

Academic year 2020/2021

Courses offered by the programme

**Génie Civil et Urbain (GCU)
Civil Engineering and Urban Planning**

Semester(s) : 7-8-9-10

Curricula are organized in groups of courses (Unités d'Enseignement (UE)), consisting of several courses (Eléments Constitutifs (EC)). An EC is a teaching module including lectures (cours magistraux (CM)), tutorials (travaux dirigés (TD)), laboratory work (travaux pratiques (TP)), projects (PR), conferences (CONF), personal work (TA) and possibly other pedagogical activities (DIV). Some internships (stages (ST)) are compulsory

Commonly used abbreviations

CM : Lectures

TD : Tutorials

TP : Laboratory Work

CONF : Conferences

TA : Personal Work

PR : Project

ST : Internship

DIV : Miscellaneous

Code	Libelle
GCU07-MDS2	Geotechnical Engineering and road Building II
GCU08-R&C	Pavement engineering
GCU09-MECH	Pavement Mechanics
GCU09-MRO	Maintenance and Rehabilitation of Infrastructure
GCU09-OGEO	Geotechnical constructions

List of courses with handout in English or that can be taught in English

Matrix Structural Analysis I	GCU07-AES
Number of hours : 60.00 h	5.00 ECTS credit
CM : 24.00 h, TD : 24.00 h, TP : 12.00 h	
Reference Teacher(s) : GUEZOULI SAMY	

Objectives :

To understand the mechanical phenomena that governs the behavior of structures (redundancy, stability) and to provide useful solution strategies such as Matrix Methods)

Content :

- 1 Energy Principles: An overview with applications to beams
 - 1.1 Principle of Virtual Work
 - 1.2 Principle of Stationary Potential Energy
 - 1.3 Principle of Complementary Virtual Work
 - 1.4 Principle of Stationary Complementary Energy
 - 1.5 Reciprocal Theorems
- Part 1: Matrix Analysis of Structures (Direct Stiffness Method)
- 2 Truss Structures
 - 2.1 Idealization / Degree of Freedom
 - 2.2 Local and Global Coordinate Systems
 - 2.3 Nodal and Element Equilibrium
 - 2.4 Element Stiffness Equations in the Local Coordinate System
 - 2.5 Coordinate Transformation
 - 2.6 Element Stiffness Equations in the Global Coordinate System
 - 2.7 Assembly of the Global Stiffness Matrix
 - 2.8 Incorporation of Boundary Equations
 - 2.9 Static Condensation / Substructuring
 - 2.10 Support Settlement / Elastic Support
 - 2.11 Temperature Effects
- 3 Continuous Beams
 - 3.1 Idealization / Degree of Freedom
 - 3.2 Nodal and Element Equilibrium
 - 3.3 Element Stiffness Equations
 - 3.4 Assembly of the Global Stiffness Matrix
 - 3.5 Incorporation of Boundary Equations
 - 3.6 Static Condensation / Substructuring
 - 3.7 Support Settlement / Elastic Support
 - 3.8 Beam with Internal Hinge
 - 3.9 Semi-Rigid Connection
 - 3.10 Temperature Effects
- 4 Frames Structures: Beam/Column Element
 - 4.1 Idealization / Degree of Freedom
 - 4.2 Local and Global Coordinate Systems
 - 4.3 Nodal and Element Equilibrium
 - 4.4 Element Stiffness Equations in the Local Coordinate System
 - 4.5 Coordinate Transformation
 - 4.6 Element Stiffness Equations in the Global Coordinate System
 - 4.7 Assembly of the Global Stiffness Matrix
 - 4.8 Incorporation of Boundary Equations
 - 4.9 Static Condensation / Substructuring
 - 4.10 Support Settlement / Elastic Support
- Part 2: Static Stability of Structures
- 5 Fundamental Concepts in Static Stability
 - 5.1 Introduction
 - 5.2 Bifurcation of Geometrically Perfect Systems
 - 5.3 The Effect of Imperfection
 - 5.4 The Role of Linearized Buckling Analysis
 - 5.5 Systems with Multiple Degrees of Freedom
- 6 Elastic Buckling Of Planar Columns
 - 6.1 Introduction
 - 6.2 Large-Deflection Solution of an Elastic Column
 - 6.3 Differential Equation of Planar Flexure

- 6.4 The Basic Case: Pin-Ended Column
- 6.5 Energy Methods / Ritz Approach
- 6.6 Five Fundamental Cases
- 6.7 The Effect of Imperfections
- 6.8 Stability of a Rigid Frame
- 6.9 End-Restrained Columns
- 7 Lateral-Torsional Buckling
 - 7.1 Introduction
 - 7.2 Basic Case: Beams Subjected to Uniform Moment
 - 7.3 The Effect of Boundary Conditions
 - 7.4 The Effect of Loading Conditions
 - 7.5 Lateral-Torsional Buckling of Singly-Symmetric Cross-Sections

Bibliography :

Requirements :

Continuum Mechanics , Elasticity, Beam Theory.

Organisation :

Lecture Review. Personal work: 50 hours

Evaluation :

Three-hour written examination; Practical work reports.

Target :

Reinforced Concrete 2 : Design of Reinforced Concrete Structures According to Eurocode 2.	GCU07-BA2
Number of hours : 48.00 h	4.00 ECTS credit
CM : 24.00 h, TD : 24.00 h	
Reference Teacher(s) : NGUYEN QUANG HUY	

Objectives :

The objectives are to provide a basic understanding of the behaviour of reinforced concrete members and structures; to provide a basic understanding of standard methods of analysis and design of reinforced concrete behaviour (including an understanding of capabilities and limitations); and to provide basic design training in a simulated professional engineering environment. At the end of this unit students will gain proficiency in design of reinforced concrete structures according to Eurocode 2.

The syllabus comprises the behaviour of reinforced concrete members and structures, including: material properties, 'elastic' analysis, ultimate strengths of beams (flexure), ultimate strength of columns (short and slender), behaviour of reinforced concrete slabs. The reinforced concrete truss analogy (shear/torsion/and detailing implications). Design of typical elements of a reinforced concrete building, structural modelling, analysis of load-effects, design criteria (for durability, fire-resistance, serviceability and strength), design calculation procedures, reinforcement detailing, structural drawings.

Content :

- Members under flexion with and without axial force at Serviceability limit states (SLS)
- Members under flexion with axial force.
- Members under deviated flexion
- Members under shear
- Members under torsion

Bibliography :

- Eurocode 0: Basis of design
- Eurocode 1: Actions on structures
- Eurocode 2: Design of concrete structures
- CEB-FIP Model Code 1990: Design code

Requirements :

Course of Reinforced Concrete 1 ; Beam theory, basic concepts of solid mechanics and structural mechanics.

Organisation :

21 hours of lectures and 21 hours of tutorials

Course Supports:

Copies of handouts

Online documents

Softwares: Autodesk Robot - Revits - Autocad

Evaluation :

Written examination (3h) and mini-project report

Target :

Fourth year student

Geotechnical Engineering and road Building II	GCU07-MDS2
Number of hours : 64.00 h	3.50 ECTS credit
CM : 24.00 h, TD : 24.00 h, TP : 16.00 h	handout in English
Reference Teacher(s) : MASSON SAMUEL	

Objectives :

Various aspects of soil mechanics. Methods for calculation and dimensioning of works. Stability and settling during the construction phase /after the handover.

Content :

1. Resistance to drained and undrained shear. Elastoplastic behaviour.
2. Regulations and norms. Limit state calculations.
3. Stability of Slopes. Method of slices.
4. Rigid and flexible retaining structure screens. Limit equation. Reaction module.
5. Shallow and deep foundations. Carrying capacity coefficient.
6. Finite element calculation of the works.

Bibliography :

1. COSTET J., SANGLERAT G., 1985, ""Cours pratique de Mécanique des Sols"", Ed. Dunod.
2. CORDARY D, 1994, ""Mécanique des Sols"", Ed. Tec Doc.
3. LAMBE T.W. et WHITMAN R.V., 1969, ""Soil Mechanics"", J. Wiley.
4. ATKINSON J.H. et BRANSBY, 1978, ""The Mechanics of Soils : an introduction to Critical State Mechanics"", Mac Graw Hill.

Requirements :

Soil Mechanics 1 - Solids Mechanics- Resistance of Materials- Continuum Mechanics, Numeric Calculation, Finite Element.

Organisation :

Review of lecture notes. Research and writing of the project: 40 hours

Evaluation :

Project report.
Oral presentation.
Practical work reports.

Target :

Project of Soil Méchanics	GCU07-PMDS
Number of hours : 10.00 h	3.00 ECTS credit
PR : 10.00 h	
Reference Teacher(s) : MASSON SAMUEL	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Open Channel Flow	GCU07-ESL
Number of hours : 42.00 h	2.50 ECTS credit
CM : 12.00 h, TD : 18.00 h, TP : 12.00 h	
Reference Teacher(s) : DUPONT PASCAL	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Written examination.
Practical work reports.

Target :

Heat Transfer Engineering II	GCU07-THER2
Number of hours : 24.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 12.00 h	
Reference Teacher(s) : DUPONT PASCAL	

Objectives :

This module provides the elements necessary for a profound understanding of the technical and theoretical problems of

Thermics for Buildings. There are four objectives:

1. An extension of the third year programme to standard elements of man-made structures;
2. Global understanding of and critical attitude towards the principles and methods of thermal code RT2000;
3. Method for integrating Thermics into the design process for buildings;
4. Technical solutions for the construction of thermically-efficient buildings.

Content :

1. Problems associated with thermics in residential buildings. The Energy Challenge.
2. Opaque walls in steady and time-dependent flow.
3. Air film thermics.
4. Thermal bridges.
5. Thermics of glass walls.
6. Solar thermal gain.
7. Humid air and hygrometry.
8. Energy consumption of buildings.

Bibliography :

1. Cortès H. et Blot J., "Transferts thermiques-Application à l'habitat", chez Ellipse, 1999
2. Croiset M., "L'hygrothermique dans l'habitat", chez Eyrolles Paris, 1970
3. "Traité de physique du bâtiment, Tome 1 : connaissances de base", édition du CSTB
4. "RT2000", Base de données I-Reef du CSTB
5. Hernot D., Porcher G., "Thermique appliquée aux bâtiments", aux éditions parisiennes CFP, 1984
6. Recknagel et col., "Manuel pratique du génie climatique- tome 1: données fondamentales", chez PYC, édition Paris, 1995, présent à la BU INSA

Requirements :

Thermics

Organisation :

Review of lecture notes(15 hours).

Evaluation :

Two-hour written examination.

