Semester: 1

Course Unit: UEF 1.1

Subject 1: Mathematics 1

- **VHS**: 67h30 (Class: 3h00, TD: 1h30)
- **Credits**: 6
- **Coefficient**: 3

Learning Objectives:

This first mathematics course is dedicated to homogenizing the level of students upon entering university. Initial new elements are taught progressively to guide students toward more advanced mathematics. The concepts covered in this course are fundamental and among the most used in the field of Science and Technology.

Recommended Prerequisites:

Basic concepts of mathematics from final year classes (sets, functions, equations, etc.).

Course Content:

Chapter 1: Methods of Mathematical Reasoning (1 Week)

1.1 Direct reasoning
1.2 Reasoning by contraposition
1.3 Reasoning by contradiction
1.4 Reasoning by counterexample
1.5 Reasoning by induction

Chapter 2: Sets, Relations, and Functions (2 Weeks)

2.1 Set theory
2.2 Order relations, equivalence relations
2.3 Injective, surjective, bijective functions: definition of a function, direct image, inverse image, characteristics of a function

Chapter 3: Real Functions of One Real Variable (3 Weeks)

3.1 Limit, continuity of a function
3.2 Derivative and differentiability of a function

Chapter 4: Applications to Elementary Functions (3 Weeks)

4.1 Power function
4.2 Logarithmic function

4.3 Exponential function
4.4 Hyperbolic function
4.5 Trigonometric function
4.6 Inverse function

Chapter 5: Limited Development (2 Weeks)

5.1 Taylor's formula
5.2 Limited development
5.3 Applications

Chapter 6: Linear Algebra (4 Weeks)

6.1 Laws and internal composition
6.2 Vector space, basis, dimension (definitions and elementary properties)
6.3 Linear application, kernel, image, rank

Assessment Method:

Continuous assessment: 40%; Exam: 60%.

Bibliographic References:

1. K. Allab, "Elements of Analysis, Functions of One Real Variable, 1st & 2nd Year University", Office des Publications universitaires.
2. J. Rivaud, "Algebra: Preparatory Classes and University Volume 1, Exercises with Solutions", Vuibert.
3. N. Faddeev, I. Sominski, "Collection of Exercises in Advanced Algebra", Moscow Edition.
4. M. Balabne, M. Duflo, M. Frish, D. Guegan, "Geometry – 2nd Year of the 1st Cycle Preparatory Classes", Vuibert Université.
5. B. Calvo, J. Doyen, A. Calvo, F. Boshet, "Algebra Exercises, 1st Cycle Scientific Preparation for Grandes Écoles 2nd Year", Armand Colin – Collection U.
6. J. Quinet, "Elementary Course in Higher Mathematics 1 - Algebra", Dunod.
7. J. Quinet, "Elementary Course in Higher Mathematics 2 - Usual Functions", Dunod.
8. J. Quinet, "Elementary Course in Higher Mathematics 3 - Integral Calculus and Series", Dunod.
9. J. Quinet, "Elementary Course in Higher Mathematics 4 - Differential Equations", Dunod.

Semester: 1

Course Unit: UEF 1.1

Subject 2: Physics 1

- **VHS**: 67h30 (Class: 3h00, TD: 1h30)
- **Credits**: 6
- **Coefficient**: 3

Learning Objectives:

To introduce students to the fundamentals of Newtonian physics through three main parts: Kinematics, Dynamics, and Work and Energy.

Recommended Prerequisites:

Basic concepts of mathematics and physics.

Course Content:

Mathematical Reminders (2 Weeks)

1. Dimensional equations
2. Vector calculus: scalar product (magnitude), vector product, functions of multiple variables, differentiation. Vector analysis: gradient, curl operators, etc.

Chapter 1: Kinematics (5 Weeks)

1. Position vector in coordinate systems (Cartesian, cylindrical, spherical, curvilinear) - law of motion - trajectory.
2. Velocity and acceleration in coordinate systems.
3. Applications: Motion of material points in different coordinate systems.
4. Relative motion.

Chapter 2: Dynamics (4 Weeks)

1. Generalities: Mass - Force - Torque - Absolute and Galilean reference frames.
2. Newton's laws.
3. Principle of conservation of momentum.
4. Differential equation of motion.
5. Angular momentum.

6. Applications of the fundamental law for forces (constant, time-dependent, velocity-dependent, central force, etc.).

Chapter 3: Work and Energy (4 Weeks)

1. Work done by a force.
2. Kinetic energy.
3. Potential energy – Examples of potential energy (gravitational, elastic).
4. Conservative and non-conservative forces - Theorem of total energy.

Assessment Method:

Continuous assessment: 40%; Exam: 60%.

Bibliographic References:

1. A. Gibaud, M. Henry; "Physics Course - Mechanics of the Point - Course and Corrected Exercises"; Dunod, 2007.
2. P. Fishbane et al.; "Physics For Scientists and Engineers with Modern Physics, 3rd Ed."; 2005.
3. P. A. Tipler, G. Mosca; "Physics For Scientists and Engineers, 6th Ed., W. H. Freeman Company, 2008.

Semester: 1

Course Unit: UEF 1.1

Subject 3: Structure of Matter

- **VHS**: 67h30 (Class: 3h00, TD: 1h30)
- **Credits**: 6
- **Coefficient**: 3

Learning Objectives:

This course allows students to acquire the basic formalism in chemistry, particularly regarding the atom, chemical bonding, chemical elements, and the periodic table with energy quantification. It aims to make students more capable of solving chemistry problems.

Recommended Prerequisites:

Basic concepts of mathematics and general chemistry.

Course Content:

Chapter 1: Fundamental Concepts (2 Weeks)

States and macroscopic characteristics of states of matter, changes of state, concepts of atom, molecule, mole, and Avogadro's number, atomic mass unit, molar mass (atomic and molecular), molar volume, Law of Conservation of Mass (Lavoisier), chemical reaction, qualitative and quantitative aspects of matter.

Chapter 2: Main Constituents of Matter (3 Weeks)

Introduction: Faraday's experiment: relationship between matter and electricity, identification of the constituents of matter and the atom, and some physical properties (mass and charge), Rutherford's planetary model, presentation and characteristics of the atom (symbol, atomic number Z, mass number A, number of protons, neutrons, and electrons), isotopy and relative abundance of different isotopes, isotope separation and determination of atomic mass and average mass of an atom: Mass spectrometry: Bainbridge spectrograph, binding and cohesion energy of nuclei, stability of nuclei.

