Detailed Bachelor's program

L2+L3 -TP

(S3, S4, S5,S6)

Semester: 3
Teaching unit: UEF 2.1.1
Subject 1: Mathematics 3
VHS: 67h30 (Lecture: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives: At the end of this course, the student should be able to know the different types of series and their convergence conditions, as well as the different types of convergence.

Recommended prerequisites: Mathematics 1 and Mathematics 2

Contents :

Chapter 1: Simple and multiple integrals 3 weeks
1.1 Review of Riemann integrals and primitive calculus.
1.2 Double and triple integrals.
1.3 Application to the calculation of areas, volumes, ...

Chapter 2: Improper integrals 2 weeks
2.1 Integrals of functions defined on an unbounded interval.
2.2 Integrals of functions defined on a bounded interval, infinite at one end.

Chapter 3: Differential equations 2 weeks
3.1 Reminder of ordinary differential equations.
3.2 Partial differential equations.
3.3 Special functions.

Chapter 4: Series 3 weeks
4.1 Numerical series.
4.2 Function sequences and series.
4.3 Integer series, Fourrier series.

Chapter 5: Fourier transforms 3 weeks
5.1 Definition and properties.
5.2 Application to solving differential equations.

Chapter 6: Laplace transform 2 weeks
6.1 Definition and properties.
6.2 Application to the solution of differential equations.

Evaluation : Continuous assessment: 40%; Final examination: 60%.

References :
1- F. Ayres Jr, Théorie et Applications du Calcul Différentiel et Intégral - 1175 exercices corrigés, McGraw-Hill.
2- F. Ayres Jr, Théorie et Applications des équations différentielles - 560 exercices corrigés, McGraw-Hill.
3- J. Lelong-Ferrand, J.M. Arnaudiès, Cours de Mathématiques - Equations différentielles, Intégrales multiples, Tome 4, Dunod Université.
4- M. Krasnov, Recueil de problèmes sur les équations différentielles ordinaires, Edition de Moscou

5- N. Piskounov, Calcul différentiel et intégral, Tome 1, Edition de Moscou
6- J. Quinet, Cours élémentaire de mathématiques supérieures 3- Calcul intégral et séries, Dunod.
7- J. Quinet, Cours élémentaire de mathématiques supérieures 4- Equations différentielles, Dunod.

Semester: 3
Teaching unit: UEF 2.1.1
Subject 2: Waves and Vibrations
VHS: 45h00 (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives: Introduce students to the phenomena of mechanical vibrations restricted to low-amplitude 1 or 2 degrees of freedom, as well as the study of mechanical wave propagation.

Recommended prerequisites: Mathematics 2, Physics 1 and Physics 2

Contents :
Part A: Vibrations

Chapter 1: Introduction to Lagrange equations 2 weeks
1.1 Lagrange equations for a particle
1.1.1 Lagrange equations
1.1.2 Case of conservative systems
1.1.3 Case of velocity-dependent friction forces
1.1.4 Case of a time-dependent external force
1.2 Systems with several degrees of freedom.

Chapter 2: Free oscillations of one-degree-of-freedom systems 2 weeks
2.1 Undamped oscillations
2.2 Free oscillations of damped systems

Chapter 3: Forced oscillations of one-degree-of-freedom systems 1 week
3.1 Differential equation
3.2 Mass-spring-damper system
3.3 Solution of the differential equation
3.3.1 Harmonic excitation
3.3.2 Periodic excitation
3.4 Mechanical impedance

4: Free oscillations of systems with two degrees of freedom 1 week
4.1 Introduction
4.2 Systems with two degrees of freedom

Chapter 5: Forced oscillations of two-degree-of-freedom systems 2 weeks
5.1 Lagrange equations
5.2 Mass-spring-damper system
5.3 Impedance
5.4 Application
5.5 Generalization to systems with n degrees of freedom

Part B: Waves

Chapter 1: One-dimensional propagation phenomena 2 weeks

1.1 Generalities and basic definitions

1.2 Propagation equation
1.3 Solution of the propagation equation
1.4 Progressive sinusoidal wave
1.5 Superposition of two sinusoidal traveling waves

Chapter 2: Vibrating strings 2 weeks

2.1 Wave equation
2.2 Harmonic traveling waves
2.3 Free oscillations of a string of finite length
2.4 Reflection and transmission

Chapter 3: Acoustic waves in fluids 1 week

3.1 Wave equation
3.2 Sound velocity
3.3 Progressive sinusoidal wave
3.4 Reflection-Transmission

Chapter 4: Electromagnetic waves 2 weeks

4.1 Wave equation
4.2 Reflection-Transmission
4.3 Different types of electromagnetic waves

Assessment method : Continuous assessment: 40%; Final examination: 60%.

Bibliographical references:

1. H. Djelouah ; Vibrations et Ondes Mécaniques - Cours & Exercices (site de l'université de l'USTHB : perso.usthb.dz/~hdjelouah/Coursvom.html)
2. T. Becherrawy ; Vibrations, ondes et optique ; Hermes science Lavoisier, 2010
3. J. Brac ; Propagation d'ondes acoustiques et élastiques ; Hermès science Publ. Lavoisier, 2003.
4. R. Lefort ; Ondes et Vibrations ; Dunod, 2017
5. J. Bruneaux ; Vibrations, ondes ; Ellipses, 2008.
6. J.-P. Perez, R. Carles, R. Fleckinger ; Electromagnetism

Semester: 3
Teaching unit: UEF 2.1.2
Subject 3 : Fluid Mechanics
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives: Introducing the student to the field of fluid mechanics, fluid statics will be detailed in the first part. In the second part, the study of the motion of non-viscous fluids will be considered, and finally real fluid motion will be studied.

Recommended prior knowledge : /

Contents :
Chapter 1: Properties of fluids (3 weeks)
Physical definition of a fluid: states of matter, divided matter (dispersion, suspensions, emulsions)
Perfect fluid, real fluid, compressible fluid and incompressible fluid.
Mass density, density Fluid rheology, fluid viscosity, fluid surface tension

Chapter 2: Fluid Statics (4 weeks)
Definition of pressure, pressure at a fluid point, Fundamental law of fluid statics, Level surface
Pascal's theorem, Calculation of pressure forces: flat plate (horizontal, vertical, oblique), center of thrust, instruments for measuring static pressure, measurement of atmospheric pressure, barometer, Torricelli's law 2. Pressure for non-miscible fluids on top of each other.

Chapter 3: Perfect incompressible fluid dynamics (4 weeks)
Continuous flow, continuity equation, mass flow and volume flow, Bernoulli's theorem, cases without work exchange and with work exchange, Applications to flow and velocity measurements: Venturi, Diaphragms, Pitot tubes...Euler's theorem

Chapter 4: Real incompressible fluid dynamics (4 weeks)
Flow regimes, Reynolds experiment, Dimensional analysis, Vashy-Buckingham theorem, Reynolds number 3. Linear and singular, linear and singular pressure drops, Moody diagram.
Generalization of Bernoulli's theorem to real fluids

Assessment method : Continuous assessment: 40%; Final examination: 60%.

Bibliographical references:

1- R. Comolet, ‘Mécanique des fluides expérimentale’, Tome 1, 2 et 3, Ed. Masson et Cie.
2- R. Ouziaux, ‘Mécanique des fluides appliquée’, Ed. Dunod, 1978
3- B. R. Munson, D. F. Young, T. H. Okiishi, ‘Fundamentals of fluid mechanics’,Wiley & sons.
4- R. V. Gilles, ‘Mécanique des fluides et hydraulique : Cours et problèmes’, Série Schaum, Mc Graw Hill, 1975.
5- C. T. Crow, D. F. Elger, J. A. Roberson, ‘ Engineering fluid mechanics’,Wiley & sons
6- R.W. Fox, A. T. Mc Donald, ‘Introduction to fluid mechanics’, fluid mechanics’

Semester: 3
Teaching unit: UEF 2.1.2
Subject 4 : Rational Mechanics
VHS: 45h00 (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives: The student will be able to grasp the nature of a problem (static, kinematic or dynamic) in solid mechanics, and will have the tools to solve the problem within the framework of classical mechanics. This subject is a prerequisite for the subjects: RDM and analytical mechanics.

Recommended prerequisites: Physics 1 and Mathematics 2

Contents :
Chapter 1: Mathematical review (elements of vector calculus) (1 week)
Chapter 2: Generalities and basic definitions (2 weeks)
Definition and physical meaning of force, Mathematical representation of force
Operations on force (composition, decomposition, projection), Type of force: point, line, surface, volume, Force classification: internal forces, external forces. Mechanical models: material point, solid body.

Chapter 3: Statics (3 weeks)
Axioms of statics, Links, supports and reactions , Axiom of links , Equilibrium conditions

Chapter 4: Kinematics of rigid solids (3 weeks)
Brief review of kinematic quantities for a point-material., Kinematics of a solid body, Translational motion, Rotational motion about a fixed axis, Planar motion, Compound motion.

Chapter 5: Geometry of mass (3 weeks)
Mass of a material system: Système continu, Discrete System
Integral Formulation of the Center of Mass: Definitions (Linear, Surface, and Volume Cases), Discrete Formulation of the Center of Mass, Guldin's Theorems, Moment and Product of Inertia of Solids, Inertia Tensor of a Solid, Special Cases, Principal Axes of Inertia, Huyghens' Theorem, Moment of Inertia of Solids with Respect to an Arbitrary Axis

Chapter 6. Dynamics of Rigid Solids (3 weeks)

Brief Review of Dynamic Quantities for a Material Point, Elements of Rigid Body Kinetics:, Momentum Angular Momentum, Kinetic Energy, Equation of Dynamics for a Solid Body, Angular Momentum Theorem, Kinetic Energy Theorem, Applications: Pure Translation, Rotation about a Fixed Axis, Combined Translation and Rotation.
Assessment Method: Continuous Assessment: 40%; Final Exam: 60%.
Bibliographic References:
1. Elements of Rational Mechanics. S. Targ. Mir Publishing, Moscow
2. Mechanics for Engineers. STATICS. Russell Publishing, Ferdinand P. Beer
3. General Mechanics. Lectures and Corrected Exercises. Sylvie Pommier. Yves Berthaud. DUNOD.
4. General Mechanics - Theory and Application, Editions Séries. MURAY R. SPIEGEL Schaum, 367p.
5. General Mechanics - Exercises and Solved Problems with Course References, Office of University Publications, Tahar HANI 1983, 386p.

