TEN / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/3/-/-

Description

This course is aimed at introducing the main sizing principles for individual liquid-solid separation operations, by sedimentation and by floatation. We shall present the operating conditions which make this separation possible, and the different existing methods.

Expected skills

- Know the principles of sedimentation and floatation
 - Know how to design an installation
 - Know how to choose a method appropriate for the quality of the water to be treated
-

UE073 Filtration - TEN / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 12/9/-/-

Description

This course will introduce the different mechanisms involved in liquid-solid separation in membrane and depth filtration. We shall present a comparison between technologies, and give design methods.

Expected skills

- Know the principles of depth and membrane filtration
 - Know how to choose a method appropriate for the quality of the water to be treated
 - Know how to design an installation
-

UE073 Environmental microbiology - TEN / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/4.5/-/-

Description

After reviewing the biological diversity of microorganisms in the water environment, this course is devoted in its first part to bacteriology: we shall characterize the bacterial cell, we shall describe the influence of chemical and physical factors on bacterial growth, and we shall present the different methods for counting bacteria. In the second part of the course, we shall focus on health hazards linked to the presence of pathogenic microorganisms in the water environment, in relation to water treatment and use. We shall give examples of parasitic, bacterial and viral pathologies linked to water. Finally, we shall present the legal context of the indicators of fecal contamination.

Expected skills

- Carry out bacteria cultures and counting
 - Identify the major metabolic pathways
 - Analyze the microbiological hazards linked to the different uses of water
-

UE073 Wastewater metrology - TEN / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/4.5/-/-

Description

This course is aimed at presenting the different tools for characterizing complex environments such as rainwater, urban wastewater and industrial effluents. In addition to waste water origin and composition, the course is largely devoted to the description of the overall assessment criteria for particle, organic, carbon, nitrogen, phosphorous pollution, and pollution by halogenated compounds (TSS/VSS, TOC, COD, BOD, nitrogen quantity determined by Kjeldahl's method, TP, AOX, etc.). The impact of the different types of pollution in terms of environmental and health hazards will be systematically described. We shall also discuss toxicity tests.

Expected skills

- Know the origin and the different types of pollution of urban waste water
 - Know the principle, the implementation and the fields of application of analysis methods for waste water
 - Assess the impact of pollution on environments
 - Interpret and critically comment on analysis results
-

UE073 Reactors - TEN / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 12/7.5/-/-

Description

After classifying the different types of chemical reactions, this course will present the theory of perfect (continuous and discontinuous) reactors applied to the simple kinetics of single-phase reactions. This teaching will also introduce the description of reactive flows (residence time distribution) and their effects on conversion. For every reactor, design methodology will be shown through all fundamental principles (material balances) making it possible to solve the problems met in this field.

Expected skills

- Solve the equations governing material balances within reaction environments
- Carry out an investigation for finding the residence time distribution of a real-world reactor, and to model the real-world reactor with a combination of ideal reactors

UE073 Technologies for environmental analysis - TEN / Semester S7

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/4.5/-/-

Description

This course will use the context of environmental analysis for presenting techniques for sample preparation, for pollutant identification and quantification in water, soil and air environments, as supplements to the methods presented in the courses on the “Chemistry of natural environments”, “Pollutants in natural environments” and “Metrology of urban waste water”. We shall present the methods aimed at analyzing metal elements (atomic absorption spectrometry, inductively coupled plasma associated with different types of detectors) and trace organic micro-pollutants such as disinfection by-products, drug or pesticide residues (liquid or gas chromatography coupled with mass spectrometry). The course will be illustrated by many examples of water analyses, and we shall establish a close link with the aspects of water treatment.

Expected skills

- Select an appropriate method, to prepare samples, to implement atomic spectroscopy, and liquid and gas chromatography methods, to know how to interpret analysis results and assess the performances of an analytical method

UE073 Practical exercises - TEN / Semester S7

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/35/-

Description

Practical classes will make use of the techniques, processes and methods discussed in the UE073 TEN module.

Expected skills

- Get autonomy in carrying out experiments in the field of water chemical and microbiological analysis, and in the field of process engineering applied to water treatment
- Use the obtained results

UE081 – Building information modelling - TC GEGC / Semester S8

Coef 15 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 3/8/-/12

Description

BIM is a working method, a process which uses a 3D smart digital scale model as central element of the exchanges between the different persons involved in construction. To this end, a visit to a construction site or a building (e.g.: STEP) will be carried out, then 2D drawings will be provided to the engineering students who will have to model the building, and thus create its 3D digital scale

model. In parallel with this work, acquisition tools for 3D point clouds (3D scanner) will be presented and used in the case of old buildings.

Expected skills

- U Advanced knowledge on a BIM-oriented software (REVIT)

UE081 – Hydraulics of networks - TC GEGC / Semester S8

Coef 15 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 13.5/10.5/-/-

Description

Within the urban water cycle, this course will give the tools for designing hydraulic networks with completely (drinking water distribution networks) and partially (waste water and rainwater collection networks) full pipes. Starting from needs to be satisfied (demand for drinking water or quantities of wastewater and rainwater to be stored or discharged), we shall assess the regimes due to flows in terms of specific discharges and piezometric lines. Taking into account the distribution and operation restrictions of hydraulic networks, we calculate the optimal diameters of pipes which would fulfil the medium-term needs in terms of quantity, and the long-term needs in terms of mechanical and physical-chemical resistance. We shall also discuss the heritage management of the two networks, drinking water supply and collective sewerage, in order to provide better functioning of these two networks.