Chapter 3: Radioactivity – Nuclear Reactions (2 Weeks)

Natural radioactivity (α, β, and γ radiations), artificial radioactivity and nuclear reactions, kinetics of radioactive decay, applications of radioactivity.

Chapter 4: Electronic Structure of the Atom (2 Weeks)

Wave-particle duality, interaction between light and matter, Bohr's atomic model: hydrogen atom, hydrogen atom in wave mechanics, poly-electronic atoms in wave mechanics.

Chapter 5: Periodic Classification of Elements (3 Weeks)

Periodic classification by D. Mendeleev, modern periodic classification, evolution and periodicity of the physico-chemical properties of elements, calculation of atomic and ionic radii, successive ionization energies, electron affinity, and electronegativity (Mulliken scale) by Slater's rules.

Chapter 6: Chemical Bonds (3 Weeks)

Covalent bonding in Lewis theory, polarized covalent bond, dipole moment and partial ionic character of the bond, molecular geometry: Gillespie theory or VSEPR, chemical bonding in the quantum model.

Assessment Method:

Continuous assessment: 40%; Exam: 60%.

Bibliographic References:

1. Ouahes, Devallez, "General Chemistry", OPU.
2. S.S. Zumdhal & collaborators, "General Chemistry", De Boeck Université.
3. Y. Jean, "Electronic Structure of Molecules: From Atoms to Simple Molecules", 3rd edition, Dunod, 2003.
4. F. Vassaux, "Chemistry in IUT and BTS".
5. A. Casalot & A. Durupthy, "Inorganic Chemistry Course for 2nd Cycle", Hachette.
6. P. Arnaud, "Course in Physical Chemistry", Ed. Dunod.
7. M. Guymont, "Structure of Matter", Belin Coll., 2003.
8. G. Devore, "General Chemistry: Volume 1, Study of Structures", Coll. Vuibert, 1980.
9. M. Karapetiantz, "Constitution of Matter", Ed. Mir, 1980.

Course Unit: UEM 1.1

Subject 1: Practical Physics 1

- **VHS**: 22h30 (TP: 1h30)
- **Credits**: 2
- **Coefficient**: 1

Learning Objectives:

To reinforce theoretical knowledge provided in the course through a series of practical manipulations.

Recommended Prerequisites:

Basic concepts of mathematics and physics.

Course Content:

Minimum of 5 experiments (3h00 / 15 days):

- Methodology for presenting lab reports and error calculation.
- Verification of Newton's second law.
- Free fall.
- Simple pendulum.
- Elastic collisions.
- Inelastic collisions.
- Moment of inertia.
- Centrifugal force.

Assessment Method:

Continuous assessment: 100%.

Course Unit: UEM 1.1

Subject 2: Practical Chemistry 1

- **VHS**: 22h30 (TP: 1h30)
- **Credits**: 2
- **Coefficient**: 1

Learning Objectives:

To reinforce theoretical knowledge provided in the course on the structure of matter through a series of practical manipulations.

Recommended Prerequisites:

Basic concepts of chemistry.

Course Content:

1. Laboratory safety
2. Preparation of solutions
3. Concepts of uncertainty calculations applied to chemistry
4. Acid-base titration by colorimetry and pH-metry
5. Acid-base titration by conductometry
6. Redox titration
7. Determination of water hardness
8. Ion analysis in water: chloride ion determination by the Mohr method

Assessment Method:

Continuous assessment: 100%.

Semester: 5

Course Unit: UEF 3.1.1

Subject 2: Hydrology II

- **VHS**: 45h00 (Class: 1h30, TD: 1h30)
- **Credits**: 4
- **Coefficient**: 2

Learning Objectives:

To familiarize students with hydrological phenomena and their genesis, as well as the foundations for estimating and evaluating parameters related to these phenomena (precipitation, river flow, floods, etc.). Hydrology is of critical importance in hydraulic studies.

Recommended Prerequisites:

Probability and statistics, Hydrology I.

Course Content:

Chapter 1: Concepts of Probability and Statistics (4 Weeks)

Descriptive statistics; frequency analysis.

Chapter 2: Statistical and Probabilistic Study of Precipitation (4 Weeks)

Analysis and representation of rainfall data related to a station; study of the homogeneity of rainfall series.

Chapter 3: Study of River Flows (3 Weeks)

Measurement of flows in rivers; presentation of data related to flows; study of flow regimes.

Chapter 4: Study of Flood Flows (4 Weeks)

Basic data; probabilistic methods; empirical methods; hydrometeorological methods; analysis of flood hydrographs.

Assessment Method:

Continuous assessment: 40%; Exam: 60%.

Bibliographic References:

1. Réméniéras G., "Hydrology for Engineers", Ed. Eyrolles.
2. José Lamas, "General Hydrology", Ed. Gaëtan Morin.
3. Dubreuil P., "Introduction to Hydrological Analysis", Ed. Masson et Cie, 1997.
4. Banton, Bangoy, "Multi-Science Hydrogeology of Groundwater", Presses de l'Université du Québec.

Course Unit: UED 3.1

Subject 1: IrrigationSemester: 5

- **VHS**: 22h30 (Class: 1h30)
- **Credits**: 1

Coefficient: 1

Learning Objectives:

By the end of this semester, the student should acquire basic knowledge of the functioning of an irrigation system.

Recommended Prerequisites:

Basic concepts of hydraulics.

Course Content:

Chapter 1: Generalities about Soil (3 Weeks)

Definition; characteristics and physical properties of soils; soil water in relation to irrigation.

Chapter 2: Principles of Irrigation (3 Weeks)

Definition of irrigation; supplementary or additional irrigation; water in plants; side effects of irrigation; classification of irrigation types; conditions for rational irrigation.

Chapter 3: Irrigation Network (3 Weeks)

Description; determination of the reach of canals; losses in canals.

Chapter 4: Irrigation Techniques (3 Weeks)

Definition of an irrigation technique; surface irrigation; subsurface irrigation; infiltration irrigation; sprinkler irrigation; drip irrigation.

Chapter 5: Study of an Irrigation Project by Sprinkler and Drip (3 Weeks)

Estimation of water needs for crops (evapotranspiration; rainfall deficit; usable reserve; readily usable reserve; agricultural deficit; characteristic flows); equipment calculation.