Semester: 3
Teaching Unit: Fundamental Teaching Unit 2.1
Course 1: Probability & Statistics
VHS: 45h00 (Course: 1h30, Tutorials : 1h30)
Credits: 4
Coefficient: 2

Course Objectives: This module allows students to learn the essential concepts of probability and statistics, namely: statistical series with one and two variables, probability on a finite universe, and random variables.

Recommended Prior Knowledge: Programming basics acquired in Math 1 and Math 2

Course Content:
Part A: Statistics
Chapter 1. Basic Definitions (1 week) Concepts of population, sample, variables, modalities Different types of statistical variables: qualitative, quantitative, discrete, continuous.

Chapter 2. Statistical Series with One Variable (3 weeks)
Frequency, Percentage. Cumulative frequency. Graphical representations: band diagram, pie chart, bar chart. Frequency polygon. Histogram. Cumulative curves. Position characteristics Dispersion characteristics: range, variance and standard deviation, coefficient of variation. Shape characteristics.

Chapter 3. Statistical Series with Two Variables (3 weeks)
Data tables (contingency table). Scatter plot. Marginal and conditional distributions. Covariance. Linear correlation coefficient. Regression line and Mayer's line. Regression curves, regression corridor and correlation ratio. Functional adjustment.

Part B: Probabilities
Chapter 1. Combinatorial Analysis (1 Week)
Arrangements, Combinations, Permutations.

Chapter 2. Introduction to Probabilities (2 weeks)
Algebra of events, Definitions, Probabilityspaces, General theorems of probabilities

Chapter 3: Conditioning and Independence (1 week)
Conditioning, Independence, Bayes' formula.

Chapter 4. Random Variables (1 Week) Definitions and properties, Distribution function, Mathematical expectation, Covariance and moments.

Chapter 5. Common Discrete Probability Distributions (1 Week) Bernoulli, binomial, Poisson.

Chapter 6. Common Continuous Probability Distributions (2 Weeks)
Uniform, normal, exponential

Evaluation Method: Continuous assessment: 40%; Final exam: 60%.
Bibliographic References:

[1] D. Dacunha-Castelle and M. Duflo. Probabilités et statistiques : Problèmes à temps fixe. Masson, 1982.
[2] J.-F. Delmas. Introduction au calcul des probabilités et à la statistique. Polycopié ENSTA, 2008.
[3] W. Feller. An introduction to probability theory and its applications, volume 1. Wiley and Sons, Inc., 3rd edition, 1968.

[4] G. Grimmett and D. Stirzaker. Probability and random processes. Oxford University Press, 2nd edition, 1992.
[5] J. Jacod and P. Protter. Probability essentials. Springer, 2000.
[6] A. Montfort. Cours de statistique mathématique. Economica, 1988.
[7] A. Montfort. Introduction à la statistique. Ecole Polytechnique, 1991

Semester : 3
Teaching Unit: UEM 2.1
Subject 2 : Computer Science 3
VHS : 22h30 (TP : 1h30)
Credits : 2
Coefficient : 1

Subject Objectives: To teach students programming using easily accessible software (primarily: Matlab, Scilab, Mapple, etc.). This subject will be used as a tool for completing numerical methods practical work in Year 4.

Recommended Prior Knowledge: Computer Science 1 and 2

Course Content:
Laboratory Work 1: Introduction to a Scientific Programming Environment (1 week)
Laboratory Work 2: Script Files and Data and Variable Types (2 weeks)
Laboratory Work 3: Reading, Displaying, and Saving Data (2 weeks)
Laboratory Work 4: Vectors and Matrices (2 weeks)
Laboratory Work 5: Control Instructions (For and While Loops, If and Repeat Instructions) (2 weeks)
Laboratory Work 6: Function Files (2 weeks)
Laboratory Work 7: Graphics (Managing Graphics Windows, Plotting) (2 weeks)
Laboratory Work 8: Using Toolbox (2 weeks)

Assessment Method: Continuous Assessment: 100%.

Bibliographic References:
1. Getting Started with Algorithms with MATLAB and SCILAB / Jean-Pierre Grenier, . - Paris: Ellipses, 2007. - 160 p.
2. Scilab from Theory to Practice / Laurent Berger, . - Paris: D. Booker, 2014.
3. Programming and Simulation in Scilab / Bégyn Arnaud, Gras Hervé, Grenier Jean-Pierre, - Paris: Ellipses, 2014 . - 160 p.
4. Computer Science: Programming and Scientific Computing in Python and Scilab for 1st and 2nd Year Scientific Preparatory Classes / Thierry Audibert, ; Amar Oussalah ; Maurice Nivat, . - Paris: Ellipses, 2010 . - 520 p.

Semester: 3
Course Unit: UEM 2.1
Subject 3: Technical Drawing
VHS: 22:30 (Laboratory: 1:30)
Credits: 2
Coefficient: 1

Course Objectives: This course will allow students to acquire the principles of representing parts in industrial drawing. Furthermore, this subject will enable students to represent and read plans.

Recommended Prior Knowledge: /

Course Content

Chapter 1. General Information (2 Weeks)

1.1 Uses of Technical Drawings and Different Types of Drawings
1.2 Drawing Materials
1.3 Standardization (Line Types, Writing, Scale, Drawing Format and Folding, Title Block, etc.)

Chapter 2. Elements of Descriptive Geometry (6 Weeks)

2.1 Concepts of Descriptive Geometry
2.2 Orthogonal Projections of a Point - Drawing of a Point - Orthogonal Projections of a Line (Any and Specific Positions) - Drawing of a Line - Traces of a Line - Projections of a Plane (Any and Specific Positions) - Traces of a Plane 2.3 Views: Choice and arrangement of views – Dimensioning – Slope and taper – Determining the third view from two given views.
2.4 Method of drawing (layout, 45° line, etc.)
Application exercises and assessment (Laboratory work)

Chapter 3. Perspectives (2 Weeks)

Different types of perspectives (definition and purpose). Application exercises and assessment (Laboratory work).

Chapter 4. Sections and cuts (2 Weeks)

4.1 Sections, standardized representation rules (hatching).
4.2 Projections and sections of simple solids (Projections and sections of a cylinder, a prism, a pyramid, a cone, a sphere, etc.).
4.3 Half-section, partial sections, broken sections, sections, etc.
4.4 Technical Vocabulary (terminology of machined shapes, profiles, piping, etc.)
Application Exercises and Assessment (Laboratory).

Chapter 5. Dimensioning (2 Weeks)

5.1 General Principles.
5.2 Dimensioning, Tolerancing, and Adjustment.
Application Exercises and Assessment (Laboratory).

Chapter 6. Concepts of Definition and Assembly Drawings and Bills of Materials (1 Week)

Application Exercises and Assessment (Laboratory).

Assessment Method: Continuous Assessment: 100%.

Semester: 3
Teaching Unit: UED 2.1
Subject 1: Basic Technology
Total Hours: 45h00 (22h30 of Lectures: 1h30 each)
Credits: 1
Coefficient: 1

Learning Objectives:
This course will enable students to acquire knowledge about the processes of obtaining and manufacturing parts, as well as techniques for their assembly.
Recommended Prerequisite Knowledge:
(Not specified, can be added later)
Course Content:

Chapter 1: Materials (3 Weeks)
1.1 Metals and alloys and their designations
1.2 Plastics (polymers)
1.3 Composite materials
1.4 Other materials

Chapter 2: Processes for Obtaining Parts Without Material Removal (4 Weeks)
2.1 Casting, forging, stamping, rolling, drawing, extrusion, etc.
2.2 Shearing, bending, and deep drawing, etc.
2.3 Sintering and powder metallurgy
2.4 Profiles and pipes (in steel, aluminum)
- Workshop visits

Chapter 3: Processes for Obtaining Parts by Material Removal (4 Weeks)
Turning, milling, drilling, fitting, etc.
Workshop visits and demonstrations

Chapter 4: Assembly Techniques (4 Weeks)
Bolting, riveting, welding, etc.

Assessment Method:
Final exam: 100%

Bibliographic References:
2. MemoTech : productique materiaux et usinage BARLIER C. Ed. Casteilla
3. Sciences industrielles MILLET N. ed. Casteilla
4. MemoTech : Technologies industrielles BAUR D. et al , Ed. Casteilla
5. Metrologie dimensionnelle CHEVALIER A. Ed. Delagrave
6. Percage, fraisage JOLYS R et LABELL R. Ed. Delagrave
7. Guide des fabrications mecaniques PADELLA P. Ed. Dunod
8. Technologie : premiere partie, Ben Saada S et FELIACHI d. Ed. OPU Alger

Semester: 3
Teaching Unit: UED 2.1
Subject 2: Metrology
Total Hours: 22h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Teaching Objectives: To teach students the criteria for manufacturing and assembly precision of parts; to know and select appropriate methods and tools for measuring and inspecting dimensions and defects in mechanical parts.

Recommended Prerequisites: Trigonometry, optics, and others**.**

Course Content

Chapter 1. Generalities on Metrology (2 Weeks)

1.1 Definition of different types of metrology (Scientific/laboratory, legal, industrial);
1.2 Metrological vocabulary and definitions;
1.3 National and international metrology institutions.

Chapter 2. The International System of Units (SI) (3 Weeks)

2.1 Base quantities and their units of measurement;
2.2 Supplementary quantities;
2.3 Derived quantities.

Chapter 3. Metrological Characteristics of Measuring Instruments (6 Weeks)

3.1 Error and uncertainty (accuracy, precision, repeatability, reproducibility of a measuring instrument);
3.2 Classification of measurement errors (gross value, systematic error, corrected gross value);
3.3 Random errors (random errors, parasitic errors, estimated systematic errors);
3.4 Confidence interval; standard uncertainty; total measurement uncertainty;
3.5 Complete measurement result;
3.6 Identification and interpretation of specifications in a definition drawing for inspection;
3.7 Basics on gauges, jigs, and simple measuring instruments.

Chapter 4. Measurement and Inspection (4 Weeks)

4.1 Direct measurement of lengths and angles (using rulers, calipers, micrometers, and protractors);
4.2 Indirect measurement (using comparators, gauge blocks);
4.3 Dimensional inspection (using plugs, jaws);
4.4 Measuring and inspection machines used in mechanical workshops (pneumatic comparators, profile projectors, surface roughness testers).

Semester: 3
Course Unit: UET 2.1
Subject 1: Technical English
VHS: 22:30 (Lecture: 1:30)
Credits: 1 Coefficient: 1

Teaching objectives: The aim of this course is to enable students to reach a level where they can use a scientific document and talk about their specialty and field in English at least with ease and clarity.