Expected skills

- Design and size a drinking water, wastewater and rainwater network
- Select hydraulic equipment
- Know the construction techniques and the network operation restrictions

UE081 – Road infrastructures 1 - TC GEGC / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 7.5/-/-/-

Description

This first section of the course concerns road and earth-moving methods from a regulatory environmental and technical point of view. The objectives are (1) to present techniques:

- *Materials, constituents and the GTR and (2) initiation into a few practical rules: cubature, progression of a earth-moving work site, checks (bearing capacity, compactness, etc.).*
- *Technology of viability materials, standardization and classification of aggregates and soils (GTR).*

Expected skills

- Define the main road earth-moving tasks - to participate in a construction site meeting - to calculate the excavated material-filling equilibrium - to check the installation and compaction of the different structure layers of a pavement

UE081 - Metrology - TC GEGC / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 3/9/-/-

Description

This course is aimed at defining all aspects relating to metrology, and more particularly starting from the sensor for the value to be measured (measured) to the user (displayed). This course will rely on basic mathematical concepts, and will offer the students the means to make appropriate choices of sensors for the different applications they will meet in their job. For this reason, the course has to be divided into four parts devoted to:

- *Defining the metrology vocabulary, and the mathematical tools required for assessing sensor performances (example: accuracy, fidelity, standard deviation)*
- *Presenting the different types of sensors providing only one measured quantity, whether direct or indirect (example: concept of probes). Presenting the technologies used depending on the types of sensors, and a list of sensors widely used within the framework of professions relating to*

mechanics, civil engineering and water treatment (examples: manometer, flow-meter, pH meter, strain gauge, probe)

- The concepts of analogue/digital conversion of signals will also be discussed. This will allow us to introduce the concepts of resolution and the basics of space measurement. This will also be used in extending the course toward the concepts of time resolution for simple sensors (one measured quantity)

The last part will concern an extension to the concepts of sensors providing measurement fields (example: Camera, SEM), discussing 2D, 2D ½ and 3D measurement issues through specific examples from the fields concerned (mechanics, civil engineering, water treatment).

UE081 - Topography - TC ENSIP / Semester S8

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 13.5/10.5/-/8

Description

Topography is a method for describing a field configuration with all its characteristic points. The elements to be collected have to make it possible to position in space each of these points, aiming at creating a graphic representation, a topographic map. By extension, topography is used to transfer the characteristic elements of a future construction to the field with the aim of building it. We then talk about the layout of structures. Finally, topography is used to follow in time the evolution of elements, whether natural or not, through comparisons between periodically performed topographic readings. This course consists of four sections: 1- General aspects: description of the activity of a geomatics/land surveyor, of the positioning techniques on land and of topography. 2- Levelling: altimetry description, learning how to carry out a direct levelling by using a level, or an indirect levelling using a tacheometer from a closed traverse. 3- Polygon shape: planimetric description, learning how to create a polygon shape using the tacheometer from a closed traverse. 4- Project design: reading and establishing a topographic map, carrying out a road layout, estimating the cubatures applied to quarries, earth movings and water dams.

Expected skills

- Know the activity of a geomatics/land surveyor
- Master the field survey techniques (direct or indirect levelling, traverse and polygon shape),
- Use topographic instruments, the level and the tacheometer
- Know how to use Lambert's coordinates
- Read and establish a topographic map
- Prepare a professional presentation in English (speaking proficiency + written comprehension),
- Calculate cubatures (application to road earth movings, quarry operations, water reservoirs)
- Regulate a drinking water supply network or a rainwater and wastewater network

UE081 – Roadways and networks - TC GEGC / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/6/-/12

Description

The teaching is provided around four topics: initiation to VRD environment presenting the constituent elements of road networks and the participants in the public domain, a regulatory section on the authorization for work on road networks (road networks rules, permit, etc.), a supplementary section on the execution of road network work, which presents the different types of existing work, and the methods and the professional rules for carrying them out, and a last part dedicated to financial resources, especially those allocated to communities.

Expected skills

- Understand and decipher the notable elements of road networks and public participants
- Know road networks work and the execution methods
- Know the regulatory authorizations and the financial resources needed for carrying out road work

UE082 - English 4 - TC GEGC / Semester S8

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/18/-/

Description

During this semester, groups will be heterogeneous, and the course focuses on the English speaking world and on the scientific world. The students will develop their practise of English in relation with new technologies, in order to be able to use it in the professional world. They will have to prepare two substantial talks: research will be carried out so that they can extend their language and professional skills in English, on a hot topic; another review work will be presented on international scientific research, in front of a jury.

Expected skills

- Prepare a professional presentation in English (speaking proficiency + written comprehension)
- Carry out research work (extension of language skills and know-how in civilization) in order to be able to carry out a review of scientific journals

UE082 Public contracting codes – TC GEGC / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 10.5/8/-/-

Description

Public authorities represent major players for implementing purchase policies in the field of public works and water (work, services and provisions). Within this framework, a first part of the course is dedicated to public contracts, and will also present the regulations governing public orders, the different participants (powers and counter powers), the law regarding public contracting authorities [loi MOP], the organization of competition and the obligations of the Contractors and service providers, general and special contractual documents. Secondly, the execution and contractual management modes for contracts, are discussed; this second part is supported by a constant reference to the repository containing the main French regulations and European jurisprudence. For each part, examples of applications in the fields of civil engineering and water are presented, and a case study shows a concrete example for the content of this course.