Target :

Building Acoustics	GCU07-ACOUS
Number of hours : 22.00 h	2.00 ECTS credit
CM : 10.00 h, TD : 8.00 h, TP : 4.00 h	
Reference Teacher(s) : MOLEZ LAURENT	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Lighting Design	GCU07-ECLA
Number of hours : 26.00 h	2.00 ECTS credit
CM : 18.00 h, TD : 8.00 h	
Reference Teacher(s) : HELLOU MUSTAPHA	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

English	HUM07-ANGL
Number of hours : 28.00 h	2.00 ECTS credit
TD : 28.00 h	
Reference Teacher(s) : RANNOU ISABELLE	

Objectives :

Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :

-Learning by doing:

The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.

-Expressing oneself accurately and fluently.

The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.

-Writing CVs and cover letters

-Scientific English

-Discovering the professional world in an international context

-Preparing for the TOEIC (during the second semester, a specific ζ Toeic Booster ζ course will be available)

Bibliography :

- Oxford Advanced learners ζ Dictionary

- English Grammar in Use (Cambridge University Press)

Requirements :

1st, 2nd and 3rd year English courses (or equivalent)

Organisation :

Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.

Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :

One two-hour written exam.

Target :

Entrepreneurship and Innovation	HUM07-EI
Number of hours : 48.00 h	3.00 ECTS credit
CM : 24.00 h, TD : 24.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Sport and physical education	HUM07-EPS
Number of hours : 24.00 h	1.00 ECTS credit
TD : 24.00 h	
Reference Teacher(s) : LE LAGADEC PIERRE	

Objectives :

Team work, discovery of one's capabilities, communication, invention and management responsibilities.

Content :

Choice of two activities from a menu. Adapting to destabilising situations and taking responsibility when risk is involved.

Speaking to groups. Leading group stretching exercises. Indoors: Rock climbing or badminton in teams. Outdoors: C.O or Kayak or golf

Bibliography :

Several specialized books are available to the students at the library. Links to internet sites are given on the EPS website.

Requirements :

Organisation :

Evaluation :

Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Light engineering for theatre with studies	HUMF1-LUM
Number of hours : 2.30 h	1.00 ECTS credit
DIV : 2.30 h, DIV : 2.30 h	
Reference Teacher(s) : MERIC STEPHANE	

Objectives :

Teach students how to deal with the technical aspects of theatre plays, concerts, public-address systems for conferences, recordings...

Content :

Microphones, sound recording, sound software, stage/light mixing techniques, lighting desks and sound control systems : theoretical and practical experience.

Bibliography :

Requirements :

None

Organisation :

Workshops on Thursday afternoon in local venues or at INSA

Evaluation :

Validation of first semester (no mark awarded)

Target :

Any year

Semestre 8

Parcours Formation Initiale GCU

1	GCU08-1		ADVANCED STRUCTURAL ANALYSIS	5.50
	GCU08-ADP	O	Dynamics of Structures	2.00
	GCU08-CPS	O	Plastic Analysis of Structures	1.50
	GCU08-MEF	O	Numerical Modelling	2.00
2	GCU08-2		GEOLOGY AND MATERIALS	4.50
	GCU08-SGH	O	Geology and Hydrogeology	1.50
	GCU08-CDB	O	Concrete behaviour	1.50
	GCU08-IR	O	Introduction to scientific research	1.50
3	GCU08-3		DESIGN OF STRUCTURES	6.00
	GCU08-BA3	O	Reinforced Concrete Structures 3.	2.50
	GCU08-CM1	O	Steel structures	1.50
	GCU08-R&C	O	Pavement engineering	2.00
4	HUM08		Non-scientific syllabus S8	6.00
	HUM08-ANGL	O	English	2.00
	HUM08-ECO	O	Economy and Management	1.00
	HUM08-SHES1	O	Engineer & Society - M1	1.00
	HUM08-SHES2	O	Engineer & Society - M2	1.00
	HUM08-EPS	O	Sport and Physical Education	1.00
5	GCU-STAGE08		STAGE 4GCU	8.00
	GCU08-STAGE	O	Fourth year work placement	8.00

O = compulsory, C= in choice , F= optional

Dynamics of Structures	GCU08-ADP
Number of hours : 48.00 h	2.00 ECTS credit
CM : 24.00 h, TD : 24.00 h	
Reference Teacher(s) : HJIAJ MOHAMMED	

Objectives :

The stability of elastic structures using the functions of stability. Local buckle and discharge. Analysis of dynamic structures as applied to earthquake-resistant engineering.

Content :

1. Elastic buckling of bars and structures
2. Calculation of critical load using the energy method
3. Calculation of critical load using the successive approximations method
4. Influence of initial curvature - phenomenon of inversion of flexion
5. Functions of stability
6. Problem Solving: for rigid-knot structures / articulated-knot structures / continuous beams
7. Classification of sections (Eurocodes) (Reminder) - Theoretical models of collapse by buckling (local - shearing) in structural calculations
8. Understanding Discharge in structural calculations
9. Understanding Seismology
10. Simple damped oscillator
11. Response spectra
12. Multiple oscillators
13. Dimensioning of Structures
14. Potential energy
15. Earthquake-resistance
16. Applications

Bibliography :

1. TIMOSHENKO S., GERE J.M., 1966, ""Théorie de la stabilité élastique"", Dunod
2. APK (BOURRIER P. et BROZETTI J.), 1996, ""Construction métallique et mixte acier-béton"", Eyrolles
3. DAVIDOVICI V., 1980 ""Calcul dynamique des structures en zone sismique"", Eyrolles
4. ABSI E., 1987, ""Introduction au génie parasismique"", Annales ITBTP
5. Eurocodes 3, 4 et 8

Requirements :

General Mechanics and Mathematical Analysis (vectorial analysis, Partial derivative problems, functions of a complex variable, etc).

Organisation :

Review of lecture notes. Homework; 90 hours.

Evaluation :

Two written examinations of two and three hours respectively.

Target :

Plastic Analysis of Structures	GCU08-CPS
Number of hours : 18.00 h	1.50 ECTS credit
CM : 12.00 h, TD : 6.00 h	
Reference Teacher(s) : SOMJA HUGUES	

Objectives :

Calculations for plasticity of structures. Application in steel and wooden buildings.

Content :

1. General theory of plasticity: plastic behaviour of structures, load function and load surface, rules of plastic deformation, metalwork, Prandtl-Reuss and Hencky equations. Elastoplastic behaviour of hyperstatic systems.
2. Limit equilibrium of beam sections: flexion, moment-rotation curve, plastic hinge, interaction with normal and shear forces, curves of interaction.
3. Theory of Limit Analysis: Static theorem, kinematic theorem and combined theorem - Calculation of maximum loads of reinforced structures by combination of independent mechanisms - Maximum loads of thin plates.

Bibliography :

1. PRAGER W. KIEFFER J., EPAIN R., 1958, ""Problèmes de Plasticité Théorique"", Ed. Dunod, Paris.
2. RJANITSYN A.R., 1959, ""Calcul à la Rupture et Plasticité des Constructions"", Ed. Eyrolles, Paris.
3. COURBON J., 1965, ""Résistance des Matériaux"", Tome 2, Ed. Dunod, Paris.
4. MANDEL J., 1966, ""Cours de Mécanique des Milieux Continus"", Ed. Gauthier-Villars.
5. MASSONNET Ch. et SAVE M., 1977, ""Calcul plastique des constructions"", Vol. 1, Ed. Nélissen, Liège.
6. FREY F., 2000, ""Mécanique des structures"", Vol. 2, Ed. Presses Polytechniques et Universitaires Romandes.

Requirements :

Mechanics of Elastic Solids. Structural Analysis I.

Organisation :

21 hours

Evaluation :

Two-hour written examination

Target :

Numerical Modelling	GCU08-MEF
Number of hours : 42.00 h	2.00 ECTS credit
CM : 12.00 h, TD : 18.00 h, TP : 12.00 h	
Reference Teacher(s) : MEFTAH FEKRI	

Objectives :

Be able to start from the strong formulation of a continuous initial-boundary value problem in order to derive its weak form and then the associated discrete finite element model. Be able to derive a finite element for a given formulation. Be able to discretize and solve an engineer problem.

Content :

I. Partial differential equations (PDE)

- I.1 Classification
- I.2 Examples of PDE in engineering
- I.3 Discrete approximation of derivatives – Finite different schemas
- I.4 Mechanical formulation in elasticity: Bars – Beams – Plane states – Axisymmetric states – Plates
- I.4 Applications

II. Linear static analysis

- II.1 Strong form of boundary value problem (BVP) in elasticity
- II.2 Average formation and Weak form of BVP
- II.3 Space discretization and fields interpolation
- II.4 Discretized problem – Algebraic set of equations
- II.5 Kinematic boundary conditions.
- II.6 Force versus Displacement control
- II.7 Iso-parametric transformation
- II.8 Numerical integration
- II.9 Applications

III. Linear and nonlinear thermal analysis

- III.1 Strong form – Weak form of a thermal initial boundary value problem (IBVP)
- III.2 Space discretization and fields interpolation
- III.3 Time discretization schemes.
- III.4 Algebraic set of equations and boundary conditions management
- III.5 Stability – Precision criteria
- III.6 Iterative algorithms for nonlinear convection and radiation.
- III.7 Applications

IV. Linear dynamic analysis

- IV.1 Strong form – Weak form of a dynamic initial boundary value problem (IBVP)
- IV.2 Space discretization and fields interpolation
- IV.3 Time discretization schemes
- IV.4 Inertia and dumping terms
- IV.5 Algebraic set of equations and boundary conditions management
- IV.6 Stability – Precision criteria
- IV.7 Analysis of free vibration systems
- IV.8 Applications

Bibliography :

Requirements :

Continuum mechanics with the emphasis on deformable solids. Numerical methods (interpolation, integration...) – Linear algebra (matrices). Matlab programming environment.

Organisation :

Practical work classes are dedicated to projects of programming under Matlab environment.

Evaluation :

2 hours Exam at the end of the semester plus an evaluation of the practical work projects.

Target :
4GCU

Geology and Hydrogeology	GCU08-SGH
Number of hours : 36.00 h	1.50 ECTS credit
TD : 24.00 h, TP : 12.00 h	
Reference Teacher(s) : RANGEARD DAMIEN	

Objectives :

Practical and theoretical study methods for land, soil and road-building materials.

Content :

1. Using cartographic documents and aerial photos.
2. Geological structures.
3. Geotechnics.
4. Terracing.
5. Road-building techniques.

Bibliography :

FOUCAUT A. et RAOULT J.F., 1975, ""Coupes et cartes géologiques"", Ed. SEDES et DOIN

Requirements :

Third year programme.

Organisation :

Evaluation :

2 ninety-minute written examinations.
Practical Work reports.