Recommended prior knowledge: English 1 and English 2

Subject content

1. Oral comprehension and expression, acquisition of vocabulary, grammar... etc. - nouns and adjectives, comparatives, following and giving instructions, identifying things.
2. Use of numbers, symbols, equations.
3. Measurements: length, area, volume, power, etc.
4. Describing scientific experiments.
5. Characteristics of scientific texts.

NB: Courses are taught largely or entirely in English.

Evaluation: Final exam: 100%.

Bibliographical references:

Semester: 4
Course Unit: UEF 2.2.1
Subject 1: Soil Mechanics
VHS: 45 hours (Lecture: 1.5 hours, Tutorial: 1.5 hours)
Credits: 4
Coefficient: 2

Course Objectives: The student will be able to characterize the physical parameters of soils, classify them based on laboratory and in-situ identification tests, and become familiar with soil flows. They will also become familiar with soil settlement and consolidation.

Recommended Prior Knowledge: Fundamental subjects from Semesters 1, 2, and 3

Subject Content:

Chapter 1. Introduction to Soil Mechanics (2 weeks)
Purpose of Soil Mechanics (History and Scope of Application), Definitions of Soils, Origin and Formation of Soils, Soil Structure (Coarse-Grained and Fine-Grained Soils).

Chapter 2. Identification and Classification of Soils (4 weeks)
Physical Characteristics, Granulometric Analysis, Consistency of Fine-Grained Soils (Atterberg Limits), Soil Classification.

Chapter 3. Soil Compaction (3 weeks)
Compaction theory, Laboratory compaction tests (Normal and Modified Proctor tests),
Special in-situ compaction equipment and processes, Compaction requirements and control.

Chapter 4: Water in Soil (3 weeks)
Water flow in soils: velocity, gradient, rate, Darcy's law, permeability,
Measurement of permeability in the laboratory and in-situ, Principle of effective stress.

Chapter 5. Soil Settlement and Consolidation (3 weeks)
Determination of stresses due to overloading, Boussinesq's theory (point and distributed load), Settlement amplitude: Instantaneous settlement, primary settlement, and secondary settlement, Soil compressibility: Characteristics of the compressibility curve, Determination of the compressibility curve from laboratory tests, Terzaghi's one-dimensional consolidation theory.

Assessment Method: Final exam: 100%

Bibliographic References:
1. COSTET J. et SANGLERAT G, "Cours pratique de mécanique des sols", Tome 1, Dunod, 1981.
2. SANGLERAT G., CAMBOU B., OLIVARI G. "Problèmes pratiques de Mécanique des sols, Tome 1, Dunod, 1983.
3. AMAR S. et MAGNAN J.P. "Essais de mécanique des sols en laboratoire et en place,", publié par LCPC, 1980.
4. SCHLOSSER F. "Éléments de mécanique des sols, 2e Ed., Presses de l'Ecole Nationale des Ponts et Chaussées", 1997.

Semester: 4
Course Unit: UEF 2.2.1
Subject 2: Construction Materials
VHS: 22:30 (Lecture: 1.5 hours)
Credits: 2
Coefficient: 1

Course Objectives: The student will be able to characterize the physical and mechanical parameters of construction materials.

Recommended Prior Knowledge: Fundamental subjects from Semesters 1, 2, and 3

Subject Content:

Chapter 1: General (2 weeks)

History of construction materials, Classification of construction materials, Properties of construction materials.

Chapter 2: Aggregates (4 weeks)

Grading, Classification of aggregates, Characteristics of aggregates, Different types of aggregates.

Chapter 3: Binders (6 weeks)

Classification, Air binders (air lime), Hydraulic binders (Portland cement), Main components and additions

Chapter 4: Mortars (3 weeks)

Composition, Different types of mortars (lime mortar, cement mortar), Main characteristics

Assessment method: Final exam: 100%.

References:

1- Materials Volume 1, Properties, Applications, and Design: Courses and Exercises: Bachelor's and Master's Degrees, Engineering Schools, Dunod Publishing, 2013.
2- Concrete Admixtures, Afnor, 2012.
3- Aggregates, Soils, Cements, and Concrete: Characterization of Civil Engineering Materials through Laboratory Testing:
STI Civil Engineering Final Year, BTS Building, BTS Public Works, DUT Civil Engineering, Master's Degree in Geosciences and Civil Engineering, Engineering Schools, Casteilla, 2009.
4- Physicochemical Properties of Construction Materials: Matter and Materials, Rheological and Mechanical Properties, Safety and Regulations, Thermal, Hygroscopic, Acoustic, and Optical Behavior, Eyrolles, 2012.

Semester : 4
Unité d'enseignement: UEF 2.2.2
Matière 1 : Mathematics 4
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Crédits: 4
Coefficient: 2

Course Objectives: This course focuses on the differential and integral calculus of complex functions of a complex variable. Students should be proficient in the various techniques for solving functions and integrals with complex and special variables.

Recommended Prior Knowledge: Mathematics 1, Mathematics 2, and Mathematics 3.

Course Content:
Functions with Complex Variables and Special Functions
Chapter 1: Holomorphic Functions. Cauchy-Riemann Conditions (3 weeks)

Chapter 2: Power Series (3 weeks)
Radius of Convergence. Domain of Convergence. Power Series Expansion. Analytic Functions. Laurent Series and Laurent Series Expansion

Chapter 3: Cauchy Theory (3 weeks)
Cauchy's Theorem; Cauchy Formulas. Singular point of functions, general method for calculating complex integrals

Chapter 4: Applications (4 weeks)
Equivalence between holomorphy and analyticity. Maximum theorem. Liouville's theorem. Rouche's theorem. Residue theorem. Calculation of integrals using the residue method.

Chapter 5: Special Functions (2 weeks)
Euler's special functions: Gamma and Beta functions, applications to integral calculations
Assessment Method: Continuous Assessment: 40%; Examination: 60%.

Bibliographic References:

1- Henri Catan, Théorie élémentaire des fonctions analytiques d'une ou plusieurs variables complexes. Editeur Hermann, Paris 1985.
2- Jean Kuntzmann, Variable complexe. Hermann, Paris, 1967.Manuel de premier cycle.
3- Herbert Robbins Richard Courant.What is Mathematics ?, Oxford University Press, Toronto,1978. Ouvrage classique de vulgarisation.
4-Walter Rudin, Analyse réelle et complexe. Masson, Paris, 1975. Manuel de deuxième cycle.

Semester: S4
Teaching Unit: Fundamental Teaching Unit 2.2.2
Course 2: Numerical Methods
VHS: 45h00 (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching Objectives: Familiarization with numerical methods and their applications in the field of mathematical calculations.

Recommended Prior Knowledge: Mathematics 1, Mathematics 2, Computer Science 1 and Computer Science 2

Course Content:

Chapter 1: Resolution of Non-linear Equations f(x)=0 (3 weeks)

Introduction to calculation errors and approximations, Introduction to methods for solving non-linear equations, Bisection method, Successive approximations method (fixed point), Newton-Raphson method.

Chapter 2: Polynomial Interpolation (2 weeks)

General introduction, Lagrange polynomial, Newton polynomials.

Chapter 3: Function Approximation (2 weeks)

Approximation method and quadratic mean, Orthogonal or pseudo-orthogonal systems, Approximation by orthogonal polynomials, Trigonometric approximation.

Chapter 4: Numerical Integration (2 weeks)

General introduction, Trapezoid method, Simpson's method, Quadrature formulas.

Chapter 5: Resolution of Ordinary Differential Equations (initial condition or Cauchy problem) (2 weeks)

General introduction, Euler method, Improved Euler method, Runge-Kutta method.

Chapter 6: Direct Resolution Methods for Systems of Linear Equations (2 weeks)

Introduction and definitions, Gauss method and pivoting, LU factorization method, Choeleski factorization method, Thomas algorithm (TDMA) for tridiagonal systems.

Chapter 7: Approximate Resolution Methods for Systems of Linear Equations (2 weeks)

Introduction and definitions, Jacobi method, Gauss-Seidel method, Use of relaxation.

Evaluation Method: Continuous assessment: 40%; Final exam: 60%.

References:

1- C. Brezinski, Introduction à la pratique du calcul numérique, Dunod, Paris 1988.

2- G. Allaire et S.M. Kaber, Algèbre linéaire numérique, Ellipses, 2002.

3- G. Allaire et S.M. Kaber, Introduction à Scilab. Exercices pratiques corrigés d'algèbre linéaire, Ellipses, 2002.

4- G. Christol, A. Cot et C.-M. Marle, Calcul différentiel, Ellipses, 1996.

5- M. Crouzeix et A.-L. Mignot, Analyse numérique des équations différentielles, Masson, 1983.

6- S. Delabrière et M. Postel, Méthodes d'approximation. Équations différentielles. Applications Scilab, Ellipses, 2004.

7- J.-P. Demailly, Analyse numérique et équations différentielles. Presses Universitaires de Grenoble, 1996.

Semester: 4
Course Unit: UEF 2.2.3
Subject: Strength of Materials
VHS: 45 hours (Lecture: 1.5 hours, Tutorial: 1.5 hours)
Credits: 4
Coefficient: 2

Course Objectives: Learn the basic concepts of the strength of materials. The purpose and assumptions of the strength of materials, the concept of internal forces, geometric characteristics of sections, the constitutive law of materials, the concept of permissible stresses, and the design of parts under simple loading.

Recommended Prior Knowledge: Rational mechanics; function analysis.

Course Content:

Chapter 1: Introduction and Generalities (2 weeks)

Purpose and assumptions of the strength of materials, Different types of loads, Connections (supports, restraints, hinges), General Principle of Equilibrium, Equations of Equilibrium, Method of Sections, Concept of internal forces: Normal force N, Shear force T, Bending moment M, Definitions, Sign conventions and units.

Chapter 2: Geometric Characteristics of Cross Sections (2 weeks)

Center of gravity, Static moments, Moments of inertia of a cross section, Transformation of moments of inertia. Central principal axes, principal moments of inertia.

Chapter 3: Simple Tension and Simple Compression (3 weeks)

Definitions, Axial tensile and compressive forces, Normal stress, Elastic deformation, Hooke's law, Young's modulus, Stress-strain diagram, Strength condition and concept of allowable stress.

Chapter 4: Simple Bending (4 weeks)

Definitions and assumptions, Shear forces, Bending moments, Differential relationship between load, shear force, and bending moment. Diagram of shear forces and bending moments, Normal stress in simple bending, Concept of the neutral axis and design. Deformation of a beam subjected to simple bending (concept of deflection), Calculation of tangential stress in simple bending.