Expected skills

- Understand and to know the purchasing rules and modes for public authorities (+ state)
- Discover the repository governing public orders (CMP, CCAG, CCTG, MOP law, etc.)
- Understand the legal rules applicable to the public contracts for work and services
- Provide the tools for assessing the regularity of a procedure
- Respond to a call for bids in line with the public contract code
- Become familiar with the decision-making and legal context for granting and executing public contracts
- Anticipate and manage execution and management disputes in public contracts

UE082 Rainwater management – TC GEGC / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 9/3/-/-

Description

Rainwater and surface run-off management is an important issue for local authorities in their town and country planning, both for public health reasons (risk of deterioration of surface water quality) and for safety reasons (flood risk). Within a sustainable development approach, industries are also concerned because reusing rainwater for certain purposes saves drinking water. This course discusses the regulatory framework relating to rainwater (town planning, rainwater reuse), rainwater characterisation (pollution), possible depollution treatments, and presents the different methods of quantitative control of rainwater (swales and ditches, draining trenches, infiltration wells, cell structures, dry basin, tank-structure, water retaining roads, storing roofs, etc.). Reusing rainwater in housing (private or collective) is also discussed.

Expected skills

- Know the different alternative techniques in rainwater sanitation

UE082 Heat transfer – TC GEGC / Semester S8

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/24/-/-

Description

This course brings general knowledge on the different modes of heat transfer and the associated physical mechanisms. The first part concerns conduction: Fourier's law, the heat equation, concepts of thermal resistances, contact thermal resistance, thermal capacity. The problems treated concern plane geometries (semi-infinite wall) and cylindrical geometries (pipe insulation, optimisation, etc.). The transient aspect of conduction is treated by introducing appropriate methods (the method of separation of variables). The second part is an introduction to convective phenomena: notion of convective exchange coefficient, Nusselt's number (forced convection), Rayleigh's number (natural convection), most common correlations. The third part concerns thermal radiation transfers: thermal radiation of surfaces, black and grey surfaces. PLANCK's and STEFAN-BOLTZMANN's laws, the concept of form factors, of energy exchange between surfaces with diffuse emission and reflection. De Poljak's method will be presented. The fourth part concerns heat exchangers: introduction to heat exchangers: heat exchanger technology, flow direction, modes of transfer, efficiency and design using the DTlm and NUT methods.

Expected skills

- Qualify heat exchanges by studying a physical phenomenon
- Quantify heat exchanges
- Justify the choice of materials from a thermal point of view
- Qualify heat exchanges by studying a physical phenomenon
- Design thermal systems
- Give solutions corresponding to technical specifications
- Design a heat exchanger depending on the characteristics of a process

UE082 Cross-field project – TC GEGC / Semester S8

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/-/10

Description

This project is aimed at validating the pedagogic skills of the 1st and 2nd year (specialty and GMC-GTS/TEN study path) of the GEGC diploma. The project will concern the water treatment plant (STEP) La Folie site) in Poitiers. This project will start by visiting the site, and then the students (in groups of 2/3) will work on a part of the site, in relation to their skills acquired in their specialty and through their study programs. The groups of students will be able to approach different fields and to complete their knowledge on topography, building, geotechnics, VRD, waste water treatment, the management and maintenance of a STEP, etc.

UE083 Geotechnics 4: foundations – GMC-GTS / Semester S8

Coef 40 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 30/12/24/-

Description

Reviews on laboratory tests and presentation of in-situ testing. The first part of this course presents the type of foundations (well, raft, strip footing, piles, micro-piles, etc.) and their sizing (briefly). A project on a real-world situation of geotechnical investigation (G1, G2 AVP [in French: avant-projet = draft phase of a project]): mineralogy investigation, analysis of laboratory tests (Atterberg's limits, MBT (methylene blue test), particle size distribution, etc.), in-situ tests (penetrometer, pressure meter, etc.), choice of the type of foundations. All infrastructure calculations, foundations and underground work require in-situ upstream investigations: surveys using an excavator or trenches, drill holes and boreholes. The second part of the course focuses on the different methods of investigation through boreholes and drill holes using hammer drill sand rotary drills, as well as equipment elements (tubes, strainer), and on the properties/use of sludge from drill holes. The presentation of in-situ tests: "water" tests - infiltration and geotechnical tests: pressure meter, hand vane tester, penetrometer, pico-meter, is accompanied by practical classes and/or demonstration on construction sites. We shall also discuss in-situ equipment, dilatometer, inclinometer, settlement plate.

Expected skills

- Know Eurocode 7 (deep foundations)
- Definitions and knowledge of the types of foundations (shallow, deep and special)
- Master geotechnical missions (G1 and G2AVP)
- Know the in-situ tests

UE083 Road infrastructures 2 – GMC-GTS / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 8/-/-/-

Description

This second part on road techniques and earthwork is an application of the French directives Recommandations pour les Terrassements Routiers and the technical guide Réalisation de Remblais et couches de forme, for determining the categories of roads, traffic, levelling courses and platforms with applications to different geological fields, platform and compaction inspection tests. We shall also discuss the choice of earth-moving equipment, the optimisation of outputs (Q/S) and excavated material / filling.

Expected skills

- Define a road structure - to define technical specifications for installation and inspection

UE083 Rock mechanics 2: rock masses – GMC-GTS / Semester S8

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/4.5/-/-

Description

This course presents the basics of rock mechanics and methods for the pre-sizing of underground structures of underground structures (AFTES recommendations, Bieniawski's RMR method, Barton's Q-system). The mechanical role of water in rock and rock masses is also discussed.