Assessment Method:

Exam: 100%.

Bibliographic References:

1. CEMAGREF, "Practical Guide to Irrigation".
2. PHOCAIDES, A. "Manual of Pressure Irrigation Techniques", (2nd Ed.).
3. DONEEN I.D., "Irrigation Techniques and Water Management. FAO Bulletin on Irrigation and Drainage No. 1", Rome, 1972.

Semester: 6

Course Unit: UEF 3.2.1

Subject 1: Hydraulic Structures

- **VHS**: 45h00 (Class: 1h30, TD: 1h30)
- **Credits**: 4
- **Coefficient**: 2

Learning Objectives:

The objective of this course is to provide students with the necessary knowledge for the design and implementation of hydraulic works aimed at the management of watercourses.

Recommended Prerequisites:

General hydraulics I and II.

Course Content:

Chapter 1: Objectives of Hydraulic Works (3 Weeks)

Chapter 2: Hydrography (2 Weeks)

Generalities on watercourses, characteristics of the bed and the layout.

Chapter 3: Erosion Protection Works (3 Weeks)

Erosion in watercourses.

Chapter 4: Flow through Spillways (3 Weeks)

Classification; general equation of spillways.

Chapter 5: Flood Protection Works (3 Weeks)

Chapter 6: Case Study: Flood Protection of an Urban Area (3 Weeks)

Assessment Method:

Continuous assessment: 40%; Exam: 60%.

Bibliographic References:

1. M. Carlier, "General and Applied Hydraulics", Eyrolles, Paris.

2. W.H. Graf and M.S. Altinakar, "River Hydraulics Volume 1: Steady Flow".
3. W.H. Graf and M.S. Altinakar, "River Hydraulics Volume 2: Unsteady Flow and Transport Phenomena", Presses polytechniques et universitaires romandes, Lausanne.

Semester: 1
Course Unit: UEM 1.1
Subject: Computer Science 1
Total Hours: 45h00 (Lecture: 1h30, Lab: 1h30)
Credits: 4
Coefficient: 2

Objectives and Recommendations

The objective of this course is to enable students to learn programming using a modern programming language (Fortran, Pascal, or C). The choice of language is left to the discretion of each institution. The concept of algorithms should be implicitly addressed during the learning of the programming language.

Prerequisite Knowledge

Basic knowledge of web technology.

Course Content

Part 1: Introduction to Computer Science (5 Weeks)

1. Definition of Computer Science
2. Evolution of Computer Science and Computers
3. Information Coding Systems
4. Operating Principles of a Computer
5. Hardware Components of a Computer
6. System Components
    1. Basic Systems (Operating Systems: Windows, Linux, Mac OS, etc.)
    2. Programming Languages, Application Software

Part 2: Concepts of Algorithms and Programs (10 Weeks)

1. Concept of an Algorithm
2. Flowchart Representation
3. Structure of a Program
4. Problem-Solving Approach and Analysis
5. Data Structures: Constants and Variables, Data Types
6. Operators: Assignment Operator, Relational Operators, Logical Operators, Arithmetic Operations, Operator Precedence
7. Input/Output Operations
8. Control Structures: Conditional Control Structures, Repetitive Control Structures

Practical Sessions for Computer Science 1

The practical sessions aim to illustrate the concepts taught during the lectures. They should begin according to the following schedule:

- Introductory lab to familiarize with computer hardware and operating systems (exploring various OS functionalities)
- Introductory lab on using a programming environment (Editing, Assembling, Compiling, etc.)
- Application lab for programming techniques covered in lectures.

Evaluation Method

Continuous Assessment: 40%; Final Exam: 60%.

Recommended Readings

1. John Paul Mueller and Luca Massaron, *Algorithms For Dummies* (Large Print), 2017.
2. Charles E. Leiserson, Clifford Stein, and Thomas H. Cormen, *Introduction to Algorithms: 957 Exercises and 158 Problems*, 2017.
3. Thomas H. Cormen, *Algorithms: A Beginner's Guide*, 2013.

Course Overview

Semester: 1
Course Unit: UEM 1.1
Subject: Methodology of Writing
Total Hours: 15h00 (Lecture: 1h00)
Credits: 1
Coefficient: 1

Objectives of the Course

To familiarize and train students in the current concepts of writing methodology used in the fields of Science and Technology. Among the skills to be acquired: knowing how to introduce oneself; knowing how to write a CV and a cover letter; knowing how to express one's position in writing or verbally regarding an opinion or idea; mastering syntax and spelling in writing.

Prerequisite Knowledge

Basic French. Basic principles of document writing.

Course Content

Chapter 1: Concepts and Generalities on Writing Techniques (2 Weeks)

- Definitions, standards
- Applications: writing a summary, a letter, a request

Chapter 2: Information Research, Synthesis, and Utilization (3 Weeks)

- Information research in libraries (Print: Books, Journals)
- Information research on the Internet (Digital: Databases; Search Engines, etc.)
- Applications

Chapter 3: Writing Techniques and Procedures (3 Weeks)

- Basic principles of writing: Punctuation, Syntax, Sentences
- Sentence length
- Paragraph division
- Use of a neutral style and writing in the third person
- Readability
- Objectivity
- Intellectual rigor and Plagiarism

Chapter 4: Writing a Report (4 Weeks)

- Title page, Summary, Introduction, Method, Results, Discussion, Conclusion, Bibliography, Appendices, Abstract, and Keywords

Chapter 5: Applications (3 Weeks)

- Report on a practical work

Evaluation Method

Final Exam: 100%.

Recommended Readings

1. J.-L. Lebrun, *Practical Guide to Scientific Writing*, EDP Sciences, 2007.
2. M. Fayet, *Successful Reports*, 3rd edition, Eyrolles, 2009.
3. M. Kalika, *Master's Thesis - Managing a Thesis, Writing a Report, Preparing a Defense*, Dunod, 2016.
4. M. Greuter, *Successful Thesis and Internship Reports*, l'Étudiant, 2014.
5. F. Cartier, *Written and Oral Communication*, GEP - Eyrolles Edition, 2012.
6. M. Fayet, *Methods of Written and Oral Communication*, 3rd edition, Dunod, 2008.
7. E. Riondet, P. Lenormand, *The Big Book of Letter Templates*, Eyrolles, 2012.
8. R. Barrass, *Scientists Must Write – A Guide to Better Writing for Scientists, Engineers, and Students*, 2nd edition, Routledge, 2002.
9. G. Andreani, *The Practice of Correspondence*, Hachette, 1995.
10. Ph. Rubens, *Science & Technical Writing, A Manual of Style*, 2nd edition, Routledge, 2001.
11. A. Wallwork, *User Guides, Manuals, and Technical Writing – A Guide to Professional English*, Springer, 2014.