Chapter 5: Shear (2 weeks)

Definitions, Simple shear – pure shear, Shear stress, Elastic deformation in shear, Shear strength condition.

Chapter 6: Torsion (2 weeks)

Definitions, Tangential or sliding stress, Elastic deformation in torsion, Torsional strength condition.

Assessment method: Continuous assessment: 40%; Exam: 60%.

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References:

F. Beer, Mécanique à l'usage des ingénieurs – statique, McGraw-Hill, 1981.
2. G. Pissarenko et all, Aide-mémoire de résistance des matériaux.
3. I. Mirolioubov et coll, "Problèmes de résistance des matériaux", Editions de Moscou.
4. L. Aleinik& J. Durler, "Résistance des matériaux", Ed. Spes, Dunod.
5. M. Kerguignas&G. Caignaert, "Résistance des matériaux", Ed. Dunod Université.
6. P. Stepine, Résistance des matériaux, Editions MIR ; Moscou, 1986.
7. S. Timoshenko, Résistance des matériaux, Dunod, 1986.
8. William et Nash, Résistance des matériaux, cours et problème, série Schaum, 1983.

Semester: 4 **Course Unit: UEM 2.2**
Subject 1: Practical work Soil Mechanics **VHS: 22:30 (Practical work: 1.5 hours)**
Credits: 2 **Coefficient: 1**

Course Objectives:
Students will be able to characterize the physical parameters of soils, classify them based on in-situ and laboratory identification tests, and control their compaction.

Recommended prior knowledge:
Soil mechanics course.

Subject content:
- Measurement of weight characteristics (density – water content)
- Measurement of consistency parameters (Atterberg limits)
- Particle size analysis (by sieving and sedimentometry)
- Measurement of compaction and bearing characteristics (Proctor and CBR tests)
- In-situ density measurement (membrane densitometer test)

Assessment method: Continuous assessment: 100%.

Semester: 4
Course Unit: UEM 2.2
Subject 2: Practical Construction Materials
VHS : 22h30, (TP : 1h30)
Credits: 2
Coefficient: 1

Course Objectives: The student will be able to characterize the physicomechanical parameters of construction materials.

Recommended Prior Knowledge: Construction Materials Course.

Subject Content:

Laboratory Work 1: Densities of Cement, Sand, and Gravel

Laboratory Work 2: Particle Size Analysis of Sand and Gravel

Laboratory Work 3: Water Content and Bulk Volume of Sand

Laboratory Work 4: Porosity of Sand and Gravel

Laboratory Work 5: Volumetric Coefficient of Gravel

Laboratory Work 6: Sand Equivalent

Laboratory Work 7: Cement Consistency and Setting Test

Assessment Method: Continuous Assessment: 100%.

Semester: 4
Course Unit: UEM 2.2
Subject 3: Computer-assisted Design
VHS : 22h30, (TP : 1h30)
Credits: 2
Coefficient: 1

Course Objectives: This course will allow students to acquire the principles of part representation in industrial drawing. Furthermore, this subject will enable students to represent and read drawings.

Recommended Prior Knowledge: Technical Drawing.

Course Content:
1. PRESENTATION OF THE CHOSEN SOFTWARE (SolidWorks, AutoCAD, Catia, Inventor, etc.)
1.1 Introduction and History of CAD;
1.2 Configuration of the chosen software (interface, shortcut bar, options, etc.);
1.3 Software Reference Elements (software help, tutorials, etc.);
1.4 Saving Files (part file, assembly file, drawing file, backup procedure for submission to the instructor);
1.5 Communication and Interdependencies Between Files

2. SKETCHING CONCEPTS (3 weeks)
2.1 Sketching tools (point, line segment, arc, circle, ellipse, polygon, etc.);
2.2 Sketching relationships (horizontal, vertical, equal, parallel, hilly, fixed, etc.);
2.3 Sketch dimensioning and geometric constraints.

3. 3D MODELING (3 weeks)
3.1 Concepts of planes (front plane, right plane, and top plane);
3.2 Basic functions (extrude, remove material, revolve);
3.4 Display functions (zoom, multiple views, multiple windows, etc.);
3.5 Modification tools (Erase, Offset, Copy, Mirror, Trim, Extend, Move);
3.6 Creating a sectional view of the model.

4. 3D MODEL DRAWING (3 weeks)
4.1 Editing the drawing and title block:
4.2 Selecting views and drawing:
4.3 Object layouts and properties (hatching, dimensioning, text, tables, etc.)

5. ASSEMBLIES (2 weeks)
5.1 Assembly constraints (parallel, coincidence, coaxial, fixed, etc.):
5.2 Creating assembly drawings:
5.3 Assembly drawing and parts list: Exploded view.

Assessment method: Continuous assessment: 40%; Exam: 60%.
References:
Solidworks bible 2013 Matt Lombard, EditionWiley,
- Dessin technique, Saint-Laurent, GIESECKE, Frederick E. Éditions du renouveau pédagogique Inc., 1982.
- Exercices de dessins de pièces et d'assemblages mécaniques avec le logiciel SolidWorks, Jean-Louis Berthéol, François Mendes,
- La CAO accessible à tous avec SolidWorks : de la création à la réalisation tome1 Pascal Rétif,
- Guide du dessinateur industriel, Chevalier A, Edition Hachette Technique

Semester: S4
Teaching Unit: Fundamental Teaching Unit 2.2.2
Course 2: Numerical Methods
VHS: 45h00 (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching Objectives: Familiarization with numerical methods and their applications in the field of mathematical calculations.

Recommended Prior Knowledge: Mathematics 1, Mathematics 2, Computer Science 1 and Computer Science 2

Course Content:

Chapter 1: Resolution of Non-linear Equations f(x)=0 (3 weeks)

Introduction to calculation errors and approximations, Introduction to methods for solving non-linear equations, Bisection method, Successive approximations method (fixed point), Newton-Raphson method.

Chapter 2: Polynomial Interpolation (2 weeks)

General introduction, Lagrange polynomial, Newton polynomials.

Chapter 3: Function Approximation (2 weeks)

Approximation method and quadratic mean, Orthogonal or pseudo-orthogonal systems, Approximation by orthogonal polynomials, Trigonometric approximation.

Chapter 4: Numerical Integration (2 weeks)

General introduction, Trapezoid method, Simpson's method, Quadrature formulas.

Chapter 5: Resolution of Ordinary Differential Equations (initial condition or Cauchy problem) (2 weeks)

General introduction, Euler method, Improved Euler method, Runge-Kutta method.

Chapter 6: Direct Resolution Methods for Systems of Linear Equations (2 weeks)

Introduction and definitions, Gauss method and pivoting, LU factorization method, Choeleski factorization method, Thomas algorithm (TDMA) for tridiagonal systems.

Chapter 7: Approximate Resolution Methods for Systems of Linear Equations (2 weeks)

Introduction and definitions, Jacobi method, Gauss-Seidel method, Use of relaxation.

Evaluation Method: Continuous assessment: 40%; Final exam: 60%.

References:

1- C. Brezinski, Introduction à la pratique du calcul numérique, Dunod, Paris 1988.

2- G. Allaire et S.M. Kaber, Algèbre linéaire numérique, Ellipses, 2002.

3- G. Allaire et S.M. Kaber, Introduction à Scilab. Exercices pratiques corrigés d'algèbre linéaire, Ellipses, 2002.

4- G. Christol, A. Cot et C.-M. Marle, Calcul différentiel, Ellipses, 1996.

5- M. Crouzeix et A.-L. Mignot, Analyse numérique des équations différentielles, Masson, 1983.

6- S. Delabrière et M. Postel, Méthodes d'approximation. Équations différentielles. Applications Scilab, Ellipses, 2004.

7- J.-P. Demailly, Analyse numérique et équations différentielles. Presses Universitaires de Grenoble, 1996.

8- E. Hairer, S. P. Norsettet G. Wanner, Solving Ordinary Differential Equations, Springer, 1993.

Semester: 4

Course Unit: UEM 2.2
Subject 5: Practical MDF and RDM
VHS: 15h00 (TP : 1h00)
Credits: 1
Coefficient: 1

Course Objectives: Apply the various concepts studied in the "Fluid Mechanics" subjects taught in Semester 3 and the "Strength of Materials" subject of the current semester.

Recommended Prior Knowledge: /

Part I: Fluid Mechanics
Part II: Strength of Materials
Subject Content:
Part I: Practical: Fluid Mechanics
Laboratory No. 1: Measuring the Density and Density of Liquids
Laboratory No. 2: Measuring the Viscosity of Liquids
Laboratory No. 3: Measuring the Pressure of Liquids and Calibrating a Manometer
Laboratory No. 4: Measuring Hydrostatic Force and Determining the Center of Buoyancy
Laboratory No. 5: Measuring the Flow Rate of Liquids
Part II: Practical: Strength of Materials
Laboratory No. 1. Tensile and Compression Tests
Laboratory No. 2. Torsion Test
Laboratory No. 3. Bending Test
Laboratory No. 4. Impact Test
Laboratory No. 5. Hardness Test

Assessment Method: Continuous Assessment: 100%.

Semester: 4
Teaching Unit: UED2.2
Subject 1: Geology
Total Hours: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Course Objectives:
The student will be able to read and interpret a geological map and better understand geotechnical problems. Knowledge of the geophysical methods used will also be acquired.

Recommended Prerequisite Knowledge:
Fundamental subjects from Semesters 1, 2, and 3.

Course Content:

Chapter 1: Introduction to Geology (2 weeks)

- Definition of geology
- Paleontology
- Origin of the Earth
- Divisions of geology

Chapter 2: Minerals and Rocks (4 weeks)

- Concept of mineralogy
- Unconsolidated rocks
- Igneous rocks
- Sedimentary rocks
- Metamorphic rocks

Chapter 3: Action of Different Elements on Rocks (3 weeks)

- Action of air on rocks
- Action of water on rocks
- Action of glaciers on rocks

Chapter 4: Concept of Geodynamics (3 weeks)

- Internal geodynamics (Earthquakes, volcanoes, etc.)
- External geodynamics (Weathering, erosion, landslides, and slips, etc.)