Expected skills

- propose methods to characterize the discontinuities of a rock mass .
- carry out a pre-dimensioning of an underground structure (tunnel, underground gallery)

UE083 Field training: rock identification - EAT / Semester S8

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 10.5/-/-/30

Description

The skills acquired in geology will be used in practice by integrating the size of the land in the case of the geological investigation in the Sables d'Olonne sector, in a context combining magmatism and metamorphism. The expected large-scale mapping will be carried out on the basis of rigorous descriptions of the different outcrops met, including rock identification, and the analysis and measurement of geological structures. The students' work is supplemented by teaching based on the cases met on field.

Expected skills

- Use field equipment in order to identify the different types of rocks and to carry out measurements for analyzing geological structures
- Identify the different geological systems taking into account the chronology of formation and/or of settling
- Provide a report on the field observations and measurements, and on the interpretations of the geological context investigated

UE083 Calcium carbonate equilibria - TEN / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/4.5/-/-

Description

After a review of theory, we shall present the classical methods for solving calcium carbonate equilibria according to HALLOPEAU and DUBIN and LEGRAND and POIRIER, along with examples

of actual cases. Legrand-Poirier method is applied using the LpLWin software. At the end of this course, the students will be able to assess the impact of treatment (coagulation/flocculation, aeration, remineralization, decarbonation, etc.) on composition and more particularly on the aggressive or hard character of water in the process of being made drinkable.

Expected skills

- Solve calcium carbonate equilibria using graphical methods applied to water treatment
- Use the Hallopeau and Dubin calibration graph
- Use the LpLwin software

UE083 Drinking water production - TEN / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/3/-/-

Description

After presenting the European and French legislation context on drinking water production, distribution and quality, this course is devoted to describing the different treatment outlets which can be considered for treating underground water or surface water. In relation to the quality of the resource and the treatment objectives (removing suspended solids, turbidity, natural organic materials, mineral or organic micro-pollutants, algae, pathogenic germs, etc.), this course will expose in a summary manner, the criteria for choosing an appropriate treatment method. Illustrated by many examples of treatment method for drinking water, this course is aimed at being a practical guide for designing drinking water production plants.

Expected skills

- choose a complete treatment method for drinking water production depending on the quality of raw water and the treatment objectives
- design all the structures of a classic drinking water plant
- diagnose the performances of a waste water treatment plant, in order to solve malfunctioning problems and optimize performances

UE083 Chemical oxidation - disinfection - TEN / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/4.5/-/-

Description

Introduced through general concepts on disinfection and the regulations applied to drinking water production, oxidation in an aqueous environment by chlorine, chlorine dioxide and ozone, will be described: reactivity with mineral and organic compounds, place within the treatment outlets, industrial implementation, analysis.

Expected skills

- understand the chemical processes governing the oxidation reactions of the dissolved compounds
- know the oxidation by-products potentially formed and their risks to human health
- be able to choose the best appropriate oxidizer for the quality of the water to be treated, and for the treatment objectives

UE083 Precipitation and carbonate removal - TEN / Semester S8

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/3/-/-

Description

Theoretical and technological aspects of calcium carbonate precipitation for drinking and process water production are presented, as well as design data. We shall also discuss in detail the methods of precipitation of dissolved salts, such as chromium and other metals.

Expected skills

- Design and size precipitation and remineralization units

UE083 Activated onto activated carbon - TEN / Semester S8

Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 3/1.5/-/-

Description

After presenting the characteristics of activated carbon (texture, structure) and of adsorption (kinetics and adsorption equilibrium in a discontinuous reactor, filtration on granular activated carbon), the course will present the various applications of drinking water treatment (history, methods involving powder and granular activated carbon, expected performances, case study).

UE083 Biological wastewater treatment using AS and sizing - TEN / Semester S8

Coef 25 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 36/12/-/-

Description

After a short reviewing of bacterial metabolism and enzyme kinetics, the course will treat the kinetics of bacterial growth and the modelling of bioreactors using free bacteria, in order to show the influence of fundamental parameters on substrate removal and biomass production, by successively examining discontinuous reactors, continuous reactors without recirculation, single reactors, reactors in series, and piston with recirculation. The course will then discuss the biological pathways of transformation of organic pollution in aerobic and anaerobic environments, of nitrogen pollution and phosphorous pollution in waste water and sludge, and will specify, for every major type of reactions, the main reactions involved and the optimum conditions of implementation of these reactions. This teaching will then present the basics for designing all structures of an urban activated sludge treatment plant (pretreatment, primary decanter, bioreactor and clarifier, etc.), the calculation of oxygen consumption and the design of aeration systems, the estimation of sludge production and the methods for diagnosing and improving the operation of the existing installations. We shall also briefly present the various activated sludge sequencing batch reactors.

Expected skills

- Understand the biological pathways of transformation of organic, nitrogen and phosphorous pollutions, in order to apply them to water treatment
- Understand the influence of operating parameters on the performances of a bioreactor
- Design an activated sludge treatment plant (design the processes, calculation of reagent and energy consumption, etc.)
- Diagnose the performances of a waste water treatment plant using the above methods, in order to solve malfunctioning problems and optimize performances

UE083 Practical exercises 2 - TEN / Semester S8

Coef 25 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/35/-

Description

Practical classes will make use of the techniques, processes and methods discussed in the UE83 TEN module.