Target :

Concrete behaviour	GCU08-CDB
Number of hours : 24.00 h	1.50 ECTS credit
CM : 12.00 h, TP : 12.00 h	
Reference Teacher(s) : HANNAWI KINDA	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Introduction to scientific research	GCU08-IR
Number of hours : 12.00 h	1.50 ECTS credit
PR : 12.00 h	
Reference Teacher(s) : DARQUENNES AVELINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Reinforced Concrete Structures 3.	GCU08-BA3
Number of hours : 48.00 h	2.50 ECTS credit
CM : 24.00 h, TD : 24.00 h	
Reference Teacher(s) : NGUYEN QUANG HUY	

Objectives :

Safety in the field of construction sciences. The importance of the suitability of building materials. Understand and apply the results of Limit analysis. Calculations relative to limitation of normal stress for the Service Limit State. Calculations relative to Service Limit State and Ultimate Limit State.

Content :

Reinforced concrete and safety principles

- Phenomenological and regulatory characterisation of materials. Structural modelling
- Construction law details for local properties
- General rules to justify the normal stress of prismatic pieces subjected to normal forces. Service Limit State of fissuring, deformation. Ultimate Limit State of bending.

Bibliography :

http://www.btp.equipement.gouv.fr/article.php3?id_article=224

http://www.btp.equipement.gouv.fr/article.php3?id_article=378

http://www.btp.equipement.gouv.fr/article.php3?id_article=389

http://www.btp.equipement.gouv.fr/article.php3?id_article=377

THONIER H., 2006, Conception et calcul des structures de bâtiment, l'Eurocode 2 pratique, Ed. Presses de l'ENPC CALGARO J.A., CORTADE J. et ALL, 2006,

Applications de l'Eurocode 2, Ed. Presses de l'ENPC GUILLEMONT P., 2005,

Aide-mémoire béton armé, Ed. Dunod pour Editions Le Moniteur MATANA M., 2004,

Béton armé, Ed. Alternatives Norme européenne EN 1992-1-1 :2004, Ed. AFNOR MOUGIN J.P., 2000,

""Béton armé BAEL 91 modifié 99"" , Ed. Eyrolles MIEHLBRADT M., 1997,

Béton armé bases. Structure I, Ed. EPFL NICOT R., 1997, ""Béton armé, Application de l'eurocode 2"" , Ed. Ellipse DAVIDOVICI V., 1995,

""Formulaire du béton armé"" , Ed. Le Moniteur PERCHAT J. et ROUX A., 1994,

""Pratique du BAEL 91"" , Ed. Eyrolles

LACROIX R., FUENTES A. et THONIER H., 1985,

""Traité de béton armé"" , Ed. Eyrolles COIN A., 1983, ""Ossatures des bâtiments"" , Ed. Eyrolles

Requirements :

Materials. Stress and strain states in a beam. Beam Theory.

Organisation :

Evaluation :

Written examination (3h) and mini-project report

Target :

4GCU

Steel structures	GCU08-CM1
Number of hours : 24.00 h	1.50 ECTS credit
CM : 14.00 h, TD : 10.00 h	
Reference Teacher(s) : BERNARD FABRICE	

Objectives :

Global understanding of the behaviour of metal frame structures. Identification of the combination of actions on each element of the structure. Basic principles of verification of; structural safety and serviceability; elasticity and plastic dimensioning of metallic elements; assembly and stability theory.

Content :

1. History and main points.
2. The utility steels in steel construction: methods of manufacture, finished products, performances and testing.
3. Eurocodes One and Three. Different types of analysis.
4. Strength of sections.
5. Strength of elements.
6. Weld assembly, bolted joints.

Bibliography :

1. M.A. Hirt et R. Bez, 1996, Construction Métallique. Notions fondamentales et méthodes de dimensionnement, Presses Polytechniques et Universitaires Romandes
2. M.A. Hirt, A. Nussbaumer, M. Crisinel et J.P. Lebet , 2004, Construction Métallique : bases de calcul et exemples numériques adaptés aux nouvelles normes, Presses Polytechniques et Universitaires Romandes

Requirements :

Beam theory. Strength of materials. Structural mechanics. Calculation of plasticity of structures. Mechanics of elastic solids.
Stability.

Organisation :

50 hours.

Evaluation :

Three-hour written examination.

Target :

Pavement engineering	GCU08-R&C
Number of hours : 48.00 h	2.00 ECTS credit
CM : 24.00 h, TD : 12.00 h, TP : 12.00 h	handout in English
Reference Teacher(s) : MASSON SAMUEL	

Objectives :

ROAD AND TERRACING TECHNIQUES:

Road geotechnics (soil classification, compacting, soil utilisation - subgrades and embankment), earthmoving (terracing sketch), Road design (horizontal alignment, longitudinal section, cross-section). Road design software.

ROAD MATERIALS AND ROAD STRUCTURE:

Various elements of road structure (principles, thickness of the different types of layers). Constituents and requirements of road materials - focus on bituminous mixes. Principles of the French method of road design; Quality control tests for road surfaces.

Content :

ROAD AND TERRACING TECHNIQUES:

1. GTR classification of soils. Subgrades and embankment compacting.
2. Earthmoving/ Terracing.
3. Bearing capacity and roadbed classification.
4. Soil treatments.
5. Frost and defrost phenomena: consequences and solutions.
6. Road design: horizontal alignment, longitudinal section, cross-section.

ROAD MATERIALS AND ROAD STRUCTURE:

1. Introduction.
2. Road structure.
 - 2.1. Functional description of road layers.
 - 2.2. Categories of road structure.
 - 2.3. Pavement design, various structures.
3. Road materials.
 - 3.1. Basic constituents: aggregates, hydraulic binders and hydro-carbonated binders.
 - 3.2. Mixes: non treated materials, treated materials with hydraulic binders, treated materials with hydro-carbonated binders.
4. Surface quality.
 - 4.1. Evenness
 - 4.2. Pavement skid resistance

Bibliography :

SETRA-LCPC, 1992, "Réalisation des remblais et des couches de forme - Guide Technique", LCPC IST-Publications.
 LCPC- SETRA, 2000, "Traitement des sols à la chaux et/ou aux liants hydrauliques - Guide Technique", LCPC IST-Publications. SETRA, 1994,
 "Aménagements des Routes Principales (ARP)", Guide Technique. SETRA, 1985,
 "Instruction sur les Conditions Techniques d'Aménagement des Autoroutes de Liaison (ICTAAL)", Guide Technique. SETRA-LCPC, 1994,
 "Conception et dimensionnement des structures de chaussée - Guide Technique", LCPC IST-Publications.
 DI BENEDETTO. H., CORTE J.-F., Matériaux routiers bitumineux, tomes 1 2, éd. Hermes, Lavoisier, 2005.
 HERSCHKORN P., Couches de roulement, Presses de l'ENPC, 1988.
 PEYRONNE C., KAROFF G., Dimensionnement des chaussées, Presses de l'ENPC, 1991.
 NISSOUX J.-L., VILLEMAGNE M., Chaussées en béton de ciment, Presses de l'ENPC, 1988.

Requirements :

Soil physics. Plane geometry. Aggregates and hydraulic binders. Basic knowledge of Mechanics of elastic solids.

Organisation :

Review of lecture notes.

Evaluation :

2 two-hour written examinations. Practical Work reports.

Target :

English	HUM08-ANGL
Number of hours : 24.00 h	2.00 ECTS credit
TD : 24.00 h, TD : 24.00 h	
Reference Teacher(s) :	

Objectives :

Acquiring the required skills for working in a firm as an engineer. Reaching the required level (B2) is compulsory in order to graduate.

Content :

-Learning by doing:

The student will have to be able to talk and listen, write documents while showing he/she can solve problems, reason, convince and demonstrate in an articulate manner.

-Expressing oneself accurately and fluently.

The student will engage in activities requiring creative and reactive skills (such as debates, role-plays, individual oral presentations using PowerPoint, projects), which will be based on scientific topics and current events.

-Writing CVs and cover letters

-Scientific English

-Discovering the professional world in an international context

-Preparing for the TOEIC. Furthermore, during the second semester, a specific *Toeic Booster* course is available for students wishing to attend.

Bibliography :

- Oxford Advanced learners' Dictionary

- English Grammar in Use (Cambridge University Press)

Requirements :

1st, 2nd and 3rd year English courses (or equivalent)

Organisation :

Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia language lab and computer rooms are also available and make it possible for the students to work in a stimulating environment. Our teaching resources include press articles, audio and video documents (TV reports, extracts from films and series). We also use the Internet.

Regular personal work is obviously required. The student must be curious and practise English outside the classroom as well.

Evaluation :

TOEIC

15 minute oral exam

Target :

Economy and Management	HUM08-ECO
Number of hours : 10.00 h	1.00 ECTS credit
TD : 10.00 h, TD : 10.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Engineer & Society - M1	HUM08-SHES1
Number of hours : 14.00 h	1.00 ECTS credit
TD : 14.00 h, TD : 14.00 h	
Reference Teacher(s) : ECHARD PHILIPPE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Engineer & Society - M2	HUM08-SHES2
Number of hours : 14.00 h	1.00 ECTS credit
CM : 14.00 h, CM : 14.00 h	
Reference Teacher(s) : ECHARD PHILIPPE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Sport and Physical Education	HUM08-EPS
Number of hours : 20.00 h	1.00 ECTS credit
TD : 20.00 h, TD : 20.00 h	
Reference Teacher(s) :	

Objectives :

Team work, discovery of one's capabilities, communication, invention, autonomy, self-discovery and management responsibilities.

Content :

Whole class: "role of the coach, role of the referee, management" (knowledge of the rules, getting involved, leading, decision making and communicating). Practice and knowledge of the sociomotive roles involved in the strategies of team attack and team defence. Finding one's place in a group and awareness of your team-mates and their responsibilities. Organisation of Physical and Sports Education: two 15-hour and one 30-hour sports or physical activity programmes in groups.

Bibliography :

Specialised publications are available at the library. Internet links are posted and updated on the INSA Physical Education website.

Requirements :

Organisation :

Evaluation :

Evaluation is based upon student participation, progress and acquisition. The student is asked to criticise his own progress with respect to the objectives of the course. The ability to be self-critical leads to self-discovery. Sharing this knowledge with a group reinforces one's confidence.

Target :

Fourth year work placement	GCU08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ST : 240.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 8

Parcours SHN

1	GCU08-2		GEOLOGY AND MATERIALS	4.50
	GCU08-SGH	O	Geology and Hydrogeology	1.50
	GCU08-CDB	O	Concrete behaviour	1.50
	GCU08-IR	O	Introduction to scientific research	1.50
2	GCU-STAGE08		STAGE 4GCU	8.00
	GCU08-STAGE	O	Fourth year work placement	8.00

O = compulsory, C= in choice , F= optional

Geology and Hydrogeology	GCU08-SGH
Number of hours : 36.00 h	1.50 ECTS credit
TD : 24.00 h, TP : 12.00 h	
Reference Teacher(s) : RANGEARD DAMIEN	

Objectives :

Practical and theoretical study methods for land, soil and road-building materials.