Chapter 5: Adaptation of Geological Techniques to Civil Engineering Needs (3 weeks)

- Geological mapping
- Use of graphic constructions
- Geological survey of discontinuity surfaces
- Use of stereographic projection

Assessment Method:
Exam: 100%

Bibliographic References:

1. G. BOGOMOLOV, *Hydrogeology and Concepts of Engineering Geology*
2. Aurèle Parriaux and Marcel Arnould, *Geology: Basics for Engineers*, 2009

3. Roger Cojean and Martine Audiguier, *Engineering Geology: Bilingual French/English*, 2011
4. *Hydrogeology, Engineering Geology*, BRGM Editions, 1984
5. Foucault A., Raoult J-F (1995) – *Dictionary of Geology*, 4th edition, Masson Editions, 325 pages
6. Pomerol C., La Gabrielle Y., Renard M. (2005) – *Elements of Geology*, 13th edition, Dunod Editions

Semester: S4
Teaching Unit: UET 2.2
Subject 2 : Topography 1
VHS: 22h30 (Lecture: 1h30)
Credit: 1
Coefficient: 1

Course Objectives: The student will be able to understand the basics of topography, enabling them to carry out and subsequently control the layout of a building, leveling, measuring angles and coordinates, and drawing topographic plans.

Recommended Prior Knowledge: Mathematics; Physics 1; Technical Drawing

Course Content:

Chapter 1: General Information (3 weeks)
Topography in the act of construction, Different topographic measuring devices, Scales (plans, maps), Mistakes and errors
Chapter 2: Distance Measurement (3 weeks)
Direct distance measurement, Alignment methods and accuracy, Measurement practice, Indirect distance measurements
Chapter 3: Angle Measurement (3 weeks)
Operating principle of a theodolite, Setting up a theodolite (Adjustment, Reading),
Reading horizontal angles, Reading vertical angles.
Chapter 4: Determining Areas (3 weeks)
Calculating the area of a polygon, Determining the areas of contours represented on the plan,
Planimeter and surface measurement.
Chapter 5: Direct and Indirect Leveling (3 weeks)
Direct Leveling, Indirect Leveling.
Assessment Method: Final Exam: 100%.
References:
1- Antoine, P., Fabre, D., Modern Topography and Topometry (Volumes 1 and 2) – Serge Milles and Jean Lagofun, 1999.
2- Bouquillard, Topography Course BepTech.geo T1, 2006
3- Dubois, F. and Dupont, G. (1998) Summary of Topography, Principles and Methods, Editions Eyrolles Paris
4- Herman, T. (1997a) Parameters for the Ellipsoid. Editions Hermès, Paris
5- Herman, T. (1997b) Parameters for the Sphere. Edition Dujardin, Toulouse
6- Meica (1997), Digital Levels, MiecaGeosystems, Paris
7- Tchin, M. (1976), Applied Topography, Course at the National School of Arts and Industries of Strasbourg, Specializing in Topography.

Semester: S4
Teaching Unit: UET 2.2
Subject 1: Expression and Communication Techniques
Total Hours: 22h30 (Lectures: 1h30)
Credit: 1
Coefficient: 1

Teaching Objectives: This course aims to develop students' skills, both personally and professionally, in the field of communication and expression techniques.

Recommended Prerequisites: Languages (Arabic, French, English).

Course Content:

Chapter 1: Researching, Analyzing, and Organizing Information ● Identify and use documentation sources, tools, and resources. ● Understand and analyze documents. ● Build and update documentation.

Chapter 2: Improving Expression Skills ● Consider the communication context. ● Produce written messages. ● Communicate orally.
Produce visual and audiovisual messages.

Chapter 3: Enhancing Communication Skills in Interactive Situations (3 Weeks) ● Analyze interpersonal communication processes. ● Improve face-to-face communication. ● Enhance group communication skills.

Chapter 4: Developing Autonomy, Organization, and Communication Skills in Project-Based Work ● Position oneself in a project and communication approach. ● Anticipate actions. ● Implement a project: Presentation of a practical work report (Homework assignment).

Assessment Method: Final exam: 100%.

References:

1. Jean-Denis Commeignes, *12 Methods of Written and Oral Communication* – 4th Edition, Michelle Fayet and Dunod, 2013.
2. Denis Baril, *Techniques of Written and Oral Expression* , Sirey, 2008.
3. Matthieu Dubost, *Improve Your Written and Oral Expression: All the Keys* , Ellipses Edition, 2014.

Semester: 5
Teaching unit: UEF 3.1.1
Module 1: Beams and lattices
Hourly volume: 45h00 (Course: 1h30, Directed studies: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives: This course will allow students to deepen their knowledge of the strength of materials. Learn the behavior of elements under the effects of composite loading.
Determine elastic deformations and internal energy. Understand static calculations for one-dimensional elements and methods for evaluating forces in two-dimensional systems.
Evaluate forces in reticulated systems.

Recommended prior knowledge: Materials resistance 1.

Content of the module:

Chapter 1. Solicitations (4 weeks)
Compound bending, Deviated bending

Chapter 2. Deformations and internal potential (3 weeks)
Calculation of deformations due to bending moments, Calculation of the internal deformation energy of a beam in bending, principle of virtual work. Calculation of deformations by the theory of internal potential

Chapter 3. Calculation of hyperstatic straight beams (4 Weeks)
Definition of a hyperstatic beam, Menabrea method, Continuous beams, Three moments method, Focus method.

Chapter 4. Reticulated Systems (4 Weeks)
General information, Evaluation of forces in bars (node method, section method), Common types of isostatic lattice beams, Deformation of a lattice system, Externally hyperstatic lattice beam.

Evaluation mode: Continuous Control: 40%; Exam: 60%.

Bibliographic references:

1. F. Beer, Mécanique à l'usage des ingénieurs – statique, McGraw-Hill, 1981.
2. G. Pissarenko et all, Aide-mémoire de résistance des matériaux.
3. I. Mirolioubov et coll, "Problèmes de résistance des matériaux", Editions de Moscou.
4. L. Aleinik& J. Durler, "Résistance des matériaux", Ed. Spes, Dunod.
5. M. Kerguignas&G. Caignaert, "Résistance des matériaux", Ed. Dunod Université.
6. P. Stepine, Résistance des matériaux, Editions MIR ; Moscou, 1986.
7. S. Timoshenko, Résistance des matériaux, Dunod, 1986.
8. William et Nash, Résistance des matériaux, cours et problème, série Schaum, 1983.

Semester: 5

Course Unit: UEF 3.1.1
Subject 2: Reinforced Concrete
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Objectifs de l'enseignement: Enseigner les caractéristiques physiques et mécaniques du béton armé. Apprendre le dimensionnement des sections soumises à des sollicitations simples (traction, compression et flexion simple) selon les règles BAEL, CBA93.

Connaissances préalables recommandées:
Résistance des matériaux (RDM1), Matériaux de constructions (MDC1).

Contenu de la matière:
Chapitre 1. Formulation et propriétés mécaniques du béton armé (2 Semaines)
Définition et généralités, Constituants du béton armé, Propriétés mécaniques.
Chapitre 2. Prescriptions réglementaires (2 Semaines)
Règle des pivots, Etats limites, Combinaisons d'actions, Condition de non fragilité
Chapitre 3. Adhérence et ancrage (2 Semaines)
Contrainte d'adhérence, Ancrage d'une barre isolée droite, Ancrage par courbure, Recouvrement
Chapitre 4. Compression simple (3 Semaines)
Etat limite ultime de résistance, état limite de service
Chapitre 5. Traction simple (2 Semaines)
Etat limite ultime de résistance, état limite de service
Chapitre 6. Calcul de sections en béton armé soumises à la flexion simple (4 Semaines)
Section rectangulaire et section en Té Etat limite ultime de résistance + état limite de service

Mode d'évaluation: Contrôle Continu: 40%; Examen: 60%.

Références bibliographiques:
1. D.T.R-B.C.2-41, "Règles de conception et de calcul des structures en béton armé", (CBA 93).
2. Jean- Pierre Mouguin, "Cours de béton armé", B.A.E.L. 91", BERTI Edition.
3. Jean Perchat et Jean Roux, "Maitrise du B.A.E.L. 91 et des D.T.U associés", EYROLLES.
4. Jean Perchat et Jean Roux, "Pratique du B.A.E.L. 91 (Cours avec exercices corrigés)", EYROLLES.
5. Pierre Charon," Exercice de béton armé selon les règles B.A.E.L. 83", EYROLLES, 2ème édition.
6. Jean-Marie Paillé, " Calcul des structures en béton Guide d'application", Eyrolles, 2013.

Semester: 5

Course Unit: UEF 3.1.1
Subject 3: Metallic Structures
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Course Objectives: This course introduces students to the design of metal parts and their assemblies subjected to tensile, bending, and shear forces according to current limit state design standards.

Recommended Prior Knowledge: Rational Mechanics, Strength of Materials 1.

Course Content:

Chapter 1. General Information on Structural Steel (2 Weeks)

Mechanical Properties of Steels, Safety Concepts, Safety Verification Principle, Actions and Combinations of Actions, Regulatory Requirements (Ultimate and Serviceability Limit State Designs).

Chapter 2. Joints (3 Weeks)

General Information on Joints, Types of Joints (Rivets, Bolts, Welding), Technological Aspects, and Operating Principle. Chapter 3. Design of Tensioned Parts (5 Weeks)

Behavior of tensioned parts, Calculation of the net cross-sectional area, Verification of tensioned parts, Consideration of the effects of assembly eccentricities in the design of tensioned parts.

Chapter 4. Design of Bent Parts (5 Weeks)

Use of bent parts, Resistance to bending moment, Resistance to shear force, Justification at ULS, Verification at SLS.

Assessment method:

Continuous assessment: 40%; Exam: 60%.

Bibliographic references:

J. Morel. "Calculation of Steel Structures according to Eurocode 3." Eyrolles, 2005.

"CCM97: Design rules for steel structures." CGS Algiers, 1999.

M.-A. Hirt, R. Bez. "Metal Construction," Volumes 10 and 11, Presses Polytechniques et Universitaires Romandes.

J. Brozzetti, M.A. Bez. "Metal Construction (Numerical Examples Adapted to the Eurocodes)." Presses Polytechniques et Universitaires Romandes. OPU Collections, Algeria.

Semester 5

Teaching unit: UEF 3.1.2
Subject: Roads 1
SHV: 45 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Course Objectives:
This course aims to introduce the student to the rules of design and construction of roads, highways, and urban roads in accordance with current standards.

Recommended Prerequisites: Applied technical drawing, Applied topography, General concepts of physics.

Course Content:

Chapter 1: General Characteristics of Road Traffic **(2 Weeks)**
History and socio-economic importance of roads, Traffic analysis, Road classification.