Expected skills

- Get autonomy in carrying out experiments about water analysis and process engineering applied to water treatment
- Use the results obtained

UE091 - English 5 - TC ENSIP / Semester S9

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/32/-/-

Description

The absolute priority of this course is for the student to take over communication situations as close as possible to professional reality: conducting / participating in professional meeting situations, round tables and scientific, international and ethical case studies, based on hot topics in the engineering world.

Expected skills

- conduct (having prepared it) and actively participating in a professional meeting in English
- be able to give professional presentations on scientific and/or hot topics
- carry out a logical analysis on a moral and/or ethical question raised in the engineering world
- make the link between the language course and the scientific and professional training

UE091 - Management 2 - TC ENSIP / Semester S9

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 9/10.5/-/-

Description

This course discusses the initiation to reading and analysis of financial statements (balance, income statement, interim financial reports) through the presentation of data contained in the statements, and training for solving simple exercises of general accounting. Moreover, general accounting will be developed here: raw material of the analysis. Data contained in the balance and in the income statement. Characteristics quantities of the activity: the interim financial reports.

Expected skills

Analyze financial statements (balance, income statement, intermediate management balances) through the presentation of data contained in the statements, and training for solving simple exercises of general accounting, and through studying general accounting

UE091 - Quality - TC ENSIP / Semester S9

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/10.5/-/-

Description

Quality is fundamental to any production. For this reason, this course discusses the following points: human positioning with regard to the quality function; knowledge of performances, relation to objectives, cause-and-effect relation; the indicators measured and their use, preventive responsiveness. Process management, associated analysis tools; total quality management TQM, quality function deployment QFD; ISO 9000 standard, version 2000 approach; continual improvement system; quality approach sustainability.

Expected skills

- explain human positioning with regard to the quality function
- know the performances, the relation to objectives, the cause-and-effect relation, the indicators measured and their use, the preventive responsiveness
- manage the processes and the associated analysis tools
- manage via quality TQM, quality deployment QFD
- apply the ISO standards
- comprehend continual improvements systems
- make the quality approach sustainable

UE091 - Corporate life - TC ENSIP / Semester S9

Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/32/-/-

Description

Presentation given, for every group of specialties, by a head of personnel or head of human resources from various companies. Training for setting up a company Training on the steps to take in preparing the setting up of a small-medium size company on territorial authorities and sustainable development: The actions implemented by territorial authorities within the framework of sustainable development.

Expected skills

- become aware of the topic of looking for an internship or a 1st job
- simulate a collective interview
- learn the basics of setting up a company

- understand a work contract and corporate collective social relations
- discuss ethics in the framework of the company
- carry out a speed meeting simulation
- make use of their skills

UE091 - Health and safety at work 3 - TC ENSIP / Semester S9

Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 3/3/-/-

Expected skills

Develop a managerial approach, technical and strategic at the same time, to CSR, to sustainable development and to QSE risk control in a company

UE091 - Innovation-Studies-Research Project - TC GEGC / Semester S9

Coef 60 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): -/-/24/-

Description

This project consist of an in-depth study bringing an original contribution to the development of techniques in fields relating to a professional specialty. This study is carried out in partnership with a company or within a research laboratory.

Expected skills

- know how to work in a team
- conduct a project with different partners and discussion partners
- carry out a technology watch

UE092 Work environment 2 - GMC / Semester S9

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 21/21/-/-

Description

A professional project, conducted by professionals, will enable students to be involved in different stages of a project, and in different positions and situations. The participation of professionals who work in the fields for which skills and missions are taught. Actual case study: a planning operation combined with a building operation. Using real-life scenarios in which the students will be asked to react professionally and to take positions according to their theoretical knowledge.

Expected skills

- Students will have to know how to find their way in a professional environment for a planning / building operation, and to find their place depending on their missions
- Know the functions and responsibilities of the main players
- Know the content of the different phases of a planning / building operation, and how to approach them
- Get general knowledge of the investigation methods and of the building techniques
- Get basic knowledge on the organization of an operation through an actual case study

UE092 Concrete structures 1 and 2 - GMC / Semester S9

Coef 50 + 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 37.5/43.5/-/-

Description

Structure calculation needs reviews on the definition of actions, the fundamental principle of statics, the forces (N, V and Mf), and the elementary iso- and hyperstatic systems applied to constructions. The principle of loads path is stated, and after a brief history, we shall present calculation methods for reinforced concrete and for pre-stressed concrete according to the rules of EUROCODE 2, both for the ultimate limit state and for the serviceability limit state.

Tutorial classes will be devoted to actual elementary cases of building projects. They will concern

beams, floors, piles and shallow foundations.

Expected skills

- Master the fundamental concepts governing the behavior of a reinforced concrete and/or pre-stressed concrete section
- Master the basic calculations for designing reinforced concrete and/or pre-stressed concrete structures

UE092 Design of subsurface works - GTS / Semester S9

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 27/-/-/14

Description

The module starts with complements of rock mechanics for underground work. We shall then present the typology, the framework and the history of underground work. The next step concerns land survey, both before digging and during progress, and the inspection of structures. An important part of the module is dedicated to digging methods (explosive, roadheader machine, tunnel boring machine) and retaining structures for underground structures

Expected skills

- Know the different traditional digging and retaining techniques for underground structures, and to be able to choose the best amongst them for a specific structure

UE092 Work environment 3 - GTS / Semester S9

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 4/-/-/-

Description

This module will present the application of the MOP law regarding public contracting authorities and its relation to private general contractors within the framework of underground work. We shall define the main players (client, general contractor, work company) and state their roles and responsibilities (technical and administrative monitoring of construction sites, etc.) and the regulations, in particular for the devolution of underground public contracts. We shall also discuss the contract practices in underground work.