Content :

1. Using cartographic documents and aerial photos.
2. Geological structures.
3. Geotechnics.
4. Terracing.
5. Road-building techniques.

Bibliography :

FOUCAUT A. et RAOULT J.F., 1975, ""Coupes et cartes géologiques"", Ed. SEDES et DOIN

Requirements :

Third year programme.

Organisation :

Evaluation :

2 ninety-minute written examinations.
Practical Work reports.

Target :

Concrete behaviour	GCU08-CDB
Number of hours : 24.00 h	1.50 ECTS credit
CM : 12.00 h, TP : 12.00 h	
Reference Teacher(s) : HANNAWI KINDA	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Introduction to scientific research	GCU08-IR
Number of hours : 12.00 h	1.50 ECTS credit
PR : 12.00 h	
Reference Teacher(s) : DARQUENNES AVELINE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Fourth year work placement	GCU08-STAGE
Number of hours : 240.00 h	8.00 ECTS credit
ST : 240.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Semestre 9

Parcours Formation Initiale GCU

1	GCU09-1		COMMON CORE 1	10.00
	GCU09-DUR	O	Durability	1.50
	GCU09-BA4	O	Reinforced Concrete Structures III	2.00
	GCU09-BP1	O	Prestressed Concrete Structures	2.00
	GCU09-MARS	O	Ground improvement	2.00
	GCU09-MRO	O	Maintenance and Rehabilitation of Infrastructure	1.50
	GCU09-CBOI1	O	Construction Bois I	1.00
2	GCU09-2		COMMON CORE 2	4.00
	GCU09-DDC	O	Construction Law and Legislation	1.00
	GCU09-CPA1	O	Conception Parasismique	1.50
	GCU09-URBA1	O	Urban planning	1.50
3	GCU09-3		THREE POSSIBLE SPECIALIZATIONS: BUILDING ENGINEERING OR URBAN ENGINEERING OR PUBLIC WORKS	10.50
	GCU09-CBOI2	C	Wood Structures	1.00
	GCU09-CM2	C	Steel structures	2.00
	GCU09-CPA2	C	Conception Parasismique II	1.00
	GCU09-ABAT	C	Building Acoustics	1.00
	GCU09-THER3	C	Heat Transfer Engineering III	1.50
	GCU09-TCOND	C	Thermal Conditioning	1.50
	GCU09-FETB	C	Fluids and Building Equipment	1.00
	GCU09-HGE	C	Urban Hydrogeology and Water Ressource Management	1.50
	GCU09-HUR	C	Design of Water Supply & Waste Conveyance Systems	1.50
	GCU09-GTD	C	Waste Management & Contaminated Sites	1.00
	GCU09-QAIR	C	Air Quality Assessment & Sustainable Development	1.00
	GCU09-AURB	C	Urban Acoustics	1.00
	GCU09-VIT	C	Public Road & Transportation Infrastructure	1.50
	GCU09-DURB	C	Sustainable Mobility in Cities	1.50
	GCU09-URBA2	C	Urban planning 2	1.50
	GCU09-MECH	C	Pavement Mechanics	2.00
	GCU09-OGEO	C	Geotechnical constructions	2.00
	GCU09-HYTM	C	Marine Hydraulic Engineering	1.00
	GCU09-HYDR	C	Hydrogeology	1.00
	GCU09-BP2	C	Prestressed Concrete	1.00
	GCU09-POUV	C	Bridges and Infrastructures	2.00
	GCU09-CMX	C	Composite Steel - Concrete Structures	1.50
4	HUM09		Non-scientific syllabus S9	5.50
	HUM09-ANGL-CONV	C	English S9 Conversation	1.50
	HUM09-ANGL-TOEIC	C	TOEIC 5th year	1.50
	HUM09-PM-A	C	Economics, Law and Business Studies A (Lean six sigma)	2.00
	HUM09-PM-B	C	Economics, Law and Business Studies B (Human Resource Management)	2.00
	HUM09-PM-C	C	Economics, Law and Business Studies C (Human Resources Management)	2.00
	HUM09-PM-D	C	Economics, Law and Business Studies D (MANAGEMENT -	2.00

			ETHICS - RESPONSIBILITY)	
	HUM09-PM-E	C	Economics, Law and Business Studies E (International Strategy and Development)	2.00
	HUM09-PM-F	C	Economics, Law and Business Studies F (sustainable development)	2.00
	EII09-EVST	C	Evaluation stage	1.00
	HUM09-PM-G	C	Economics, Law and Business Studies G (serious game)	2.00
	EII09-HUMT	C	Societal responsibility of business	1.00
	EII09-EVST	C	Evaluation stage	1.00
	INF09-DROIT	C	Legal Training for Engineers	2.00
	SRC09-SPEC	C	Conferences	1.00
	SRC09-CONF	C	SRC09-CONFERENCES	1.00

O = compulsory, C= in choice , F= optional

Durability	GCU09-DUR
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : KAMALI BERNARD SIHAM	

Objectives :

Identification of and understanding the main causes of damage to building materials. Characterisation techniques. The principles of prevention.

Content :

I. DURABILITY OF CONCRETE:

1. The physico-chemical basics of the durability of concretes: hydrates, porous network of concrete - Interfaces, surface properties, properties of capillary transport, permeability, diffusion, migration.
2. The chemical processes of the degradation of concrete. Effect of acid, sea water, sulphates on concrete. Degradation by alkali-silica reaction - Carbonation, Corrosion.
3. The physical processes of the degradation of concrete. Freeze - thaw cycling, Abrasion, Erosion, Cavitation.
4. Principles of prevention .

II. DURABILITY AFTER IMPLEMENTATION:

1. Factors of intrinsic alteration (effects connected to the mineralogical composition, role of hydric properties, mechanical properties and transfer properties).
2. Factors of extrinsic alteration (freeze, effects of salts, effects of gaseous atmospheric pollution, biological colonisation).
3. Patina.

Bibliography :

1. La durabilité des bétons. Collection de l'Association Technique de l'Industrie des Liants Hydrauliques, sous la direction de Jacques Baron et Jean-Pierre Ollivier. Edition Presse de l'Ecole Nationale des Ponts et Chaussées.
2. La dégradation des bétons: couplage fissuration dégradations chimi ques. Sous la direction de Jean Michel TORRENTI, Olivier DIDRY, Jean Pierre OLLIVIER, Frederic PLAS. Edition HERMES.
3. Les bétons à hautes performances : caractérisation, durabilité, applications. Sous la direction de Yves MALIER. Edition Presse de l'Ecole Nationale des Ponts et Chaussées.

Requirements :

Organisation :

Evaluation :

Written examination.
Mini-project (Report and oral presentation).

Target :

5GCU

Reinforced Concrete Structures III	GCU09-BA4
Number of hours : 12.00 h	2.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : NGUYEN QUANG HUY	

Objectives :

Give to students a simple concrete building to apply previous lectures in a coordinated way.

Content :

Every week students meet the professor first to discuss the project and ask the questions they have encountered in the project, then to prepare with the professor the work for next week.

Bibliography :

1. DAVIDOVICI V., 1995, "Formulaire du béton armé", Ed. Le Moniteur
2. RENAUD H., 1989, "Constructeur bâtiment", Ed. Foucher
3. DREUX G., 1981, "Calcul pratique du béton armé", Ed. Eyrolles
4. "EC2", 1992, Ed. AFNOR
5. "BAEL 91", 1991, Ed. Journal Officiel
6. PERCHAT J. et ROUX A., 1994, "Pratique du BAEL 91", Ed. Eyrolles
7. LACROIX R., FUENTES A. et THONIER H., 1985, "Traité de béton armé", Ed. Eyrolles
8. MOUGIN J.P., 1995, "Béton armé, BAEL 91 et DTU associés", Ed. Eyrolles
9. ALBIGES M. et MINGASON M., 1984, "Théorie et pratique du béton armé aux états limites", Ed. Eyrolles
10. COIN A., 1983, "Ossatures des bâtiments", Ed. Eyrolles.

Requirements :

Beam theory, reinforced concrete I, II, III

Organisation :

4 à 6 homework a week for a total around 70 h.

Evaluation :

Mini-project

Target :

5GCU

Prestressed Concrete Structures	GCU09-BP1
Number of hours : 18.00 h	2.00 ECTS credit
CM : 18.00 h	
Reference Teacher(s) : DARQUENNES AVELINE	

Objectives :

Principles of prestressed structures. Application to concrete.

Content :

1. Main points - history.
2. Understanding of safety and regulation in construction.
3. Materials.
4. Process of prestressing concrete.
5. Phases of construction.
6. Execution and inspection.
7. Cable Tension and assessment of loss of tension.
8. Simple longitudinal flexion study (Service Limit State).
9. Simple longitudinal flexion study (Ultimate Limit State).
10. Tangent loading (Justification).
11. Tensioning cables.
12. Synthesis exercises.

Bibliography :

1. THONIER H., LE BETON PRECONTRAIT AUX ETATS LIMITES, Presse des Ponts et Chaussées, 1992.
2. CHAUSSIN R., FUENTES A., LACROIX R. , PERCHAT J. LA PRECONTRAINTTE, Presse des Ponts et Chaussées 1992
3. Cours de béton précontraint INSA Document photocopié, par Jean BACOT
4. Documents techniques des fabricants de systèmes de précontrainte et des constructeurs.
5. Films, CD rom, etc ; reportages personnels sur des chantiers.

Requirements :

Modules on; General Mechanics. Resistance of Materials. Reinforced Concrete.

Organisation :

Review of lecture notes. Completion of drawings. 30 hours

Evaluation :

Mini-project (in pairs).

Target :

5GCU

Ground improvement	GCU09-MARS
Number of hours : 24.00 h	2.00 ECTS credit
CM : 24.00 h	
Reference Teacher(s) : RANGEARD DAMIEN	

Objectives :

The students are lead to deepen and to develop their knowledge about rocks mechanics as a discontinuous medium and about current elastic-plastic models of soils.