Chapter 2: Vehicle Movement **(5 Weeks)**
Elements of traffic, Individual vehicle movement (motive force, adhesion and braking, stopping distance), Group vehicle movement (safety distance, visibility distance), Determination of road's level of service.

Chapter 3: Geometric Characteristics of Roads **(8 Weeks)**
Regulatory requirements, Horizontal alignment (straight alignment, curves, curve connections and progressive transitions, clothoid implementation), Vertical profile (vertical gradient, vertical profile connections, coordination between horizontal alignment and vertical profile), Standard and current cross-sections (dimensioning, transverse gradient, curve widening), Road capacity.

Evaluation Method:
Continuous Assessment: 40%; Final Examination: 60%

Bibliographical References:
1. R. Coquand. "Routes." Volumes 1 and 2, Eyrolles.
2. M. Faure. "Cours de routes." Volumes 1 and 2. Aléas.
3. J. Sauterey. "Cours de routes: dimensionnement des chaussées." Presses des Ponts, France.
4. J. Sauterey. "Cours de routes: couches de roulement." Presses des Ponts, France.
5. L. Gagnon. "Techniques routières." Modulo.
6. "B40: normes techniques d'aménagement des routes en Algérie."
7. Collections SETRA-LCPC. France.

Semester: 5
Course Unit: UEF 3.1.2
Subject 2: Road Materials
VHS: 22h30 (Cours: 1h30)
Credits: 2
Coefficient: 1

Course Objectives: This course aims to introduce students to the components of hydraulic concrete and bituminous mixes used in public works, their formulation and production processes, as well as their characteristic physicochemical and mechanical properties.

Recommended Prior Knowledge: Construction Materials 1.

Subject Content:

Chapter 1. General Information (3 Weeks)

Classification of Construction Materials, Common Physicochemical and Mechanical Properties, Selection of Aggregate Sources.

Chapter 2. Binders (4 Weeks)

Mineral Binders, Hydraulic Binders, Hydrocarbon Binders.

Chapter 3. Hydraulic Concrete (4 Weeks)

Cements, Mortars, Concrete Design, Implementation and Testing.

Chapter 4. Bituminous Mixtures (4 Weeks)

Bitumens and Emulsions, Composition, Application, and Control.

Assessment Method : Exam: 100%.

Bibliographic References

1. R. Dupain, R. Lanchon, J.-C. Saint-Roman. « Granulats, sols, ciments et bétons », Casteilla, 2009.
2. C. Lemaître. « Les propriétés physico-chimiques des matériaux de construction ». Eyrolles, 2012.
3. C. Lemaître. « Mise en oeuvre et emploi des matériaux de construction ». Collection Blanche BTP, 2012.
4. G. Dreux. « Nouveau guide du béton et de ses constituants ». Eyrolles, 1998.
5. « Ciments et bétons actuels (1987) ». CIIC, Paris, 1980.
6. M. Venuat. « La pratique des ciments et des bétons ». Le Moniteur des TPB, 1976.
7. Collections OPU, Algérie.

Semester: 5
Course Unit: UEM 3.1
Subject 1: Applied Technical Drawing
VHS : 37h30 (TP : 2h30)
Credits : 3
Coefficient : 2
Objectifs de l'enseignement

Course Objectives: This course aims to introduce students to drawing in accordance with accepted standards and then to reading and interpreting technical drawings applied to public works.

Recommended Prior Knowledge: Technical Drawing.

Course Content

Chapter 1. General Information on Technical Drawings (2 Weeks)

General Presentation Rules, General Presentation Conventions.

Chapter 2. Specific Presentation Rules and Conventions (3 Weeks)

Site Planning and Soil Investigation (conventional terrain representation, lithological soil legend, geological cross-section, survey surveys), Masonry (principles of representation of different masonry categories), Reinforced and Prestressed Concrete (formwork and reinforcement plans), Steel Framing (overall drawings, assemblies), Timber Framing (traditional framing, modern framing).

Chapter 3. Drawing of Roads and Civil Engineering Structures (6 Weeks)

Roads (general plan, longitudinal profile, cross-sections), Civil Engineering Structures (arrangement of figures, medium and large civil engineering structures, identification of sections and cross-sections, designation of figures).

Chapter 4. Drawing of Sanitation Structures (4 Weeks)

Network Plans, General Rules for Network Presentation.

Mode Assessment: Continuous assessment: 100%.

Bibliographic references:

1. G. Kienert and J. Pelletier. "Technical Drawing of Public Works and Buildings." Eyrolles, 1980.
2. J.-P. Gousset. "Building Drawing Techniques - Technical Drawing and Plan Reading: Principles and Exercises." Collection Blanche BTP, 2011.
3. OPU Collections, Algeria.

Semester: 5
Course Unit: UEM 3.1
Subject 2: Road Geotechnics
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Course Objectives: This laboratory course aims to introduce students to the characterization of soils and rock materials used in road construction and to classify them according to the road earthworks guide, based on a few typical characterization tests.

Recommended Prior Knowledge: Soil Mechanics 1, Strength of Materials 1.

Subject Content:

Classification of soils and rock materials according to the road earthworks guide
Fine-grained soils, Rocky materials, Organic soils.
Specific geotechnical aspects
Earthworks (rules for soil placement and compaction, drainage, treatment). Characterization Tests
Laboratory 1: Demethylene Blue Test
Laboratory 2: Los Angeles Test
Laboratory 3: Micro-Deval Test
Laboratory 4: Fragmentation Test
Laboratory 5: Degradability Test

Assessment Method: Continuous Assessment: 100%.

Bibliographic References:

LCPC-SETRA. « Guide des terrassements routiers : Réalisation des remblais et des couches de forme ». Guide technique, France, 2000.
2. LCPC-SETRA. « Traitement des sols à la chaux et / ou aux liants hydrauliques ». Guide technique, France, 2000.
3. J. Costet, G.Sanglerat. « Cours pratique de mécanique des sols ». Dunod, 1981.
4. S. Amar, J.-P. Magnan. « Essais de mécanique des sols en laboratoire et en place : Aide-mémoire ». Rapport des LPC, France, 1980.
5. F. Schlosser. « Eléments de mécanique des sols ». Presses des Ponts, France, 1988.

Semester: 5
Course Unit: UEM 3.1
Subject 3: Applied Topographie
VHS: 45h (Cours: 1h30, TP: 1h30)
Credits: 4
Coefficient: 2

Course Objectives: This course introduces students to topographic surveys and to carrying out or verifying the layout of a road section or a structure on the ground based on surveys drawn on plans.

Recommended Prior Knowledge: Topography 1, Applied Technical Drawing.

Course Content:

Chapter 1. Topographic Survey Systems (2 Weeks)
Alignment Surveys, Abscissa and Northing Surveys, Radius Surveys, Intersection Surveys, Cross-Section Surveys.
Chapter 2. Calculating Coordinates and Areas (3 Weeks)
Axies, Orientations and Bearings, Coordinate Conversion, Calculating Areas.
Chapter 3. Framework and Detailed Surveys (4 Weeks)
Polygonal Network (path shapes, calculation of a framed path, calculation of a closed path, closure tolerance), Detailed Planimetric Survey.
Chapter 4. Road Layout (3 Weeks)
Successive phases of road layout design: Straight alignment, Longitudinal profiles, Cross sections, Curves, Cubatures.
Chapter 5. Construction of a Structure (3 Weeks)
Retaining wall, Bridge.
Laboratory Content:

Practical Exercise No. 1: Measuring angles and distances, Angles: horizontal and vertical, Distances (direct method, indirect method).
Practical Exercise No. 2: Polygonation: Site reconnaissance, Selection of stations, Reference sketches, Measuring angles and distances, Calculations and transfer.
Practical Exercise No. 3: Tacheometry
Preparing a field sketch, Surveying details by radiation, Calculations and transfer.
Practical Exercise No. 4: Surveying by abscissa, ordinate, and quasi-ordinate, Choosing lines of operation, Measurements, Calculations and transfer.
Practical Exercise No. 5: Lateral oblique measurements: Preparing a field sketch, Surveying details by radiation, Calculations and transfer.
Assessment method: Continuous assessment: 40%, Exam: 60%.

Bibliographic References:

L. Lapointe, G. Meyer. « Topographie appliquée aux travaux publics, bâtiment et levés urbains ». Eyrolles, 1986.
2. R. D'Hollander. « Topographie générales ». Tome 1 et 2, Eyrolles, 1970.
3. M. Brabant. « Maîtriser la topographie ». Eyrolles, 2003.
4. S. Milles, J. Lagofun. « Topographie et topométrie modernes ». Eyrolles, 1999.
5. Collections OPU, Algérie.

Semester: 5
Teaching unit: UED 3.1
Subject 1: Railway Infrastructure
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives: The purpose of this course is to introduce the student to the rules for designing and constructing railways and related structures in accordance with current standards.

Recommended prior knowledge: Strength of materials 1, Soil mechanics, Reinforced concrete, Construction materials 1, Metal structures

Content of the matter:

Chapter 1. General Information on Rail Transportation (2 Weeks)

The Benefits of Rail Transportation (Train, Metro, Tram).

Chapter 2. Geometric Characteristics of Railway Tracks (6 Weeks)

Rails and Their Metallic Structure, Evaluation of Loads and Overloads.

Chapter 3. Behavior and Dimensioning of Railway Tracks (4 Weeks)

Chapter 4. Railway Line Remediation Works (3 Weeks)

Assessment method: Exam: 100%.

Bibliographic references:

1. P. Alias. « Les cours de chemin de fer professés à l'Ecole des Ponts et Chaussées ». RHCP, 1996.
2. Collections OPU, Algérie.

Semester: 5

Teaching Unit: UED 3.1
Subject 2: Underground Infrastructures
Total Semester Hours (TSH): 22 hours and 30 minutes (Course: 1 hour and 30 minutes)
Credits: 1
Coefficient: 1

Course Objectives: This course aims to introduce students to the design and construction principles of road and highway tunnels, railway tunnels, and underground parking structures.

Recommended Prerequisite Knowledge: Strength of Materials, Soil Mechanics, Reinforced Concrete, Construction Materials.

Course Content:

Chapter 1. General Overview of Underground Works (2 weeks)
Main categories of underground structures (road and highway tunnels, railway tunnels, underground parking facilities, special structures), Natural conditions and constraints to be considered.

Chapter 2. Notions of Rock Mechanics (6 weeks)
Definition, Discontinuities in rock masses, Mechanical properties of the rock matrix, Rock mass modeling, Calculation methods for structures in rock (stability of rock slopes, calculation of foundations on rock, calculation of underground structures).