Course Overview

Semester: 1
Course Unit: UED 1.1
Subject: Careers in Science and Technology 1
Total Hours: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

To introduce students, in the first stage, to the various fields covered by Science and Technology, and in the second stage, to a range of careers that stem from these fields. This course also introduces the new challenges of sustainable development and the new careers that may arise from them.

Prerequisite Knowledge

None.

Course Content

Engineering Sciences: What Are They? (2 Weeks)

1.
1. The engineering profession, its history, and challenges of the 21st century.
2. Searching for a job/recruitment announcement by keyword.
3. Creating a simple job description (job title, company, main activities, required skills).
2.

Fields of Electronics, Telecommunications, Biomedical Engineering, Electrotechnics, Electromechanics, Optics & Precision Mechanics (2 Weeks)

3.

1. Definitions, areas of application (home automation, embedded applications for automobiles, video surveillance, mobile telephony, fiber optics, advanced scientific instrumentation, medical imaging and instrumentation, giant mirrors, contact lenses, electric power transport and distribution, power generation plants, energy efficiency, industrial equipment maintenance, elevators, wind turbines, etc.).
2. The role of specialists in these fields.

4.

Fields of Automation and Industrial Engineering (1 Week)

5.

1. Definitions, areas of application (industrial automated chains, machine tools with numerical control, robotics, inventory management, goods traffic management, quality control).
2. The role of specialists in these fields.

6.

Fields of Process Engineering, Hydrocarbons, and Petrochemical Industries (2 Weeks)

7.

1. Definitions, pharmaceutical industry, agri-food industry, leather and textiles industry, biotechnology, chemical and petrochemical industry, plastics industry, energy sector (oil, gas), etc.
2. The role of specialists in these fields.

8.

Sustainable Development (SD) (4 Weeks)

9.

1. Definitions, global challenges (climate change, demographic transitions, resource depletion (oil, gas, coal, etc.), biodiversity loss, etc.).
2. SD diagram (Sustainable = Viable + Livable + Equitable).
3. SD actors (governments, citizens, socio-economic sector, international organizations, etc.).
4. The global nature of SD challenges.

10.

Sustainable Engineering (4 Weeks)

11.

1. Definition, principles of sustainable engineering (definitions of sustainable energy/energy efficiency, sustainable mobility/ecomobility, resource valuation (water, metals, and minerals, etc.), sustainable production).
2. Relevance of sustainable engineering in ST fields.
3. Relationship between sustainability and engineering.
4. Engineers' responsibilities in implementing sustainable projects.

Student Work

The instructor may evaluate students by asking them to prepare job descriptions. Students are encouraged to watch a science popularization film related to their chosen career (after providing them with either the film on electronic media or a link to the film) and subsequently submit a written report or give an oral presentation summarizing the film.

Group Work

Developing job descriptions for careers in each field based on recruitment announcements found on job search websites (e.g., http://www.onisep.fr/Decouvrir-les-metiers, www.indeed.fr, www.pole-emploi.fr) (1 field per group). Depending on the institution's capabilities, it is recommended to involve doctoral students and alumni in a tutoring/mentoring system where each group can consult their tutor/mentor to develop the job description and explore various careers in ST.

Evaluation Method

Final Exam: 100%.

Recommended Readings

1. *What Careers for Tomorrow?* Publisher: ONISEP, 2016, Collection: Dossiers.
2. J. Douënel and I. Sédès, *Choosing a Job Based on Your Profile*, Editions d'Organisation, Collection: Employment & Career, 2010.
3. V. Bertereau and E. Ratière, *What Career Are You Made For?* Publisher: L'Étudiant, 6th edition, Collection: Careers, 2015.
4. *The Big Book of Careers*, Publisher: L'Étudiant, Collection: Careers, 2017.
5. *Careers in Aerospace and Space Industry*, Collection: Pathways, Publisher: ONISEP, 2017.
6. *Careers in Electronics and Robotics*, Collection: Pathways, Publisher: ONISEP, 2015.
7. *Careers in Environment and Sustainable Development*, Collection: Pathways, Publisher: ONISEP, 2015.
8. *Careers in Construction and Public Works*, Collection: Pathways, Publisher: ONISEP, 2016.
9. *Careers in Transport and Logistics*, Collection: Pathways, Publisher: ONISEP, 2016.
10. *Careers in Energy*, Collection: Pathways, Publisher: ONISEP, 2016.
11. *Careers in Mechanics*, Collection: Pathways, Publisher: ONISEP, 2014.
12. *Careers in Chemistry*, Collection: Pathways, Publisher: ONISEP, 2017.
13. *Careers in Web Development*, Collection: Pathways, Publisher: ONISEP, 2015.
14. *Careers in Biology*, Collection: Pathways, Publisher: ONISEP, 2016.

Course Overview

Semester: 1
Course Unit: UET 1.1
Subject: French Language 1
Total Hours: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Course Objectives This course aims to develop the following four skills: Listening comprehension, Reading comprehension, Oral expression, and Written expression through the reading and study of texts.

Prerequisite Knowledge

Basic French.

Course Content

The course proposes a set of themes that address fundamental sciences, technologies, economics, social issues, communication, sports, health, etc. The instructor can select texts from this list to develop during the course or freely choose other themes. Texts may be sourced from various communication media: daily newspapers, sports or entertainment magazines, specialized or popular science journals, books, websites, audio and video recordings, etc.

For each text, the instructor helps students develop their linguistic skills: listening, comprehension, and both oral and written expression. Additionally, the instructor will use the text to highlight grammatical structures, which will be developed during the same class session. Below are examples of grammatical structures that can be illustrated. Not all need to be covered in detail; some can be briefly reviewed while others can be explored in depth.