Content :

Advanced mechanics of rocks

- geometrical and mechanical characterization of rock joints
- water in rocks : permeability of sound rock and joints
- modelling approaches: scale, homogenisation, discontinuous medium
- the distinct element method
- stability of rock mass : sliding, rock falls

Advanced mechanics of soils

- different moduli of compressibility
- oedometric and isotropic compressibility
- shear tests (reminds)
- critical state and limit state concepts
- elastic-plastic models : Mohr-Coulomb, Cam Clay, Soft Soil

Bibliography :

Homand F., Duffaut P., (coord.), Manuel de mécanique des roches. Presses de l'Ecole des Mines, 2000.
 Lambert S., Nicot F., (dir.), Géomécanique des instabilités rocheuses. Hermès & Lavoisier, 2010.
 Itasca C. G., UDEC, Universal Distinct Element Code, 2004. www.itascacg.com/udec/symp.html
 Hicher P.Y., Shao J.F., Modèles de comportement des sols et des roches, Hermès 2002.
 Plaxis, Material models manual. www.terrasol.fr

Requirements :

Fundamentals of soil mechanics : compressibility, permeability, shear resistance
 GCU06-22, GCU07-21, GCU05-32, GCU08-22

Organisation :

Lectures, exercices, use of numerical codes

Evaluation :

Written examination

Target :

5th year and master of research students

Maintenance and Rehabilitation of Infrastructure	GCU09-MRO
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	handout in English
Reference Teacher(s) : DARQUENNES AVELINE	

Objectives :

Problems associated with works maintenance and problem diagnosis. Modern, non-destructive techniques for diagnosing abnormalities. Principles and methods for treating degraded concrete.

Content :

1. Policy for the maintenance of classified buildings
 - Implementation of maintenance policy
 - Technical evaluation
 - Classification of the works
 - Indication of the state
 - Technical priority
 - Socioeconomic priority
 - Strategy of intervention.
2. The problem of auscultation, evaluation and diagnosis of the works.
3. Basics and principles of the usual non-destructive physical methods of the qualification of concrete
 - Non-destructive evaluation methods using ultrasound, electromagnetism (radar), thermal imagery (infrared thermography), electric and electrochemical methods (resistivity, potential and speed of corrosion), radiographic and gammagraphic methods, optical methods
 - Applications: evaluation of the state of the material. Evaluation of the waterproofness of the works.
4. Reparation of concrete
 - Damage to concrete
 - Concepts for carrying out repairs
 - Repair procedures
 - Choice of materials
 - Preparation of the surface to be repaired
 - Implementation techniques
 - Crack injection
5. Reinforcing the structure
 - Strengthening
 - Addition of material
 - Principles of dimensioning.
6. Case studies:
 - bridges
 - Buildings
 - Protection of steel
 - Reparation with screed
 - Reparation and reinforcement by sprayed concrete
 - Reparation by casting or injection of concrete or mortar.

Bibliography :

Requirements :

Understanding of diagnosis abnormalities in buildings.

Organisation :

Review of lecture notes.

Evaluation :

Two-hour written examination.

Target :

5GCU

Construction Bois I	GCU09-CBO11
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : BERNARD FABRICE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Construction Law and Legislation	GCU09-DDC
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : DUPONT PASCAL	

Objectives :

Understanding of law and judicial reasoning in preparation for future dealings with the legal department of a company.

Content :

1. Introduction to law (characteristics, specialisation: classification).
2. Origins and the hierarchy of standards.
3. Legal organisation (jurisdictions, law practitioners).
4. The decennial responsibility of builders and the presentation of a legal proceeding regarding construction law.
5. Employment and the employment contract (rules, sanctions).

Bibliography :

1. LYON-CAEN, ""Manuel de Droit du Travail"", Précis Dalloz
2. Dictionnaire Permanent, Droit de la Construction, Droit social.
3. Dictionnaire des termes juridiques - Editions Dalloz

Requirements :

Knowledge of materials used in building and public works. Overview of French institutions and the separation of the three powers of government.

Organisation :

Evaluation :

Exam.

Target :

5GCU

Conception Parasismique	GCU09-CPA1
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : COUCHAUX MAEL	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :
5GCU

Urban planning	GCU09-URBA1
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) : HELLOU MUSTAPHA	

Objectives :

The aim of this course is to equip students with a culture of the city and regional planning, teaching them some technical operational planning tools.

Content :

This course is divided into two parts of 12 hours each :

Part 1: Urban and Regional Planning

The challenges of the contemporary metropolis: live and move sustainably

Mobility, city, city planning

- Cerda, Soria, Haussmann
- Le Corbusier, Frank Lloyd Wright
- Mobility and Urban Planning in the 60s
- The urban transport plans

Urban planning, climate and energy

- The greening of development tools
- Energy assessment of a planning operation

Part 2: Urban planning jobs. The different players

A practice to serve projects. Urban projects, city projects. Examples and models

Production of housing as an engine of urban development.

Land. Fundamentals, regulatory tools, land interventions

The spatial approach. Theories and tools

Mobility and urban shapes

The operational approach: administrative procedures, project management : 6th course

Bibliography :

Requirements :

Organisation :

The course is mainly based on experiments on various french sites, some courses present other international contexts to students

Evaluation :

Exam (2h)

Target :

5GCU

Wood Structures	GCU09-CBOI2
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : BERNARD FABRICE	

Objectives :

Familiarisation with wood as a building material. An approach to the dimensioning of wooden structures.

Content :

1. Description of wood, durability, treatment, pathology.
2. Using the plan of a house: calculations for wooden elements under flexion, compression, shearing.
3. Buckling and discharge.
4. Calculation for assemblies.
5. Calculation of fire resistance.
6. Presentation of the most common types of wooden structures.

Bibliography :

1. Règles CB71
2. Règles Eurocode 5.

Requirements :

Basics of Resistance of Materials used in Civil Engineering.

Organisation :

10 hours.

Evaluation :

Two-hour written examination.

Target :

5GCU (BAT)

Steel structures	GCU09-CM2
Number of hours : 36.00 h	2.00 ECTS credit
CM : 36.00 h	
Reference Teacher(s) : COUCHAUX MAEL	

Objectives :

A first introduction to steel design.

To be able to design a simple steel building from the scratch

Acquire a general knowledge of the techniques used in steel building construction, and of the main design rules

Content :

1. Introduction to the design - main structural schemes
2. Structural analysis : first and second order global analysis
3. Design of members and sections
4. Local loadings
5. Joint design by component method
6. Earthquake design

Bibliography :

1. APK, 1996, "construction métallique et mixte acier-béton", tomes 1 et 2, éditions Eyrolles
2. Jaspard JP, Cours de construction métallique, université de Liège (disponible en ligne)
3. CD ROM ESDEP, leçons de construction métallique, APK, 1999 (disponible en ligne)
4. SPRINT, rapport de recherche RA 351 : "L'eurocode 3 et les assemblages en acier : aides de calcul pour assemblages rigides et semi rigides"
5. HIRT, BEZ, NUSSBAUMER, 2006, "Construction métallique : Notions fondamentales et méthodes de dimensionnement", presses polytechniques et universitaires romandes.
6. PLUMIER A, cours de construction parasismique, université de Liège (disponible en ligne)

Requirements :

Steel design I, dynamic analysis, plastic analysis

Organisation :

Lectures, and project made by groups of two students

Evaluation :

By the project.

Target :

5GCU

Conception Parasismique II	GCU09-CPA2
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : COUCHAUX MAEL	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Building Acoustics	GCU09-ABAT
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : MOLEZ LAURENT	

Objectives :

Basics of building acoustics.

Content :

1. Environmental noiseproofing.
2. Impact noiseproofing.
3. Equipment noiseproofing.
4. Regulations.
5. Understanding the acoustics of a large room.

Bibliography :

1. JOSSE R., 1977, ""Notions d'acoustique"", Ed. Eyrolles
2. JOUHANNEAU J., 1997, ""Acoustique des salles et sonorisation"", Lavoisier Tec et Doc

Requirements :

Basics of physics-acoustics.

Organisation :

Calculations from class notes: 16 hours.

Evaluation :

Mark for on-site calculations taken over a period of four hours.

Target :

5GCU (Building department option)

Heat Transfer Engineering III	GCU09-THER3
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) : DUPONT PASCAL	

Objectives :

Standard quality of building is mainly studied through the global static parameter Ubat and then the main issue of this course is to work further on unstationary situations. For this purpose, the concept of thermal inertia is introduced through the quantification of stored energy either in external wall or internal one. An upgrade of the latest French Thermal regulatory calculus is made with professional lecturers.

Content :

- I. Introduction
- II. Thermal basis
 - II.1. Building budget
 - II.2. Thermal stresses
 - II.3. Free parameters in the conception
- III. Simplified dynamical model
 - III.1. Equivalent electrical scheme
 - III.2. Simple wall model
 - III.3. Two time constante model
 - III.4. Thermal regulation model
- IV. RT 2012
 - IV.1. Actual thermal regulation
- V. Software
 - V.1. DPE
 - V.2. Dynamic simulation
 - V.3. Regulatory calculus

Bibliography :

- Cortès H. et Blot J., "Transferts thermiques-Application à l'habitat ", chez Ellipse, 1999, présent à la BU INSA
- "Traité de physique du bâtiment, Tome 1 : connaissances de base", edition du CSTB, présent à la BU INSA
- "RT2005", Base de données I-Reef du CSTB en ligne sur l'intranet de l'INSA dans les services de la BU
- Hernet D., Porcher G., "Thermique appliquée aux bâtiments", aux éditions parisiennes CFP, 1984, présent à la BU INSA
- Incropera F.P., De Witt D.P., "Introduction to heat transfert ", chez Wiley New York, 1996.
- Recknagel et col., "Manuel pratique du génie climatique- tome 1 :données fondamentales",
- Cours de Nicolas Tixier enseignant-Chercheur à l'Ecole d'Architecture de Grenoble (disponible sur le net)

Requirements :

Thermal sciences 1&2 of the forth year.

Organisation :

The course is organized through a general presentation of the thermal science applied to building with a major focus on unstationary regimes. Many hours are spent in the computer room to write mathematical model and realize progressively personal small project. Some lectures were done by external people on actual issues and thermal regulation (RT). A precise building is given to perform unstationary analysis and regulatory calculus.

Evaluation :

It is achieve through personal project on a precise building.

Target :

5GCU

Thermal Conditioning	GCU09-TCOND
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : DUPONT PASCAL	

Objectives :

Familiarize students with the concepts of thermal conditioning. Learn to dimension. Raise awareness to energy saving context.

Content :

- 1) what you need to know before starting
- 2) a heating system
- 3) a ventilation system
- 4) an air conditioning system
- 5) control of an hvac installation

Bibliography :

LIBERT, A., Génie climatique de A à Z. N° spécial de la revue Chaud-froid plomberie
 LE RECKNAGEL, Manuel Pratique du Génie Climatique - 3ème édition, librairie du centre

Requirements :

Thermic, aeraulic

Organisation :

Course, study of cases

Evaluation :

Small project

Target :

5GCU

Fluids and Building Equipment	GCU09-FETB
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : DUPONT PASCAL	

Objectives :

Mastering the regulatory aspects concerning security in buildings. Become familiar with the technical layouts for the implementation of building networks.