Expected skills

- Master the code of public contracts and its specificities in the case of underground structures

UE092 Concrete structures 1 - GTS / Semester S9

Coef 50 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 27/34.5/-/-

Description

Structure calculation needs a review on the definition of actions, the fundamental principle of statics, forces (N, V and M), and elementary iso- and hyperstatic systems applied to constructions. The principle of lowering of loads is stated, and after a brief history, we shall present calculation methods for reinforced concrete and for pre-stressed concrete according to the rules of EUROCODE 2, both for the ultimate limit state and for the serviceability limit state.

Tutorial classes will be devoted to elementary, actual cases of building projects. They will discuss beams, floors, piles and shallow foundations.

Expected skills

- Master the fundamental concepts governing the behavior of a reinforced concrete and/or pre-stressed concrete section
- Master the basic calculations for designing reinforced concrete and/or pre-stressed concrete structures

UE092 Underground works - GTS / Semester S9

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 18/-/-/-

Description

This module is dedicated to excavation techniques with tunneling boring machine, to soil improvement techniques such as jet grouting, injections and ground freezing. We shall also present in detail digging into shallow ground using ground improvement techniques at the front of the face (pre-vaults, umbrella vaults), and the use of shields for digging tunnels. We shall also discuss the management of aquifers. In this module, we shall also discuss the techniques of covered trenches.

Expected skills

- Be able to adapt underground work methods to unfavorable conditions
-

UE092 Drinking water - TEN / Semester S9

Coef 40 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 38/8/-/8

Description

This is an advanced course over the 2nd year teaching. It is aimed at providing specialized teaching on specific treatments for removing iron, manganese, arsenic, selenium, fluoride, nitrogen and organic micropollutants. It is supplemented by the presentation of water disinfection methods using UV radiation, water desalination methods, and eco-methods applied to the production of drinking water. The course compare, according to technical and economic criteria, the different technologies which can be considered, and gives the basics of structure sizing. We shall study many examples of installations. The problems of malfunctioning and non-conformities in a drinking water unit or the problems of drinking water management during crises will be discussed by professionals. Finally, a drinking water treatment unit will be designed through two projects presented by industry people: from a given water resource and production constraints, a choice has to be made and the dimensioning of a method for drinking water treatment has to be carried out.

Expected skills

- Design and size treatment structures for drinking water
 - Diagnose treatment methods for drinking water
-

UE092 Hydraulics of networks 2 - TEN / Semester S9

Coef 40 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 10/18/-/-

Description

This course is an initiation in the use of software for flow modelling in full pipe networks (Porteau software, with a case study on drinking water) and in a pipe with free surface (Infoworks software with a case study on sewage). This course will also discuss the evolution of water quality in a drinking water network, and the topic of asset management of drinking water and sewage networks.

Expected skills

- Know the data and methods associated with modelling tools
 - Know how to enter this data, how to calculate flow regimes
 - Simulate operation, think critically and to use results
 - Know how to use numerical tools for sizing and drawing up a master plan
-

UE092 Air pollution - TEN / Semester S9

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 21/16.5/-/-

Description

This module will describe sources of atmospheric pollution (transport, large combustion installations, incineration, industries, etc.) along with their associated pollutants (SO₂, NO_x, O₃, VOCs, CO, particles, etc. .) and the main targets (human health, climate impact, material goods and biological resources, odor pollution). It will then present the European and French regulations and the organization of the inspection of industrial installations and air quality monitoring in France (Atmo network). It will then describe the manual and automated methods of analysis for different atmospheric pollutants. After a brief presentation of gas-liquid equilibrium and of the writing conventions, this module will also present the different types of gas-liquid contactors that can be used, namely in the water and gaseous effluent treatment industry. The course will then discuss the material conservation equations, the concepts of theoretical stages for tray columns, and of transfer unit for packed columns, and the sizing of gas-liquid transfer reactors. We shall present a few concepts of material transfer with chemical reaction in the liquid phase. This course will then synthetically present the treatment methods for gaseous emissions from static and mobile sources. It will thus present the main available depollution technologies, specific industrial applications to the major classes of pollutants, and finally a few emergent methods or those under development.

Expected skills

- Select and implement air analyses
- Interpret results
- Know the different methods for air purification
- Design and size a gas treatment installation

UE093 Calculations and models in civil engineering – GMC-GTS / Semester S9

Coef 30 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 20/30/-/-

Description

The design engineer uses calculation codes based on the resolution of partial differential equations. This course aims at presenting the analytical and numerical methods, the most used in civil engineering for the solution of partial differential equations (finite difference and finite element methods). For each method, a particular attention will be paid to the convergence criteria as well as to the stability of the schemes implemented. This course also introduces the theory of Plasticity, widely used in geomechanics. This theory is illustrated in the course by applications from geotechnical problems (Cam-Clay model). The teaching includes tutorials with the finite element software Plaxis. The students of the GMC-GTS course will have 15 hours of specific tutorials with Plaxis.