Chapter 3. Construction Methods for Underground Structures (5 weeks)
Typical construction phases of tunnels using the conventional method (blasting, mucking, installation of support, waterproofing installation, final lining), Various types of support systems (New Austrian Tunneling Method - NATM, steel ribs, face support), Various types of lining (cast-in-place concrete, precast segments).

Chapter 4. Asset Management and Safety Measures (2 weeks)
The role of inspections, Maintenance and safety of structures.

Assessment Method: Exam: 100%.

Bibliographic References:
1. A. Bouvard-Lecoanet, G. Colombet, F. Esteulle. « Ouvrages souterrains : Conception, réalisation, entretien ». Presses des Ponts, France, 1992.
2. B. Brady, E. Brown. « Rock Mechanics for underground mining ». Springer, 2004.
3. CFMR. « Manuel de mécanique des roches : Fondements ». Presses de l'ENSMP, Paris, 2000.
4. CFMR. « Manuel de mécanique des roches : Les applications ». Presses de l'ENSMP, 2004.
5. J.-L. Durville, H. Héraud. « Description des roches et des massifs rocheux (c352 »). Techniques de l'ingénieur, traité de construction, 1995.
6. M. Panet. « Le calcul des tunnels par la méthode convergence – confinement », Presses des Ponts, France, 1995.
7. Z. -T. Bieniawski. « Engineering Rock Mass Classifications ». Wiley, 1989.
8. K. Szechy. « Traité de construction des tunnels ». Dunod, 1970.

Semester: 5

Course Unit: UET 3.1
Subject 1: Public Works Machinery
VHS: 22h30 (Cours: 1h30)
Credits: 1
Coefficient: 1

Course Objectives: This course aims to introduce students to the machinery used on public works sites.

Recommended Prior Knowledge: None.

Course Content:

Chapter 1. Introduction (1 Week)

Overview of public works projects and the need for special machinery.

Chapter 2. Drilling and Boring Machinery (3 Weeks)

Vertical Drills, Horizontal Drills, Tunnel Boring Machines, and Drilling Rigs. Chapter 3. Mining, Loading, and Transport Equipment (3 Weeks)

(Dozers or Tractors, Crawler Tractors or Bulldozers, Dumpers, Dump Trucks, Loaders, Backhoe Loaders,

Scrapers).

Chapter 4. Lifting and Handling Equipment (2 Weeks)

Forklifts, Cranes.

Chapter 5. Earthmoving Equipment (3 Weeks)

Graders, Compactors, Rollers, Pavers.

Chapter 6. Pavement Materials Installation Equipment (3 Weeks)

Asphalt Mixing Plants, Spreaders, Milling Machines, Chip Spreaders, Pulverizers, Pavers.

Assessment Method : Exam: 100%.

Semestre: 6
Unité d'enseignement: UEF 3.2.1
Matière 2: Béton armé et précontraint
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Crédits: 4
Coefficient: 2

Objectifs de l'enseignement:
Ce cours a pour objet d'initier l'étudiant aux dimensionnements des pièces en béton armé soumises aux sollicitations, (Effort tranchant, Flexion composée et Torsion), selon les normes de calcul aux états limites en vigueur. Il permet également d'avoir des notions générales sur la technologie du béton précontraint.

Connaissances préalables recommandées:
Résistance des matériaux, Matériaux de constructions, Béton 1.

Programme de la matière:
Chapitre 1. Effort tranchant (3 Semaines)
Calcul des armatures transversales, Vérifications dans les zones d'application des efforts concentrées, Vérification de la résistance au poinçonnement, Vérifications dans les zones de jonction avec l'âme des poutres.
Chapitre 2. Flexion composée (6 Semaines)
Calcul des sections aux états limites des sections rectangulaires et circulaires, Flambage des poteaux comprimés.
Chapitre 3. Torsion (2 Semaines)
Aperçu général sur le phénomène de torsion et justification du béton et des armatures**.**
Chapitre 4. Généralités sur le béton précontraint (4 Semaines)
Technologie de la précontrainte, Action de la précontrainte, Fondements des règles de calcul et de justification, Prescriptions réglementaires (BPEL).
Mode d'évaluation:
Contrôle Continu: 40%; Examen: 60%.
Références bibliographiques:
1. D.T.R-B.C.2-41, "Règles de conception et de calcul des structures en béton armé".
2. Jean- Pierre Mouguin, "Cours de béton armé B.A.E.L. 91", BERTI Edition.
3. Jean Perchat et Jean Roux, "Maitrise du B.A.E.L. 91 et des D.T.U associés", EYROLLES.
4. Jean Perchat et Jean Roux, "Pratique du B.A.E.L. 91 (Cours avec exercices corrigés)", EYROLLES
5. Pierre Charon, "Exercice de béton armé selon les règles B.A.E.L. 83", EYROLLES 2ème édition.
6. A.Fuentès. « Cours de béton précontraint ». Tomes 1 et 2, OPU, Algérie, 2006.
7. G. Dreux, J. Mazars, M. Rimboeuf. « Cours pratique du béton précontraint : Règles BPEL ». Eyrolles, 1984.

Semester: 6
Teaching Unit: UEF 3.2.1
Subject: Bridges (Module 2)
Total Hours: 67h30 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Course Objectives: This course aims to introduce students to the design and construction principles of road and railway bridges, in accordance with applicable standards.

Recommended Prerequisites: Strength of Materials, Construction Materials, Reinforced and Prestressed Concrete, Soil Mechanics, Steel Structures.

Course Content:

Chapter 1: General Concepts of Bridges **(2 weeks)**
Definition and classification of bridges, natural data and constraints, structural components of bridges.

Chapter 2: Loads and Stresses on Bridges **(3 weeks)**
Permanent loads, traffic loads (road bridges and railway bridges), load combinations, influence lines, stress analysis.

Chapter 3: Reinforced Concrete Bridges **(3 weeks)**
Design, typical structures, dimensioning elements (main and secondary reinforcement calculation), various construction details.

Chapter 4: Prestressed Concrete Bridges **(3 weeks)**
Design, typical structures, dimensioning elements (cable number calculation, cable sections and paths, prestress loss), validation of special sections.

Chapter 5: Steel Bridges **(2 weeks)**
Design, typical structures, dimensioning elements.

Chapter 6: Supports and Bearings **(2 weeks)**
Supports (piers, abutments), bearings (metallic, concrete, elastomeric, pot bearings).

Evaluation Method:
Continuous Assessment: 40% ; Final Exam: 60%

Bibliographic References:
1. B. Gely, J.-A. Calgaro. « Conception des ponts ». Presse des Ponts, France, 1994.
2. J.-A. Calgaro. « Projet et construction des ponts : généralités, fondations, appuis, ouvrages courants ». Presse des Ponts, France, 2000.
3. Collections SETRA-LCPC, France.
4. Collections OPU, Algérie

Semester: 6
Course Unit: UEF 3.2.2

Subject 1: Foundations and Earthworks
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Course Objectives: This course aims to introduce students to the design and stability calculation rules for foundations of civil engineering structures (bridges, retaining walls), earthworks (cuttings, embankments), and retaining structures.

Recommended Prior Knowledge: Strength of Materials 1, Soil Mechanics 1.

Course Content:

Chapter 1. Plasticity and Shear Strength of Soils (2 Weeks)

Concept of Mohr's stress circle, Mohr-Coulomb plasticity criterion (intrinsic curve, case of granular soils, case of cohesive soils), Measurement of soil shear characteristics (direct shear, triaxial shear), Drained and undrained characteristics.

Chapter 2. Earth Pressures and Abutments (2 Weeks)

Limit equilibrium states (soil at rest, pressure equilibrium, abutment equilibrium), pressure and abutment coefficients (Rankine equilibrium, Boussinesq equilibrium, Prandtl equilibrium).

Chapter 3. Slope and Embankment Stability (4 Weeks)

Description and classification of ground movements, Methods for calculating slope stability (concepts of safety coefficient), Plane landslides, Rotational landslides (Fellenius and Bishop slice methods).

Chapter 4. Shallow and Deep Foundations (4 Weeks)

Definition and classification of foundations, Theory of bearing capacity, Calculation of shallow foundations, Calculation of deep foundations.

Chapter 5. Retaining Structures (3 Weeks)

Definition and classification of retaining structures, Stability of retaining walls, Stability of sheet pile walls.

Assessment method: Continuous assessment: 40%; Exam: 60%.

Bibliographic references:

J. Costet, G.Sanglerat. « Cours pratique de mécanique des sols ». Dunod, 1981.
2. G. Phillipponat, B. Hubert. « Fondations et ouvrages en terre Collection Blanche BTP », 1997.
3. F. Schlosser. « Eléments de mécanique des sols ». Presse des Ponts, France, 1997.
4. F. Schlosser. « Exercices de mécanique des sols ». Presse des Ponts, France, 1995.
5. G. Olivari, G. Sanglerat, B. Cambou. « Problèmes pratiques de Mécanique des sols ». Dunod, 1987.
6. Collections OPU, Algérie.

Semester 6
Teaching unit: UEF 3.2.2

Subject: Roads 2
SHV: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Course Objectives: This course aims to introduce the student to the rules of design and construction of roads, highways, and urban roads in accordance with current standards.

Recommended Prerequisites: Roads 1, Applied technical drawing, Applied topography, General concepts of physics.

Course Content:
Chapter 1: Dimensioning of Pavement Structures **(2 Weeks)**
- Flexible pavements, Rigid pavements, Semi-rigid pavements.
Chapter 2: Intersection Design **(3 Weeks)**
- Level intersections, Roundabouts, Interchanges.
Chapter 3: Urban Roads **(3 Weeks)**
- General concepts, Characteristics of urban road networks, Dimensioning of streets, sidewalks and parking areas, Pedestrian facilities.
Chapter 4: Road Signage **(3 Weeks)**
- General concepts, Safety concepts in signage, Signals and protection devices, Horizontal and vertical signage, Public lighting.
Chapter 5: Road Pathology and Maintenance **(2 Weeks)**
- General concepts, Pavement assessment methods, Survey of deterioration by type, Pavement maintenance, Pavement reinforcement.
Chapter 6: Road Safety **(1 Week)**
- Definition of accidents (personal injury accidents, material damage accidents, statistics), Risks related to road conditions, Risks related to road users, Preventive measures.

Evaluation Method: Continuous Assessment: 40%; Final Examination: 60%.