Content :

- 1) Regulatory approach: Charts and related texts (ERP, Residential CDT)
- 2) Key concepts: stability and fire resistance, reaction to fire (M4-M2-M1), clearances (widths depending on numbers), Stairs, external defense
- 3) Smoke evacuation (manual and mechanical)
- 4) Fire & Security systems
- 5) Alarm
- 6) Elevator
- 7) Fluids and networks : Electricity, heating systems, gas

Bibliography :

- Collectif CSTB, Sécurité incendie & Réglementation -Habitations, ERP, locaux d'activité, Editions CSTB
- Casso et Associés, Guide Sécurité incendie - Guide d'application de la réglementation incendie, Editions Le Moniteur

Requirements :

Organisation :

Study of cases, pedagogy by projects

Evaluation :

Project in group

Target :

5GCU

Urban Hydrogeology and Water Ressource Management	GCU09-HGE
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) : HELLOU MUSTAPHA	

Objectives :

Hydrology & Water management: familiarize students with problems related to resource management of surface and groundwater. Raise awareness of the criteria on water pollution, sources of pollution. Train engineer to analyze the response of urban catchments during precipitation, calculation and design of distribution facilities, drainage and water treatment.

Content :

1. Organisation of water management in France.
2. Water resources. Treatment of drinking-water. Adduction and drinking-water distribution networks.
3. Urban zone sanitation systems and projects. Waste-water treatment.
4. Alternative techniques for urban sanitation
5. Characteristics of catchments
6. Statistical analysis of the pluviometric data
7. Rain-flow transformation
8. Applications

Bibliography :

1. VALIRON F., 1990, ""Gestion des eaux"" (3 tomes), Presses de l'E.N.P.C.
2. DUPONT A., 1969, ""Hydraulique urbaine"" (2 tomes), Ed. Dunod
3. COSTE C et LOUDET M., 1987, ""L'assainissement en milieu urbain ou rural"" , Ed. Le Moniteur
4. REMENIERAS G., 1976, ""Hydrologie de l'ingénieur, 1. VALIRON F., 1990, "Gestion des eaux" (3 tomes), Presses de l'E.N.P.C.
5. LLAMAS J., 1993, "Hydrologie générale - Principes et applications", Ed. Gaëtan Morin
6. MUSY A. "Hydrologie générale "Ed. EPFL
7. BOURRIER, R. 2010Techniques de la gestion et de la distribution de l'eau, Ed. le Moniteur
8. BOURRIER, R. 2008Les réseaux d'assainissement: calculs, applications, perspectives , Ed. Tec&Doc

Requirements :

Hydraulic engineering GCU3242. Open Channel Flow GCU4142

Organisation :

Project: Uurban hydrology and hydraulic engineering

Research: Technical and municipal reviews. Publications on water management and ecology

Students are encouraged to analyse and criticise case studies

Evaluation :

Mini-project.

Target :

5GCU

Design of Water Supply & Waste Conveyance Systems	GCU09-HUR
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) : HELLOU MUSTAPHA	

Objectives :

Hydraulic design of networks and gravity systems.
 Study of hydraulic structures.
 Regulatory aspect of sanitation and distribution of drinking water

Content :

1. Adduction systems
2. Water treatment
3. Calculation of Hydraulic networks: Hardy-Cross, Newton-Raphson, EPANET
4. Modeling
5. Structure sewerage (collection networks, buffer tank, alternative solutions)

Bibliography :

Jacques BONNIN, Hydraulique urbaine, Ed. Eyrolles, 1986
 F. VALIRON, gestion des eaux, Presses de l'ENPC, 1990
 W. H. GRAF et M. Altinakar, Hydraulique fluviale, PPUR, 2008
 R. BOURRIER, Techniques de la gestion et de la distribution de l'eau, Ed. le Moniteur, 2010
 R. BOURRIER, Les réseaux d'assainissement: calculs, applications, perspectives, Ed. Tec&Doc, 2008

Requirements :

Fluid mechanics; Hydraulics ; Hydrology

Organisation :

Project: Urban hydraulics engineering
 Students are encouraged to analyse and criticise case studies

Evaluation :

Mini-Project

Target :

5GCU

Waste Management & Contaminated Sites	GCU09-GTD
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : KAMALI BERNARD SIHAM	

Objectives :

Give a general training on urban waste management

Content :

- 1) Waste: Numbers and Definitions
- 2) socio-economic issues associated with waste
- 3) methods of management and treatment
- 4) Household waste: characterization, collection and sorting
- 5) GIS tools and waste management
- 6) Methane
- 7) Composting

Bibliography :

Requirements :

Organisation :

Education provided by professionals and researchers. Case study

Evaluation :

exam (2h)

Target :

5GCU

Air Quality Assessment & Sustainable Development	GCU09-QAIR
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : MEFTAH FEKRI	

Objectives :

Understanding the problems associated with atmospheric pollution and its association with sustainable development.

Content :

Atmospheric state variables - Thermodynamics and state of the atmosphere equations - Relative humidity (humidity rate) - Density & volumetric mass - Dew temperature - Wet air. Air pollution and its consequences on human health - Nitrogen Oxides, sulphur, carbon - Volatile organic compounds - Aromatic polycyclic hydrocarbons - Hydrochloric and fluorhydric acids - Dioxins and furans - Heavy metals - Dust in suspension - photochemical oxidisers - Odours - Microbodies, bacteria, viruses, fungi, moulds, pollen. Quality of air in buildings. Our understanding of "comfort" in terms of air quality. Air quality indicators - The concept of quality indicators - Indicators of environmental impact.

Bibliography :

1. Les systèmes de ventilation; Sylvain Charreyre et Julien Maratier
2. La gestion de la qualité de l'air, Javier Garcia et Joëlle Colosio, Presses de l'Ecole des Mines de Paris

Requirements :

Organisation :

Evaluation :

Small project

Target :

5GCU

Urban Acoustics	GCU09-AURB
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : MOLEZ LAURENT	

Objectives :

Identification of the sources of noise in urban zones. Analysis under current regulations. Main technical solutions in the fight against the noise pollution.

Content :

- 1 Introduction - What is noise?
- 2 Acoustics (reminders); Physical acoustics. Physiological acoustics. Effects of noise on health.
- 3 Sources of noise. Multitude of sources. Road traffic. Air traffic. Rail traffic. Other sources
- 4 Models of noise distribution. Urban environment. Open field. Meteorological effects
- 5 Noise measurement.
- 6 Regulation: The law regarding
 - (a) road traffic noise
 - (b) air traffic noise
 - (c) rail traffic noise. European directives.
- 7 Technical solutions: Anti-noise walls. Earthen mounds. Road surfaces. Urban-planning.

Bibliography :

Requirements :

Organisation :

Evaluation :

Small project.

Target :

5GCU

Public Road & Transportation Infrastructure	GCU09-VIT
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) : KAMALI BERNARD SIHAM	

Objectives :

Learning the basics for the Geometric design and pavement design of urban roads and crossroads.
 Development a critical analysis on urban projects: Various restrictions related to urban environment are covered.
 Different degradations of urban roads are studied.

Content :

1. Urban roads: Geometric design, Pavement design. Degradation of urban roads .
2. Urban crossroads: Different types, Geometric design, Pavement design.
3. Urban expressways (VRU)
4. Road system for public transportation: Metro. Bus.
5. Some equipments for urban roads: lighting, signalling..

Bibliography :

1. "Dimensionnement des structures des chaussées urbaines", 2000, CERTU
2. "Carrefours urbains : guide", 1999, CERTU
3. "Conception structurelle d'un giratoire en milieu urbain", 2000, CERTU
4. "Guide pratique de la voirie urbaine", 1999, RGRA
5. "Catalogue des dégradations de surface des chaussées", 1998, LCPC
6. "ICTAVRU, Instructions sur les conditions techniques d'aménagement des voies rapides urbaines", 2009, CERTU

Requirements :

Basics of the French method of road design.

Organisation :

Courses, Applications and use of software, mini-project

Evaluation :

Exam and Mini-project.

Target :

5GCU

Sustainable Mobility in Cities	GCU09-DURB
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) : KAMALI BERNARD SIHAM	

Objectives :

Learning the basics of travel management in urban agglomerations taking into account all transport modes: Urban travel plan.

Learning the basics of urban travel modelling. The external negative effects of the urban travelling are studied.

Content :

1. Urban travelling : modes, database, legislation.
2. Urban travelling models.
3. External negative effects: Pollution, traffic congestion, noise, insecurity
4. Drawing up diagnostics. Travel planning scenarios
5. Urban travel plans: Examples of France's urban travel plans.

Bibliography :

1. "" Quelle est la mobilité quotidienne des personnes dans les agglomérations : approche de la question et proposition d'indicateurs "", 2004, CERTU
2. "" Etude Méthodologique de la connaissance des déplacements des périurbains "", 2004, CERTU
3. "" PDU de Rennes 2007/2017"", 2006, Rennes Métropole.
4. COHEN S., 1990, ""Ingénierie du trafic routier - Eléments de théorie du trafic et applications "", Presses de l'Ecole Nationale des Ponts et Chaussées

Requirements :

Organisation :

Courses, Applications and use of software, mini-project

Evaluation :

Mini-project.

Target :

5GCU

Urban planning 2	GCU09-URBA2
Number of hours : 12.00 h	1.50 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : DUPONT PASCAL	

Objectives :

This course aims to understand the meaning of urban morphologies .Courses explore the conditions of formation of cities : internal part system ; relationship centers on the other. Why and how a hierarchy of cities and their geographical distribution . How their functions are expressed in a particular type.

Courses voluntarily offer a wide range - in a very short available time-, in order to offer students a synthetic overview, but which allows them to understand a city map. It is trying to understand how urban typologies are related to a part in political and social contexts that are expressed in a system of urban law waveform generator, and other systems to local organizations that value infrastructure networks and balances or imbalances space built and unbuilt space.

Content :

The course is provided by a professional (architect-planner) .

The syllabus is :

- 1 . Urban Explosion : This course covers . Synthetically passing the ancient city to the metropolis and the question of land.
- 2 . Planning and training centers morphology 1: Understanding the forms of territorial organization : a study in parallel with the formation of the rural system and the urban system
- 3 . Planning and training centers morphology 2 : Urban organic The city inside / outside.
- 4 . Planning and training centers morphology 3: Comic - Reading City: city paths and islands.
- 5 . Formation of the modern city : the theme of the city infrastructure , the course covers the formation of the modern city.
- 6 . Contemporary City: structure and challenges : Urban Study : Methodology.