Expected skills

- carry out calculations with a finite element code
- build from a real case, a simplified numerical model (exploitation of the symmetries of the problem, mesh construction, boundary conditions, choice of the constitutive law) for a finite element code

UE093 Advanced geotechnics 1 and 2 - GMC / Semester S9

Coef 50+20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 39/22.5/-/11

Description

This course is the continuation of the first- and second-year geotechnics courses. It discusses three fields: foundations pathology, deep foundations and retaining structures. This teaching will be essentially provided by professionals from geotechnical consulting firms. Whether relating to sizing or foundations pathology, the courses and tutorial classes will be associated with engineering projects on real-world cases. The following subjects will be treated: Digging - Retaining structure. Analyses of the actions on excavation walls (molded walls, prefabricated walls, Jet Grouting, Berlin wall, anchoring) - Catalogue of flexible retaining structure types and technologies. Retaining structures, theory of the push-pull limit equilibrium, pre-sizing methods, and reaction coefficient method (using

the KRéa software). Sizing of deep foundations, special foundations, design and construction of underground structures, actions of forces on excavation walls, using the FOXTA software - calculations using the reaction coefficient. Soil reinforcement (tie rod bolting), stone columns.

UE093 Underground: design and studies - GTS / Semester S9

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 27/-/-/3

Description

The module starts with complements of rock mechanics for underground work. We shall then present the typology, the framework and the history of underground work. The next step concerns land survey, both before digging and during progress, and the inspection of structures. An important part of the module is dedicated to digging methods (explosive, roadheader machine, tunnel boring machine) and retaining structures for underground structures.

Expected skills

- Know the different traditional digging and retaining techniques for underground structures
 - Be able to select the best amongst them for a specific structure
-

UE093 Advanced geotechnics 1 - GTS / Semester S9

Coef 50 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 22/20/-/3

Description

This course is the continuation of the first- and second-year geotechnics courses. It discusses three fields: foundations pathology, deep foundations and retaining structures. This teaching will be essentially provided by professionals from geotechnical consulting firms. Whether relating to sizing or foundations pathology, the courses and tutorial classes will be associated with engineering projects on real-world cases. The following subjects will be treated: Digging - Retaining structure. Analyses of the actions on excavation walls (moulded walls, prefabricated walls, Jet Grouting, Berlin wall, anchoring) - Catalogue of flexible retaining structure types and technologies. Retaining structures, theory of the push-pull limit equilibrium, pre-sizing methods, and reaction coefficient method (using the KRéa software). Sizing of deep foundations, special foundations, design and construction of underground structures, actions of forces on excavation walls, using the FOXTA software - calculations using the reaction coefficient. Soil reinforcement (tie rod bolting), stone columns.

UE093 Water and health - TEN / Semester S9

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 18/3/-/-

Description

This course will discuss several aspects: toxicology (general concepts, mechanism of action of toxic substances, assessment of the toxic risk, establishing standards); sanitary inspection of drinking water and swimming water (regulations, players, result distribution) in France; management of the risk of Legionella (regulatory context, measures of prevention, maintenance of inspections).

Expected skills

- Be able to understand the effects of toxic substances and to assess a toxic risk,
 - Know the issues of sanitary inspection
-

UE093 Domestic wastewater - EI / Semester S9

Coef 50 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 42.5/11/-/4

Description

This course is divided into 4 parts: 1- Fixed-film of biomass treatment. This course is aimed at presenting the operational principles, the technological aspects, the basics for sizing, and the performances of the treatment methods using a fixed film of biomass: bacterial beds, rotating biological contactors, biofilters and activated sludge reactors with mobile supports. 2- Extensive methods. This teaching will present the operating principle, the basics for sizing and the performances

of the treatment methods for small communities, such as natural lagooning, infiltration-percolation and reed bed filters. Bamboo plantations, short rotation coppices, revegetated discharge zones, etc. will also be discussed in this course. 3- On-site sewage facility. This course will present the regulations concerning an On-site sewage facility (OSSF), the operating principles and the performances of the various treatment systems used by an OSSF. 4- Reuse of treated urban waste water. After a presentation of regulatory aspects of the different fields reusing treated waste water, the course will present, through actual cases from France and abroad, post-treatment outlet for reusing urban waste water in green space irrigation, groundwater recharging and drinking water or industrial water production. Finally, designing, sizing and installing a STEP will be carried out through two projects presented by industry people.

Expected skills

- Design and size treatment stations,
- Analyze a treatment plant in order to propose solutions for malfunctioning problems or to optimize performances

UE093 Natural aquatic systems - TEN / Semester S9

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 24/6/-/-

Description

This course will discuss the quality of the water resource, in relation to the biology of aquatic media. This course will provide an overview on aquatic ecosystems, especially relating to running water. We shall present the different biological indices (saprobic index, biotic index, standardised biotic index (French standard: global biological index, diatomic index) and we shall describe the use of bioindicators for the search of toxic substances in the natural environment. This course is also an occasion to present in detail the phenomenon of eutrophication due to human activity: it shows in rivers, seas, lakes or reservoirs, and has consequences in terms of modification of aquatic ecosystems and resources used to fight against this phenomenon. Finally, we shall present the classification of water courses using assessment grids for the quality of water.

Expected skills

- Diagnose the quality of water courses from biological analyses

UE093 Sludge treatment - TEN / Semester S9

Coef 10– Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 13.5/3/-/-

Description

This course is divided into 2 parts: First: Liquid sludge treatment. This course describes the operating principle, the technological aspects, the basics of sizing and the performances of various treatment methods for liquid sludge such as sludge static and dynamic thickening, dehydration (press filter, filter strips, centrifugation), conditioning and stabilization. Second : Treatment and recycling of dehydrated sludge. This course will discuss, more particularly, outlets for treating and recycling treated sludge. After reviewing the data related to sludge production and composition, the course will present the different recycling outlets: recycling to land (fertilizer), composting, sludge incineration and anaerobic digestion (regulatory and technological aspects). The different treatment facilities for sludge will also be described by presenting in more detail certain operations such as sludge drying and the methods for reducing sludge production.