Examples of Themes and Grammatical Structures

- Climate change
- Pollution
- Electric cars
- Robots
- Artificial intelligence
- Nobel Prize
- Olympic Games
- Sports in school
- The Sahara
- Currency
- Assembly line work
- Ecology
- Nanotechnology
- Fiber optics
- The engineering profession
- Power plants

- Energy efficiency
- Smart buildings
- Wind energy
- Solar energy

Grammatical Structures

- Punctuation, proper nouns, articles.
- Grammatical functions: noun, verb, pronouns, adjective, adverb.
- Complement pronouns: "le, la, les, lui, leur, y, en, me, te, …"
- Agreements.
- Negative sentences: "Ne … pas", "Ne … pas encore", "Ne … plus", "Ne … jamais", "Ne … point", …
- Interrogative sentences: questions with "Qui, Que, Quoi", questions with "Quand, Où, Combien, Pourquoi, Comment, Quel, Lequel".
- Exclamatory sentences.
- Pronominal verbs, impersonal verbs.
- Indicative tenses: present, future, past perfect, simple past, imperfect.

Evaluation Method

Final Exam: 100%.

Recommended Readings

1. M. Badefort, *Objective: Test of International French*, Edulang, 2006.
2. O. Bertrand, I. Schaffner, *Succeeding in the TCF, Exercises and Training Activities*, Éditions de l'École Polytechnique, 2009.
3. M. Boulares, J.-L. Frerot, *Progressive French Grammar with 400 Exercises, Advanced Level*, CLE International.
4. Collective, *Bescherelle: Grammar for Everyone*, Hatier.
5. Collective, *Bescherelle: Conjugation for Everyone*, Hatier.
6. M. Grégoire, *Progressive French Grammar with 400 Exercises, Beginner Level*, CLE International, 1997.
7. A. Hasni et al., *Training in the Teaching of Sciences and Technologies at the Secondary Level*, Presses de l'Université du Québec, 2006.
8. J.-L. Lebrun, *Practical Guide to Scientific Writing*, EDP Sciences, 2007.
9. J.M. Robert, *Difficulties in French*, Hachette.
10. C. Tisset, *Teaching the French Language at School: Grammar, Spelling, and Conjugation*, Hachette Education, 2005.
11. J. Bossé-Andrieu, *Summary of Grammar and Spelling Rules*, Presses de l'Université du Québec, 2001.
12. J.-P. Colin, *French Made Simple*, Eyrolles, 2010.
13. Collective, *French Assessment Test*, Hachette, 2001.
14. Y. Delatour et al., *Practical French Grammar in 80 Sheets with Corrected Exercises*, Hachette, 2000.
15. Ch. Descotes et al., *The Exercise Book: French Expression for Intermediate Level*, Presses Universitaires de Grenoble, 1993.
16. H. Jaraush, C. Tufts, *Sur le Vif*, Heinle Cengage Learning, 2011.
17. J. Dubois et al., *Essentials - Spelling*, Larousse, 2009.

Course Overview

Semester: 1
Course Unit: UET 1.1
Subject: English Language 1
Total Hours: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Objective

To develop the reading, writing, listening, and speaking abilities of students.

Recommended Prior Knowledge

Basic English.

Course Content

The English syllabus consists of a set of texts containing scientific and technical components. The selected texts will be used to study scientific and technical English, as well as grammar acquisition.

The texts must be chosen based on the vocabulary built up, familiarization with scientific and technical matters in English for better understanding. Each text will include a set of vocabulary concepts, special sentences (idioms), and comprehension questions. The texts should also feature terminology that translates specific words from English to French. Additionally, each session must conclude with a translation of longer statements selected from the texts.

Examples of Lectures:

- **Word Study Patterns**:
  - Iron and Steel
  - Heat Treatment of Steel
  - Lubrication of Bearings
  - The Lathe
  - Welding
  - Steam Boilers
  - Steam Locomotives
  - Condensation and Condensers
  - Centrifugal Governors
  - Impulse Turbines
  - The Petro Engine
  - The Carburation System
  - The Jet Engine
  - The Turbo-Prop Engine
  - Aerofoil

Grammar Focus:

- Make + Noun + Adjective
- Quantity, Contents
- Enable, Allow, Make, etc. + Infinitive
- Comparative, Maximum and Minimum
- The Use of Will, Can, and May
- Prevention, Protection, etc., Classification
- The Impersonal Passive
- Passive Verb + By + Noun (agent)
- Too Much or Too Little
- Instructions (Imperative)
- Requirements and Necessity
- Means (by + Noun or –ing)
- Time Statements
- Function, Duty
- Alternatives

Evaluation Mode

Final Exam: 100%.

References

1. J. Upjohn, S. Blattes, V. Jans, *Minimum Competence in Scientific English*, Office des Publications Universitaires, 1994.
2. A.J. Herbert, *The Structure of Technical English*, Longman, 1972.
3. S. Berland-Delepine, *Grammaire méthodique de l'anglais moderne avec exercices*, Ophrys, 1982.
4. *Test of English as a Foreign Language – Preparation Guide*, Cliffs, 1991.
5. R. Fowler, *The Little, Brown Handbook*, Little, Brown Company, 1980.
6. *Cambridge – First Certificate in English*, Cambridge books, 2008.
7. K. Wilson, Th. Healy, *First Choice*, Oxford, 2007.
8. M. Mann, S. Tayore-Knowles, *Destination: Grammar & Vocabulary with Answer Key*, MacMillan, 2006.
9. E. Hamby, Ph. Bedford Robinson, *Special English Computer Applications*, Cassell, 1980.
10. P. Charles Brown, Norma D. Mullen, *English for Computer Science*, Oxford University Press, 1989.
11. Graeme Kennedy, *Structure and Meaning in English: A Guide for Teachers*, Pearson, 2004.
12. Anne M. Hanson, *Brain-Friendly Strategies for Developing Student Writing Skills*, 2nd Edition, Corwin Press, 2008.
13. Ann Bridges, *How to Pass Higher English*, Hodder Gibson-Hachette, 2009.
14. Claude Renucci, *Anglais: 1000 Mots et expressions de la presse: Vocabulaire et expressions du monde économique, social et politique*, Fernand Nathan, 2006.

Course Overview

Semester: 2
Course Unit: UEF 1.2
Subject: Mathematics 2
Total Hours: 67h30 (Lecture: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Course Objectives

Students will be guided step by step towards understanding the mathematics useful for their university studies. By the end of the course, students should be able to:

- Solve first and second-degree differential equations.
- Solve integrals of rational, exponential, trigonometric, and polynomial functions.
- Solve systems of linear equations using various methods.