This course is associated with a common planning workshop with MASTER 2 AUDIT from the University of Rennes 2 . In this context the students are working on a public commission more or less fictitious , with the aim to go to APS to define a sketch of realistic action program. This workshop is being accompanied by methodological design of an urban development project carried out by a teacher from the University of Rennes 2 .

Bibliography :

Classic urban palling bibliography

Requirements :

Previous related courses in 3GCU and 4GCU

Organisation :

This course includes 12 hours of analysis of urban morphologies and 12 hours of organization of an urban planning project methodology. Concrete urban development project is given to mixed groups of students from INSA / 5GCU and UR2 / AUDIT to accustom our future engineers to work in multidisciplinary urban engineering.

Evaluation :

Target :

5GCU

Pavement Mechanics	GCU09-MECH
Number of hours : 24.00 h	2.00 ECTS credit
CM : 24.00 h	handout in English
Reference Teacher(s) : KAMALI BERNARD SIHAM	

Objectives :

Get a deep knowledge of the mechanical behaviour of pavement structures and the practice of their design. Get an expertise of analysis software. Practice evaluation and reinforcement of structures.

Content :

1. Functionality and classification of roads.
2. Traffic characterisation, Equivalent traffic calculation.
3. Mechanical behaviour of subgrade soils and roadbeds.
4. Mechanical behaviour of road materials: fatigue laws and creep.
5. Calculation of allowable stresses and strains: reliability aspects.
6. Structural design: methods and practice, Alizé software.
7. Structural survey methods.
8. Methods and practice of structural reinforcement

Bibliography :

1. PEYRONNE C., CAROFF G., Dimensionnement des chaussées. Presses de l'ENPC. 1984.
2. L.C.P.-SETRA, Conception et dimensionnement des structures de chaussées - Guide Technique. 1994.
3. ULLIDTZ P., Pavement analysis, Elsevier. 1987.

Requirements :

Mechanics of deformable media (GCU05-11), Roads and pavements (GCU08-21)

Organisation :

Lectures, exercises, case studies.

Evaluation :

Project by groups of 2 students

Target :

5GCU

Geotechnical constructions	GCU09-OGEO
Number of hours : 24.00 h	2.00 ECTS credit
CM : 24.00 h	handout in English
Reference Teacher(s) : RANGEARD DAMIEN	

Objectives :

Knowledge of working techniques and of analysis methods of different typical geotechnical constructions.

Content :

Geotechnique of dams

- foundations pathology: examples and case studies
- earth dams : types, pathology, water flow, stability

Underground works

- geotechnical investigation, characterisation of rock mass
- boring techniques, support types
- mechanical analysis : analytical solutions, convergence-confinement method, numerical methods

Soil reinforcement techniques

- general methods of analysis
- nailing, Reinforced Earth, geotextiles
- other techniques : sand piles, jet grouting, dynamic compaction..

Bibliography :

- Bordes J.-L., Les barrages-réservoirs du milieu du XVIIIe siècle au début du XXe siècle en France, Presses de l'ENPC, 2005.
- Schleiss A. J., Pougatsch H., Les barrages, traité de Génie Civil, Presses de l'EPFL.
- Thomas H., The engineering of large dams. Wiley & Sons, 1976.
- Colombet G., Esteulle F., Bouvard-Lecoanet A., Ouvrages souterrains : conception, réalisation, entretien. Presses de l'ENPC, 1992.
- Panet M., Le calcul des tunnels par la méthode convergence-confinement. Presses de l'ENPC, 1995.
- Hoek E., Practical Rock engineering, www.rocsience.com
- Recommendations Clouterre 1991, Presses de l'ENPC, 1991
- Additif 2002 aux recommandations CLOUTERRE 1991, Presses de l'ENPC, 2002.

Requirements :

Soil mechanics I (GCU06-22), Soil mechanics II (GCU07-21), Engineering geology (GCU05-32), Mechanics of deformable media (GCU05-11), Applied numerical methods (GCU08-13)

Organisation :

Lectures, exercises, case studies.

Evaluation :

Project of construction analysis by group of 2 students

Target :

5GCU

Marine Hydraulic Engineering	GCU09-HYTM
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : HELLOU MUSTAPHA	

Objectives :

- Maritime hydraulics: Modelling of swell. Effect of swell on maritime works.
- Modelling of the phenomena of erosion and sedimentation in estuaries.
- Maritime works & coastal management: An outline of the various arrangements possible to satisfy industry and simultaneously protect the coastal environment.

Content :

1. Maritime hydraulic Concepts : wave theory, wave physics
2. Sea level, wave and stirring, action of waves on structures
3. Sedimentology: definitions, sediment movements, impacts of port development
4. Dredging: dredging techniques, the materials become
5. Design of sea dikes: typologies of

Bibliography :

1. BONNEFILLE R., 1993, ""Cours d'hydraulique maritime"", Ed. Eyrolles
2. LARRAS J., 1979, ""Physique de la houle et des lames"", Ed. Eyrolles
3. GRAF W., ""Hydrodynamique"", ""Hydraulique fluviale"", Presses polytechniques et universitaires romandes
4. LEBRETON J.C., 1974, ""Dynamique fluviale"", Ed. Eyrolles

Requirements :

Physics , waves, fluid mechanics, hydraulics

Organisation :

Calculation of swell deformation in the neighbourhood of maritime works.
Dimensioning of coastal protection structures.
Study of the phenomena of erosion and fluvial deposits.

Evaluation :

Mini project (8 hours).

Target :

5GCU

Hydrogeology	GCU09-HYDR
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : LOMINE FRANCK	

Objectives :

Analysis of behaviour of catchments (urbanized and rural) during precipitation events. Determination of discharge hydrographs and maximum discharging rates. Design of drainage systems.

Content :

1. Characteristics of catchments
2. Statistical analysis of the pluviometric data.
3. Rain-flow transformation
4. Flood flow estimation
5. 1st application I : design of drainage systems
6. 2nd application : numerical modelling of the behaviour of catchments and drainage systems

Bibliography :

1. REMENIERAS G., 1976, "Hydrologie de l'ingénieur, Ed. Eyrolles
2. LLAMAS J., 1993, "Hydrologie générale - Principes et applications", Ed. Gaëtan Morin
3. Ministère de l'Agriculture, 1982, "Synthèse nationale des crues de bassins versants"
4. MUSY, A., 2002, "Hydrologie générale ", Ed. EPFL
5. ANCTIL, F., 2005, Hydrologie, Presses Internationales, Polytechnique Montréal

Requirements :

Statistics, Free surface flow, Hydraulics, Hydrogeology

Organisation :

Course + small project

Evaluation :

Small project

Target :

5GCU

Prestressed Concrete	GCU09-BP2
Number of hours : 12.00 h	1.00 ECTS credit
CM : 12.00 h	
Reference Teacher(s) : DARQUENNES AVELINE	

Objectives :

Advanced structures prestressed concrete calculations.

Content :

Indeterminate effects of prestressing
 Case of a cable
 Case of a parabolic cable
 Calculation of indeterminate times
 concordant cable
 Practical calculation of rotations at the ends
 Exercise: 2 slab bridge spans
 shear
 Following rules BPEL
 Next Eurocodes
 Study of about zones (BPEL)
 Action anchors to abouts (single cable)
 Action anchors to abouts (more cables)
 Balance the lower corner

Bibliography :

THONIER H., LE BETON PRECONTRAIT AUX ETATS LIMITES, Presse des Ponts et Chaussées, 1992.
 CHAUSSIN R., FUENTES A., LACROIX R. , PERCHAT J. LA PRECONTRAINTTE, Presse des Ponts et Chaussées 1992
 FAVRE R., JACCOUD J.-P., BURDET O. et CHARIF H., Dimensionnement des structures en béton, Presses Polytechniques et Universitaires Romandes, 2004

Requirements :

Reinforced concrete, prestressed concrete

Organisation :

Evaluation :

Small project

Target :

5GCU

Bridges and Infrastructures	GCU09-POUV
Number of hours : 36.00 h	2.00 ECTS credit
CM : 36.00 h	
Reference Teacher(s) : SOMJA HUGUES	

Objectives :

Learning of the general principles of the design of bridges, with account of :

- the different roles of the bridges
- the mechanical design
- the constitutive materials
- the erection phases

The project consists in the design of a bridge from the scratch.

Content :

1. Bridge schemes and classification
2. Piers, abutments, support systems
3. Concrete and prestressed concrete bridges
4. Steel bridges
5. Arch bridges, cable stayed bridges
6. Erection of the bridges
7. Dynamic loadings :High speed trains, footbridges, seismic action

Bibliography :

1. CREMER J.M. , "PONTS", notes de cours, université de Liège, 2006.
2. APK, 1996, "construction métallique et mixte acier-béton", tomes 1 et 2, éditions Eyrolles
3. MAQUOI R. , Cours de construction métallique, université de Liège
4. CD ROM ESDEP, leçons de construction métallique, APK, 1999

Requirements :

Steel and concrete design, dynamic and stability analysis

Organisation :

Lectures, and project made by groups of two students

Evaluation :

By the project

Target :

5GCU

Composite Steel - Concrete Structures	GCU09-CMX
Number of hours : 24.00 h	1.50 ECTS credit
CM : 24.00 h	
Reference Teacher(s) : GUEZOULI SAMY	

Objectives :

Provide students with the basic concepts useful to calculate and design such type of construction. Composite structure offers many economic benefits as in the field of bridges than buildings. This type of construction is in full development in Europe.

Content :

1. Basic concepts, terminology and areas of application (beams - columns and slabs).
2. Designs buildings and structures, development of calculation methods and codes, Eurocode 4.
3. Study of composite sections: elastic and plastic flexural strength, local buckling and shear, lateral torsional buckling. Classification of composite sections.
4. Load combinations ULS-SLS and pre-design (global analyzes cracked and uncracked). Connection design.
5. Fatigue continuous bridge girders
6. Verifications for composite piles and slabs.
7. Fire resistance.
8. Numerical Modeling.

Bibliography :

1. Comité Européen de Normalisation, 1992, Eurocode 4 - Partie 1,1
2. JOHNSON R.P., 1994, "Composite Structures of Steel and Concrete", Blackwell Scientific Publications
3. A.P.K., 1996, "Construction Métallique et Mixte Acier-Béton", chapitre 8, Ed. Eyrolles
4. A.F.P.C., 1997, "Calcul des ouvrages généraux de construction", chapitre 8, "Modélisation des ouvrages mixtes acier- béton avec leur connexion", Ed. Hermes

Requirements :

Elastic theory of structures and plastic calculations.

Organisation :

Revision of course, personal exercises to perform: 20 hours.

Evaluation :

1 mini-project different for each (Option Buildings and TP).

Target :

5GCU (Options Buildings and TP).