Bibliographical References:
1. R. Coquand. « Routes ». Tomes 1 et 2, Eyrolles.
2. M. Faure. « Cours de routes ». Tomes 1 et 2. Aléas.
3. J. Sauterey. « Cours de routes : dimensionnement des chaussées ». Presse des Ponts, France.
4. J. Sauterey. « Cours de routes : couches de roulement ». Presse des Ponts, France.
5. L. Gagnon. « Techniques routières ». Modulo.
6. « B40 : normes techniques d'aménagement des routes en Algérie ».
7. Collections SETRA-LCPC. France.

emester: 6

Course Unit: UEM 3.2
Subject 1: End-of-Cycle Project
VHS: 45h00 (TP: 3h00)
Credits: 4
Coefficient: 2

Teaching Objectives: To comprehensively and complementarily assimilate knowledge from different subjects. To put into practice the concepts taught during the program. To encourage students' sense of autonomy and initiative. To teach them to work in a collaborative environment by fostering intellectual curiosity.

Recommended Prior Knowledge: The entire Bachelor's program.

Subject Content:

The theme of the End-of-Cycle Project must be the result of a joint decision between the tutor and a student (or a group of students: in pairs or even in threes). The content of the topic must be consistent with the program objectives and the student's actual abilities (Bachelor's level). It is also preferable that this theme take into account the social and economic environment of the institution. When the nature of the project requires it, it may be subdivided into several parts. Note:

During the weeks when students are familiarizing themselves with the purpose of their project and its feasibility (bibliographic research, searching for software or hardware

necessary for the project, reviewing and consolidating lessons directly related to the topic, etc.), the subject leader must use this in-person time to remind students of the essential content of the two subjects "Writing Methodology" and "Presentation Methodology" covered during the first two semesters of the core curriculum.

At the end of this study, students must submit a written report in which they must present as clearly as possible:

- A detailed presentation of the study topic, emphasizing its relevance to its socio-economic environment.

- The resources implemented: methodological tools, bibliographic references, contacts with professionals, etc. - Analysis of the results obtained and their comparison with the initial objectives.

- Critique of the observed discrepancies and possible presentation of other additional details.

- Identification of the difficulties encountered, highlighting the limitations of the work carried out and the follow-up to be given to the work completed.

The student or group of students finally presents their work (in the form of a brief oral presentation or on a poster) to their tutor and a teacher examiner, who can ask questions and thus assess the work accomplished in terms of both technique and presentation.

Assessment method: Continuous assessment: 100%.

Semester: 6
Course Unit: UEM 3.2
Subject 2: Road Materials Practical Work
VHS: 37h30 (TP: 2h30)
Credits: 3
Coefficient: 2

Course Objectives: The purpose of these practical exercises is to put into practice and expand the theoretical knowledge acquired in the Road Materials course.

Recommended Prior Knowledge: Construction Materials, Road Materials, Roads 1, Roads 2.

Content:
Laboratory Exercise 1: Hydraulic Concrete Mixture (Dreux-Gorisse Method)
Laboratory Exercise 2: Abrams Cone Workability Test
Laboratory Exercise 3: Concrete Crushing Test
Laboratory Exercise 4: Accelerated Polishing Coefficient Measurement (Le Roux Pendulum)
Laboratory Exercise 5: Bitumen Penetrability Test
Laboratory Exercise 6: Bitumen Ductility Test
Laboratory Exercise 7: Bituminous Mixture Mixture Mixture Formulation

Assessment Method: Continuous Assessment: 100%.

References:
1. R. Dupain, R. Lanchon, J.-C. Saint-Roman. « Granulats, sols, ciments et bétons », Casteilla, 2009.
2. C. Lemaître. « Les propriétés physico-chimiques des matériaux de construction ». Eyrolles, 2012.
3. C. Lemaître. « Mise en oeuvre et emploi des matériaux de construction ». Collection Blanche BTP, 2012.
4. G. Dreux. « Nouveau guide du béton et de ses constituants ». Eyrolles, 1998.
5. « Ciments et bétons actuels (1987) ». CIIC, Paris, 1980.
6. M. Venuat. « La pratique des ciments et des bétons ». Le Moniteur des TPB, 1976.

Semester: 6
Teaching Unit: UEM 3.2
Subject 3: GEOGRAPHIC INFORMATION SYSTEM (GIS)
VHS: 22h30 (Cours: 1h30)
Creédits: 2
Coefficient: 1

Course Objectives: This course aims to introduce students to geographic information systems and their use in the public works sector.

Recommended Prior Knowledge: Subject Content:

Chapter 1. GIS: **Towards a Definition** (3 Weeks)

History (research on methods), Information Systems, Classification of Information Systems, Geographic Information System Technologies, Definitions (object-oriented definition, a definition highlighting the "decision-making" aspect in relation to use, an organizational definition), GIS Functionality, Advantages of GIS / Traditional Mapping.

Chapter 2. Geographic Information in GIS (4 Weeks)

Definition of geographic information, Main acquisition methods, Main GIS modes (vector mode, raster mode), Importance of geocoding, advantages and disadvantages of each mode

Chapter 3. GIS Processing (5 Weeks)

Geographic Databases, Database Management Systems (DBMS), Layer Crossing (Raster Crossing, Vector Crossing), Digital Processing of Satellite Images, Radiometric Corrections, Geometric Corrections, Color Composition, Dynamic Range Enhancement, Dynamic Range Spreading, Neo-Channel Synthesis, Spatial Query Concepts.

Chapter 4. Use of GIS in the Public Works Sector (3 Weeks)

Assessment Method: Exam: 100%.

Semestre:6
Teaching Unit **:TUD 3.2**
Matter1: Notions on airport infrastructure
Total Hours: 22.30h (practical work:1h.30)
Crédits:1
Coefficient:1

Course Objectives : The purpose of this course is to introduce the student to the rules for designing and building civil airfields in accordance with current standards.

Recommended Prerequisites: Material strength, Soil mechanics, Construction materials, Roads 1 & 2

Course Content :

Chapter 1. General Information on Aerodromes (2 Weeks)

The Importance of Air Transport, History, and the International Civil Aviation Organization (ICAO).

Chapter 2. Aircraft Equipment (3 Weeks)

Aircraft Classification, Aircraft Technical Data Sheets, and Determining Air Traffic.

Chapter 3. General Aerodrome Design (5 Weeks)

Movement Areas (flight direction, runways, taxiways, parking areas), Design of Flexible and Rigid Pavements, Determination of Permissible Loads, and Aerodrome Clearance.

Chapter 4. Aerodrome Drainage (3 Weeks)

Sewerage Network (Surface Drainage, Underground Drainage).

Chapter 5. Aerodrome Marking and Signage (2 Weeks)

Evaluation Method:

Continuous assessment: 100%

Semestre:6
Teaching Unit **:TUD 3.2**
Matter1: Applied hydraulics
Total Hours: 22.30h (practical work:1h.30)
Crédits:1
Coefficient:1

Course Objectives :

To teach the fundamentals of surface flow hydraulics, the influence of flows on public works, and to introduce students to the rules for sizing and managing sanitation networks.

Recommended Prerequisites: Fluid mechanics

Course Content :

Chapter 1 Open-Floor Flow (5 weeks)

Flow classification, geometric characteristics of open-flood flows, velocity and pressure in a flow section, uniform flow, gradually varying flows, abruptly varying flows.

Chapter 2 Sediment Transport in Fluvial Hydraulics (3 weeks)

Carrying and suspension of non-cohesive materials, bed erosion and deposition, sediment flow saturation.

Chapter 3 Road Drainage (5 weeks)

Roads and water, pavements, drainage structures, shoulders, outfalls.

Chapter 4 Sewerage Network Management (2 weeks)

Operation and maintenance of sewer systems, rehabilitation of sewerage networks.

Evaluation Method:

Continuous assessment: 100%

Semester: 6
Course Unit: UET 3.2
Subject 1: Professional Project and Business Management
VHS: 22h30 (Cours : 1h30)
Credits: 1
Coefficient: 1

Course Objectives: Prepare and master the methodological tools necessary for professional integration at the end of studies, prepare for the job search. Gain awareness of entrepreneurship through an overview of management skills useful for business creation and the ability to implement a project.

Course Content:

Chapter 1: Business and Society (3 weeks)
Business: Definition and objectives of a business. Different forms of business, business structure, staff, and business partners.
Different types of businesses (VSEs, SMEs, SMIs, mid-caps, large companies)
Business: Definition and objectives of a business
Different types of businesses (SARL, EURL, SPA, SNC, etc.)
Difference between business and society.

Chapter 2: Business Operations and Organization (2 weeks)
Business Organization and Operations
Main Functions of a Business (Production Company, Service Company, etc.)
Business Structure (Definition and Characteristics)
Different Types of Structures (Functional, Divisional, Multi-Divisional, Hierarchical-Functional "Staff and Line")
Ancillary Activities of a Business (Partnerships, Subcontracting, etc.)

Chapter 3: How to Join a Business (3 weeks)
Staffing Needs and Qualifications (Senior Executives, Managers, Technicians, Workers, etc.)
Where to Find Job Offers (ANEM, Job Search, Online, etc.)
How to Go About It (Application, Resume)
Different Types of Job Interviews and How to Conduct an Interview
Types of Employment Contracts (Permanent and Fixed-Term Contracts)
Salary (How a Pay Slip is Calculated) Chapter 4: How to Start Your Own Business (3 weeks)
The Business Start-up Journey (idea, capital, financial assistance, etc.)
How to find a good idea.
Financial investment assistance programs (ANSEJ, CNAC, ANDI, ANGEM, PNR)

Chapter 5: Studying a Business Start-up Project (4 weeks)
Studying a business creation project requires the promoter to plan and write out in detail the phases and steps they will need to take to get their business off the ground.
Market research (sales and marketing department, etc.).
Technical study (location, equipment and machinery requirements, production capacity, etc.).
Financial study (turnover, payroll costs, expenses and consumption, taxes, etc.).
Mini-project for studying a business creation project
Assessment method: 100% exam

Bibliographic references:

1. *-Antoine Melo '' Gestion d'entreprise'' édition Melo France 2016*
2. *-Thomas Durand '' Management d'entreprise'' édition Broché 2016*
3. *-Philippe Guillermic '' La gestion d'entreprise pas à pas '' édition Poche 2015*
4. *-Guy Raimbault ''Outils de gestion'' édition Chihab Alger 1994*
5. *-Institut de technologie financière '' Initiation comptable ''OPU Alger 1993*
6. *-Christian Bultez ''Guide et mode d'emploi des démarches '' édition Nathan Paris 1993*