Recommended Prior Knowledge

Basic knowledge of mathematics (differential equations, integrals, systems of equations, etc.).

Course Content

Chapter 1: Matrices and Determinants (3 Weeks)

1.1 Matrices (Definition, operations).
1.2 Matrix associated with a linear application.
1.3 Linear application associated with a matrix.
1.4 Change of basis, transition matrix.

Chapter 2: Systems of Linear Equations (2 Weeks)

2.1 Generalities.
2.2 Study of the set of solutions.
2.3 Methods for solving a linear system:

- Resolution by Cramer's method.
- Resolution by the inverse matrix method.
- Resolution by Gauss's method.

Chapter 3: Integrals (4 Weeks)

3.1 Indefinite integral, properties.
3.2 Integration of rational functions.

3.3 Integration of exponential and trigonometric functions.
3.4 Integration of polynomials.
3.5 Definite integration.

Chapter 4: Differential Equations (4 Weeks)

4.1 Ordinary differential equations.
4.2 First-order differential equations.
4.3 Second-order differential equations.
4.4 Ordinary second-order differential equations with constant coefficients.

Chapter 5: Functions of Several Variables (2 Weeks)

5.1 Limits, continuity, and partial derivatives of a function.
5.2 Differentiability.
5.3 Double and triple integrals.

Evaluation Mode

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

Recommended Readings

1. F. Ayres Jr, *Theory and Applications of Differential and Integral Calculus - 1175 Solved Exercises*, McGraw-Hill.
2. F. Ayres Jr, *Theory and Applications of Differential Equations - 560 Solved Exercises*, McGraw-Hill.
3. J. Lelong-Ferrand, J.M. Arnaudiès, *Mathematics Course - Differential Equations, Multiple Integrals, Volume 4*, Dunod Université.
4. M. Krasnov, *Collection of Problems on Ordinary Differential Equations*, Moscow Edition.
5. N. Piskounov, *Differential and Integral Calculus, Volume 1*, Moscow Edition.
6. J. Quinet, *Elementary Course of Higher Mathematics 3 - Integral Calculus and Series*, Dunod.
7. J. Quinet, *Elementary Course of Higher Mathematics 4 - Differential Equations*, Dunod.
8. J. Quinet, *Elementary Course of Higher Mathematics 2 - Common Functions*, Dunod.
9. J. Quinet, *Elementary Course of Higher Mathematics 1 - Algebra*, Dunod.
10. J. Rivaud, *Algebra: Preparatory Classes and University Volume 1, Exercises with Solutions*, Vuibert.
11. N. Faddeev, I. Sominski, *Collection of Exercises in Advanced Algebra*, Moscow Edition.

Semestre: 2

Unité d'enseignement: UEF 1.2

Matière 2: Physique 2

VHS: 67h30 (Cours: 3h00, TD: 1h30)

Crédits: 6

Objectifs de l'enseignement

Initier l'étudiant aux phénomènes physiques sous-jacents aux lois de l'électricité en général.

Connaissances préalables recommandées

Mathématiques 1, Physique 1.

Contenu de la matière:

Rappels mathématiques : (1 Semaine)

1- Eléments de longueur, de surface, de volume dans des systèmes de coordonnées cartésiennes, cylindriques, sphériques. Angle solide, Les opérateurs (le gradient, le rotationnel, Nabla, le Laplacien et la divergence).

2- Dérivées et intégrales multiples.

Chapitre I. Electrostatique : (6 Semaines)

1- Charges et champs électrostatiques. Force d'interaction électrostatique-Loi de Coulomb. 2-Potentiel électrostatique. 3- Dipôle électrique. 4- Flux du champ électrique. 5- Théorème de Gauss. 6- Conducteurs en équilibre. 7- Pression électrostatique. 8- Capacité d'un conducteur et d'un condensateur.

Chapitre II. Electrocinétique : (4 Semaines)

1- Conducteur électrique. 2- Loi d'Ohm. 3- Loi de Joule. 4- Les Circuits électriques. 5- Application de la Loi d'Ohm aux réseaux. 6- Lois de Kirchhoff. Théorème de Thevenin.

Chapitre III. Electromagnétisme : (4 Semaines)

1- Champ magnétique : Définition d'un champ magnétique, Loi de Biot et Savart, Théorème d'Ampère, Calcul de champs magnétiques créés par des courants permanents.

2- Phénomènes d'induction : Phénomènes d'induction (circuit dans un champ magnétique variable et circuit mobile dans un champ magnétique permanent), Force de Lorentz, Force de Laplace, Loi de Faraday, Loi de Lenz, Application aux circuits couplés.

Mode d'évaluation:

Contrôle continu: 40% ; Examen: 60%.

Références bibliographiques:

1. J.-P. Perez, R. Carles, R. Fleckinger ; Electromagnétisme Fondements et Applications, Ed. Dunod, 2011.

2. H. Djelouah ; Electromagnétisme ; Office des Publications Universitaires, 2011.

3. P. Fishbane et al. ; Physics For Scientists and Engineers with Modern Physics, 3rd ed. ; 2005.

4. P. A. Tipler, G. Mosca ; Physics For Scientists and Engineers, 6th ed., W. H. Freeman Company, 2008.

Semestre: 2

Unité d'enseignement: UEF 1.2

Matière 3: Thermodynamique

VHS: 67h30 (Cours: 3h00, TD: 1h30)

Crédits: 6

Coefficient: 3

Objectifs de l'enseignement

Donner les bases nécessaires de la thermodynamique classique en vue des applications à la combustion et aux machines thermiques. Homogénéiser les connaissances des étudiants. Les compétences à appréhender sont : L'acquisition d'une base scientifique de la thermodynamique classique ; L'application de la thermodynamique des systèmes variés; L'énoncé, l'explication et la compréhension des principes fondamentaux de la thermodynamique.

Connaissances préalables recommandées

Mathématiques de base.

Contenu de la matière:

Chapitre 1 : Généralités sur la thermodynamique (3 Semaines)

1-Propriétés fondamentales des fonctions d'état.

2- Définitions des systèmes thermodynamiques et le milieu extérieur.

3- Description d'un système thermodynamique.

4- Evolution et états d'équilibre thermodynamique d'un système.

5- Transferts possibles entre le système et le milieu extérieur.

6- Transformations de l'état d'un système (opération, évolution).

7- Rappels des lois des gaz parfaits.