English S9 Conversation	HUM09-ANGL-CONV
Number of hours : 10.00 h	1.50 ECTS credit
TD : 10.00 h, TD : 10.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :

- Improving communication skills in everyday life situations as well as in a professional or social context.
- Obtaining or reinforcing C1 level, strongly advised/recommended by the CTI. t.

Content :

- Learning by doing: students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.
- Expressing oneself accurately and fluently: students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :

1. English Grammar in Use (Cambridge University Press)
2. Dictionnaire Collins Cobuild
3. Polycopié de l' INSA

Requirements :

Having taken and passed the TOEIC test during the previous two years (800 required) or any other B2 certification recognized by the CTI.

Organisation :

- Each class lasts one hour and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.
- Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet.

Evaluation :

Continuous assessment: The final mark (out of 20) will be based on the attendance rate and the personal implication of the student during the class.

Target :

TOEIC 5th year	HUM09-ANGL-TOEIC
Number of hours : 20.00 h	1.50 ECTS credit
TD : 20.00 h, TD : 20.00 h	
Reference Teacher(s) : LE VOT PHILIPPE	

Objectives :

- Improving communication skills in everyday life situations as well as in company and business context.
- Obtaining or reinforcing the B2 level requested by the CTI.
- Obtaining 800 score at the final TOEIC test.

Content :

Learning by doing : students will have to be able to speak and listen, write a document while showing they can solve problems, reason, convince and demonstrate in an articulate manner.

Expressing oneself accurately and fluently : students will engage in activities requiring creative and reactive skills such as debates, role-plays, individual oral Power Point presentations, projects, based on scientific topics and current events.

Bibliography :

- English grammar in Use, Intermediate Edition (CUP)
- Robert and Collins bilingual dictionary or Collins Cobuild

Requirements :

Not having already taken and passed the TOEIC test during the previous two years
B1/B2 level advised

Organisation :

Each class lasts two hours and most classrooms are equipped with video and audio. A multimedia lab and computer rooms are also available for the students to work in a stimulating environment.

Teaching resources include press articles, audio and video documents (TV reports, extracts from films and series) as well as the Internet. B2 level tests are also taken throughout the course.

Evaluation :

Final mark based on :

TOEIC score at final exam + attendance (more than 4 non justified absences result in 0/20 mark).

Target :

5th year students who haven't already passed their TOEIC

Economics, Law and Business Studies A (Lean six sigma)	HUM09-PM-A
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :

This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:

- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :

* Lean Six Sigma (28h / in French)

Lean Six Sigma is a methodology that enables firms to make their processes more effective and efficient. It's the current industry standard for process improvement designed to reduce waste and enhance output quality.

* Law (8h / in French)

Main principles of the French legal system

Bibliography :

Given during the course

Requirements :

ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :

This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :

Continuous assessment (collective work)

Target :

Economics, Law and Business Studies B (Human Resource Management)	HUM09-PM-B
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :

This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:

- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :

- * Human Resource Management (20h / in French)
 - Main current challenges of Human Resource Management
 - Human Resource Management's tools and organization
 - Focus on how team managers deal with Human Resource Management
- * Law (8h / in French)
 - Main principles of the French legal system
- * Social legislation (8h / in French)
 - Main principles of French social legislation
 - Employment contract

Bibliography :

Given during the course

Requirements :

ECONOMICS AND BUSINESS MANAGEMENT - 1
 ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :

This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :

Continuous assessment (collective work)

Target :

Economics, Law and Business Studies C (Human Resources Management)	HUM09-PM-C
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :

This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:

- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field)
- Understanding the importance of teamwork: making collective decisions and producing the expected work in time

Content :

- * Human Resource Management (20h / in French)
 - Main current challenges of Human Resource Management
 - Human Resource Management's tools and organization
 - Focus on how team managers deal with Human Resource Management
- * Law (8h / in French)
 - Main principles of the French legal system
- * Social legislation (8h / in French)
 - Main principles of French social legislation
 - Employment contract

Bibliography :

Given during the course

Requirements :

ECONOMICS AND BUSINESS MANAGEMENT - 1
 ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :

This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :

Continuous assessment (collective work)

Target :

Economics, Law and Business Studies D (MANAGEMENT - ETHICS - RESPONSIBILITY)	HUM09-PM-D
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :

This course aims at enabling students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:

- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :

The program's main objective is to provide a multidisciplinary approach to the field of innovation, strategy and industrial design. This course will give an overview of the innovative process.

During this program, participants will have the opportunity to explore a business case covering the first stage of a product development project.

Bibliography :

Given during the course

Requirements :

ECONOMICS AND BUSINESS MANAGEMENT - S7 and S8

Organisation :

This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :

Continuous assessment (collective work)

Target :

Economics, Law and Business Studies E (International Strategy and Development)	HUM09-PM-E
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : GOURRET FANNY	

Objectives :

This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:

- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time.

Content :

This course provides students with the tools necessary to understand and work effectively in today's international economic environment. It explores how innovative firms address new markets and compete outside their national frontiers. The course focuses on strategic choices regarding effective actions in international business.

Bibliography :

Given during the course

Requirements :

ECONOMICS AND BUSINESS MANAGEMENT - 1
ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :

This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :

Continuous assessment (collective work)

Target :

Economics, Law and Business Studies F (sustainable development)	HUM09-PM-F
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 h, TD : 4.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :

This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:

- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :

- Project Management (28 h / in French)
 - Efficient Project Management tools and organization according to PMI (Project Management Institute)
 - Agility
 - SCRUM
- Law (8 h / in French)
 - Main principles of the French legal system

Bibliography :

Given during the course

Requirements :

ECONOMICS AND BUSINESS MANAGEMENT - 1
 ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :

This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advice to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :

Continuous assessment (collective work)

Target :

Evaluation stage	EII09-EVST
Number of hours : 5.00 h	1.00 ECTS credit
EP : 1.00 h, EP : 1.00 h, TA : 4.00 h, TA : 4.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Economics, Law and Business Studies G (serious game)	HUM09-PM-G
Number of hours : 34.00 h	2.00 ECTS credit
CM : 30.00 h, CM : 30.00 h, TD : 4.00 h, TD : 4.00 h	course taught in English
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :

This course aims to enable students to develop specific management skills in accordance with their personal objectives and professional motivations. Students chose one option among six.

Main learning outcomes are:

- Establishing a strong, specific vocabulary base
- Understanding the main issues that industrial companies deal with (in a specific management field).
- Understanding the importance of teamwork : making collective decisions and producing the expected work in time

Content :

* Business Simulation (serious game) (28h / in English)

The business simulation *Global Challenge* (a CESIM product) has been designed to improve the understanding and knowledge of the complexity of global business operations in a dynamic, competitive environment. It focuses on strategic management, international management and business policy.

The task for the student teams is to manage a global mobile telecommunications company as its technology and markets evolve. Students will develop and execute strategies for their simulated company operating in the USA, Asia, and Europe.

The simulation is based on an online platform that allows students to play in their own language (many languages available: English, Spanish, Portuguese, Chinese, etc.).

* Law (8h / in French)

Main principles of the French legal system

Bibliography :

Given during the course

Requirements :

ECONOMICS AND BUSINESS MANAGEMENT - 1

ECONOMICS AND BUSINESS MANAGEMENT - 2

Organisation :

This course is opened to students with different engineering backgrounds. Students work together in small groups and gather the necessary information and advices to set out a final report. Groups also benefit from conferences and tutorial sessions performed by professional speakers.

Evaluation :

Continuous assessment (collective work)

Target :

Societal responsibility of business	EII09-HUMT
Number of hours : 20.00 h	1.00 ECTS credit
CM : 20.00 h, CM : 20.00 h	
Reference Teacher(s) : BOUGUENNEC CHRISTELLE	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Evaluation stage	EII09-EVST
Number of hours : 5.00 h	1.00 ECTS credit
EP : 1.00 h, EP : 1.00 h, TA : 4.00 h, TA : 4.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :

Legal Training for Engineers	INF09-DROIT
Number of hours : 20.00 h	2.00 ECTS credit
CM : 20.00 h, CM : 20.00 h	
Reference Teacher(s) :	

Objectives :

To give to final-year engineers, whether or not in project manager positions, the key legal concepts for understanding the protection of intellectual creations and software, the contractual mechanisms for producing software content, and the terms of software licenses.

Content :

5 independent modules CM1 to CM5

CM1: COMPUTER CREATIONS AND ACTORS

CM 2: GENERIC CONTRACTUAL STRUCTURES AND RESPONSIBILITIES

CM 3: SPECIFIC CONTRACTUAL STRUCTURES

CM 4: SOFTWARE LICENSES (INCLUDING GPL)

CM 5: CREATION AND ADMINISTRATION OF WEB SITES

Bibliography :

On the internet : <http://www.legalis.net/>

Books : Informatique, T_I_coms, Internet - Ed Francis Lefebvre 2012

Requirements :

passing the introductory module to general law (8H Lectures)

Organisation :

Lectures (7 x 2H)

Evaluation :

final exam

Target :

Conferences	SRC09-SPEC
Number of hours : 16.00 h	1.00 ECTS credit
CM : 16.00 h, CM : 16.00 h	
Reference Teacher(s) :	

Objectives :

Teaching students the fundamentals of Project Management and practice within specific projects.

Content :

Project's Organization

Planning, analysis and formalization of individual and team goals.

Methodological tools for project management

Analysis of deviations from the specifications

Risk Management

All the concepts covered in this course will be applied to a specific case study within dedicated projects (SRC09

TCBE

module).

Bibliography :

Requirements :

Organisation :

Evaluation :

Oral defense of the project (Implementation of the lecture's concepts)

Target :

SRC09-CONFERENCES	SRC09-CONF
Number of hours : 16.00 h	1.00 ECTS credit
CM : 16.00 h, CM : 16.00 h	
Reference Teacher(s) : PREVOTET JEAN-CHRISTOPHE	

Objectives :

Industrial or academic experts in various domains present small talks (typically 2h) about technical and scientific issues in their domain. The main idea is to open students to the world of industry and research and make them sensitive to state of the art issues.

Content :

The talks may vary depending on the availability of experts

Bibliography :

Requirements :

Organisation :

Evaluation :

PASS if every session is attended, FAIL otherwise.

Target :

5SRC and 5M&N

Semestre 10

Parcours Formation Initiale GCU

1	GCU-PFE10		PROJET DE FIN D'ETUDES	30.00
	GCU10-PFE	O	Final Year Project	30.00

O = compulsory, C= in choice , F= optional

Final Year Project	GCU10-PFE
Number of hours : 350.00 h	30.00 ECTS credit
ST : 350.00 h	
Reference Teacher(s) :	

Objectives :

Content :

Bibliography :

Requirements :

Organisation :

Evaluation :

Target :