Expected skills

- Design and size sludge treatment facilities

UE101 Quarries: investigation, operation and blasting - GMC / Semester S10

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 15/-/-/16

Description

The teaching discusses the exploitation of deposits: legal aspects (legislation on the opening and layout of quarries and impact investigations), economic aspects and type of exploitations of aggregates (quarries - sand quarries). From a technical point of view, it concerns starting exploiting a quarry, optimizing the extraction technical chains, cutting down, crushing, screening massive rocks in the quarry, extracting, washing, screening and crushing running rocks. In the second part, the teaching will discuss blasting techniques and their regulations: characteristics, classification and packaging of explosives. We shall also discuss the use of low explosives and detonating explosives, the choice of detonators - detonation relays and boosters, types of priming and safety, the installation of firing and mine loading, and firing incidents. The last part of the teaching includes the description of a deposit through a field survey on different geological layers present in the context of sedimentary rocks (stratigraphic column).

Expected skills

- Know the regulations on the exploitation of a deposit (opening, exploitation, remediation, etc.)
- Draft a blasting firing plan
- Read the stratigraphic column in the field in order to assess the resource

UE101 Geophysics and petrophysics – GMC-GTS / Semester S10

Coef 40 (GMC) or 50 (GTS) – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 16/17.5/16/-

Description

The identification and characterization of soils and rock masses by geophysical methods are increasingly popular. This course aims to present the different methods of applied geophysics used in Civil Engineering. For each method, we show how the petrophysical parameters can be related quantitatively to a state parameter of the geomaterial (porosity, water content, density, salinity, clay content).

Expected skills

- Be a competent interlocutor for companies and geophysical consulting firms
- Identify the geophysical method adapted to the target
- Organize a very simple geophysical prospection

UE101 Road infrastructures 3 - GMC / Semester S10

Coef 40 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 35/9.5/-/-

Description

This course aims at characterizing the different layers making pavement and to calculate this structures. The inventory of the properties of the various materials used in pavement deal with all the anthropic layers. Material characterization begins by the organic binders both running land below layers. The teaching deals with bituminous concretes formulations, laboratory controls and tests. Using case studies, calculations are completed by the use of the ALIZE software for structure modelling.

UE101 Underground: works control - GTS / Semester S10

Coef 25 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 21/-/-/6

Description

This module is a set of conferences by professionals in underground structures and works in different fields of application: hydraulic galleries, radioactive waste storage, gas storage and tunnels and urban infrastructure. The management of excavated materials is also considered

Expected skills

- Be able to understand the specificities of underground structures due to their use.
- Be able to chose and adapt construction techniques and sizing of underground structures accounting for their use.

UE101 Blasting in the underground - GTS / Semester S10

Coef 10 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 8/-/-8

Description

This module is devoted to work using explosives, from a technical and regulatory point of view. Part of the module is common to the GMC study path. The teaching will discuss blasting technologies and their regulations: characteristics, classification and packaging of explosives. We shall also discuss the use of low explosives and detonating explosives, the choice of detonators - detonation relays and boosters, types of priming and safety, the installation of firing and mine loading, and firing incidents. The second part of the module is more specifically dedicated to the underground use of explosives.

Expected skills

- Know the regulations in terms of work using explosives
- Know how to set up an underground firing plan

UE101 Project - GTS / Semester S10

Coef 25 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 1.5/-/-18

Description

Synthesis project to summarize the knowledge acquired during training in underground works

Expected skills

- Be able to use all the knowledges and skills acquired during the GTS UE to size an underground structure and propose construction techniques.

UE101 Water for industry - TEN / Semester S10

Coef 40 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 47/7.5/-/-

Description

This course consists of three sections: 1 - Water use and treatment in the industry. This course will discuss how water is used in different sectors of industrial activity. For certain industries, the course will describe the main manufacturing operations in order to define the water needs, the required water qualities, and will present the main characteristics of the produced waste water. 2- Production of process water. This course will discuss the different process water production facilities, from industrial water quality to ultra-pure water quality. 3 – Treatment water from boilers and cooling circuits. After describing the water cycle in a boiler room, and the different constraints relating to boiler operation, this course will present treatment and conditioning possibilities for boiler waters. The treatment of cooling circuit water will then be discussed, with a focus on the main problems met (scaling, corrosion, biological clogging).

Expected skills

- Design process water treatment facilities and to be able to assess the advantages and limits of each of the facilities proposed
- Analyze industrial installations aiming at proposing solutions for malfunctioning or to performances optimization

UE101 Industrial wastewater - TEN / Semester S10

Coef 40 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 38/11/-/-

Description

The course describes the different treatment methods for industrial waste water (and in particular methods more specifically implemented in this field: advanced oxidation, evapoconcentration, electrocoagulation, etc.) and presents many treatment facilities. We shall present the different possibilities for saving water (reusing water, using rainwater, clean technologies) through actual examples.

UE101 Data management - TEN / Semester S10

Coef 20 – Courses (h)/Tutorial classes (h)/Practical classes (h)/Project (h): 6/5/-/-

Description

This course is aimed at introducing database management methods. We shall present statistical analyses and teach how to use the R software.

Expected skills

- Know how to use Big Data analysis tools
 - Be able to use the R-software
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