Chapitre 2 : Le 1er principe de la thermodynamique : (3 semaines)

1. Le travail, la chaleur, L'énergie interne, Notion de conservation de l'énergie.

2. 2. Le 1er principe de la thermodynamique : énoncé, notion d'énergie interne d'un système, application au gaz parfait, la fonction enthalpie, capacité calorifique, transformations réversibles (isochore, isobare, isotherme, adiabatique).

Chapitre 3 : Applications du premier principe de la thermodynamique à la thermochimie

(3 semaines)

Chaleurs de réaction, l'état standard, l'enthalpie standard de formation, l'enthalpie de dissociation, l'enthalpie de changement d'état physique, l'enthalpie d'une réaction chimique, loi de Hess, loi de Kirchoff.

Chapitre 4 : Le 2ème principe de la thermodynamique (3 semaines)

1- Le 2ème principe pour un système fermé. 2. Enoncé, du 2ème principe : Entropie d'un système isolé fermé. 3. calcul de la variation d'entropie : transformation isotherme réversible, transformation isochore réversible, transformation isobare réversible, transformation adiabatique, au cours d'un changement d'état, au cours d'une réaction chimique.

Chapitre 5 : Le 3ème Principe et entropie absolue (1 semaine)

Chapitre 6 : Energie et enthalpie libres – Critères d'évolution d'un système (2 semaines)

1- Introduction. 2- Energie et enthalpie libre. 3- Les équilibres chimiques

Mode d'évaluation:

Contrôle continu: 40% ; Examen: 60%.

Références bibliographiques:

1. C. Coulon, S. Le Boiteux S. et P. Segonds, Thermodynamique Physique - Cours et exercices avec solutions, Edition Dunod.

2. H.B. Callen, Thermodynamics, Cours, Edition John Wiley and Sons, 1960

3. R. Clerac, C. Coulon, P. Goyer, S. Le Boiteux & C. Rivenc, Thermodynamics, Cours et travaux dirigés de thermodynamique, Université Bordeaux 1, 2003

4. O. Perrot, Cours de Thermodynamique I.U.T. de Saint-Omer Dunkerque, 2011

5. C. L. Huillier, J. Rous, Introduction à la thermodynamique, Edition Dunod.

Course Overview

Semester: 2
Course Unit: UEM 1.2
Subject: Practical Physics 2
Total Hours: 45h00 (TP: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

To reinforce the theoretical concepts covered in Physics 2 through practical sessions.

Recommended Prior Knowledge

Mathematics 1, Physics 1.

Course Content

A minimum of 5 experiments (3h00 / 15 days):

- Presentation of measuring instruments and tools (Voltmeter, Ammeter, Rheostat, Oscilloscopes, Generator, etc.).
- Kirchhoff's laws (loop law, junction law).
- Thevenin's Theorem.
- Association and measurement of inductances and capacitances.
- Charging and discharging a capacitor.
- Oscilloscope usage.
- Practical work on magnetism.

Evaluation Mode

Continuous assessment: 100%.

Course Overview

Semester: 2
Course Unit: UET 1.2
Subject: French Language 2
Total Hours: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

To develop the following four skills: Listening comprehension, Reading comprehension, Oral expression, and Written expression through reading and studying texts.

Recommended Prior Knowledge

Basic French.

Course Content

The course proposes a set of themes that address fundamental sciences, technologies, economics, social issues, communication, sports, health, etc. The instructor can choose texts from this list to develop during the course or freely select other themes. Texts may be borrowed from various communication media: daily newspapers, sports or entertainment magazines, specialized or popular science journals, books, websites, audio and video recordings, etc.

For each text, the instructor helps students develop their linguistic skills: listening, comprehension, and both oral and written expression. Additionally, the instructor will use the text to highlight grammatical structures, which will be developed during the same class session. Below are examples of grammatical structures that can be illustrated. Not all need to be covered in detail; some can be briefly reviewed while others can be explored in depth.

Examples of Themes and Grammatical Structures

- The pharmaceutical industry
- The agri-food industry
- The National Employment Agency (ANEM)
- Sustainable development
- Renewable energy
- Biotechnology
- Stem cells
- Road safety
- Dams
- Water – Water resources
- Avionics
- Automotive electronics

- Electronic newspapers
- Carbon-14 dating
- Violence in stadiums
- Drugs: a social scourge
- Smoking
- School failure
- The Algerian War
- Social networks
- China, an economic power
- Superconductivity

Grammatical Structures

- The subjunctive, conditional, imperative.
- The past participle, passive voice.
- Possessive adjectives, possessive pronouns.
- Demonstratives, demonstrative pronouns.
- Expression of quantity (several, some, enough, many, more, less, as much, …).
- Numbers and measurements.
- Pronouns "who, that, where, whose".
- Time subordinate conjunctions.
- Cause, consequence.
- Purpose, opposition, condition.
- Comparatives and superlatives.

Additional Themes

- Cryptocurrency
- Advertising
- Autism

Evaluation Mode

Final Exam: 100%.

Recommended Readings

1. M. Badefort, *Objective: Test of International French*, Edulang, 2006.
2. O. Bertrand, I. Schaffner, *Succeeding in the TCF, Exercises and Training Activities*, Éditions de l'École Polytechnique, 2009.
3. M. Boulares, J.-L. Frerot, *Progressive French Grammar with 400 Exercises, Advanced Level*, CLE International.
4. Collective, *Bescherelle: Grammar for Everyone*, Hatier.
5. Collective, *Bescherelle: Conjugation for Everyone*, Hatier.
6. M. Grégoire, *Progressive French Grammar with 400 Exercises, Beginner Level*, CLE International, 1997.

7. A. Hasni et al., *Training in the Teaching of Sciences and Technologies at the Secondary Level*, Presses de l'Université du Québec, 2006.
8. J.-L. Lebrun, *Practical Guide to Scientific Writing*, EDP Sciences, 2007.
9. J.M. Robert, *Difficulties in French*, Hachette.
10. C. Tisset, *Teaching the French Language at School: Grammar, Spelling, and Conjugation*, Hachette Education, 2005.
11. J. Bossé-Andrieu, *Summary of Grammar and Spelling Rules*, Presses de l'Université du Québec, 2001.
12. J.-P. Colin, *French Made Simple*, Eyrolles, 2010.
13. Collective, *French Assessment Test*, Hachette, 2001.
14. Y. Delatour et al., *Practical French Grammar in 80 Sheets with Corrected Exercises*, Hachette, 2000.
15. Ch. Descotes et al., *The Exercise Book: French Expression for Intermediate Level*, Presses Universitaires de Grenoble, 1993.
16. H. Jaraush, C. Tufts, *Sur le Vif*, Heinle Cengage Learning, 2011.
17. J. Dubois et al., *Essentials - Spelling*, Larousse, 2009.

Semestre: 2

Unité d'enseignement: UET 1.2

Matière 1: Langue Anglaise 2

VHS: 22h30 (Cours: 1h30)

Crédits: 1

Coefficient: 1

Objective:

Develop the reading, writing, listening and speaking abilities of the students.

Recommended prior Knowledge:

Basic English.

Contents:

The English syllabus consists of a set of texts containing scientific and technical parts. The chosen texts must be used to study scientific and technical English and Grammar acquisition.

The texts must be selected according to the vocabulary built up, familiarization with both scientific and technical matters in English for further understanding. Therefore, each text will be defined by a set of vocabulary concepts, a set of special sentences (idioms) and comprehension questions.

The texts must contain also a terminology which means the translation of some words from English to French one. Besides, the activity at the end of each session must include a translation of long statements which are selected from the texts.

Examples for some

lectures:

Examples of Word Study: Patterns

Radioactivity.

Chain Reaction.

Reactor Cooling System.

Conductor and Conductivity.

Induction Motors.

Electrolysis.

Liquid Flow and Metering.

Liquid Pumps.

Petroleum.

Road Foundations.

Rigid Pavements.

Piles for Foundations.

Suspension Bridges.

Explanation of Cause

Result

Conditions (if), Conditions (Restrictive)

Eventuality

Manner

When, Once, If, etc. + Past Participle

It is + Adjective + to

As

It is + Adjective or Verb + that…

Similarity, Difference

In Spite of, Although

Formation of Adjectives

Phrasal Verbs

Evaluation mode:

Exam : 100%.

References:

1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office des Publications Universitaires, 1994.

2. A.J. Herbert, The Structure of Technical English, Longman, 1972.

3. S. Berland-Delepine, Grammaire méthodique de l'anglais moderne avec exercices, Ophrys, 1982.

4. Test of English as a Foreign Language – Preparation Guide, Cliffs, 1991.

5. R. Fowler, The Little, Brown Handbook, Little, Brown Company, 1980.

6. Cambridge – First Certificate in English, Cambridge books, 2008.

7. K. Wilson, Th. Healy, First Choice, Oxford, 2007.

8. M. Mann, S. Tayore-Knowles, Destination : Grammar & Vocabulary with Answer Key, MacMillan, 2006.

9. E. Hamby, Ph. Bedford Robinson, Special English Computer Applications, Cassell, 1980.

10. P. Charles Brown, Norma D. Mullen, English for Computer Science, Oxford University Press, 1989.

11. Graeme Kennedy, Structure and Meaning in English: A Guide for Teachers, Pearson, 2004.

12. Anne M. Hanson, Brain-Friendly Strategies for Developing Student Writing Skills, 2nd Edition, Corwin Press, 2008.

13. Ann Bridges, How to Pass Higher English, Hodder Gibson-Hachette, 2009.

14. Claude Renucci, Anglais : 1000 Mots et expressions de la presse : Vocabulaire et expressions du monde économique, social et politique, Fernand Nathan, 2006

Course Overview

Semester: 3
Course Unit: UEF 2.1.1
Subject: Mathematics 3
Total Hours: 67h30 (Lecture: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Course Objectives

By the end of this course, students should be able to understand the different types of series and their convergence conditions, as well as the various types of convergence.

Recommended Prior Knowledge

Mathematics 1 and Mathematics 2.

Course Content

Chapter 1: Simple and Multiple Integrals (3 Weeks)

1.1 Reminders on Riemann integrals and the calculation of primitives.
1.2 Double and triple integrals.
1.3 Applications to the calculation of areas, volumes, etc.

Chapter 2: Improper Integrals (2 Weeks)

2.1 Integrals of functions defined over an unbounded interval.
2.2 Integrals of functions defined over a bounded interval, infinite at one of the endpoints.

Chapter 3: Differential Equations (2 Weeks)

3.1 Reminder on ordinary differential equations.
3.2 Partial differential equations.
3.3 Special functions.

Chapter 4: Series (3 Weeks)

4.1 Numerical series.
4.2 Sequences and series of functions.
4.3 Power series, Fourier series.

Chapter 5: Fourier Transform (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 solving differential equations.

Evaluation Mode

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

Recommended Readings

1. F. Ayres Jr, *Theory and Applications of Differential and Integral Calculus - 1175 Solved Exercises*, McGraw-Hill.
2. F. Ayres Jr, *Theory and Applications of Differential Equations - 560 Solved Exercises*, McGraw-Hill.
3. J. Lelong-Ferrand, J.M. Arnaudiès, *Mathematics Course - Differential Equations, Multiple Integrals, Volume 4*, Dunod Université.
4. M. Krasnov, *Collection of Problems on Ordinary Differential Equations*, Moscow Edition.
5. N. Piskounov, *Differential and Integral Calculus, Volume 1*, Moscow Edition.
6. J. Quinet, *Elementary Course of Higher Mathematics 3 - Integral Calculus and Series*, Dunod.
7. J. Quinet, *Elementary Course of Higher Mathematics 4 - Differential Equations*, Dunod.
8. M. R. Spiegel, *Laplace Transforms, Course and Problems, 450 Solved Exercises*, McGraw-Hill.

Course Overview

Semester: 3
Course Unit: UEF 2.1.1
Subject: Waves and Vibrations
Total Hours: 45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Course Objectives

To introduce students to mechanical vibration phenomena restricted to low amplitude oscillations for 1 or 2 degrees of freedom, as well as the study of mechanical wave propagation.

Recommended Prior Knowledge

Mathematics 2, Physics 1, and Physics 2.

Course Content

Introduction: This course is divided into two parts: Waves and Vibrations, which can be approached independently. Due to the content's complexity, it is recommended that students in Electrical Engineering (Group A) study Waves first, followed by Vibrations. For students in Groups B and C (Civil Engineering, Mechanical Engineering, and Process Engineering), it is advisable to start with Vibrations. The instructor is encouraged to cover both parts comprehensively, emphasizing practical applications while supporting theoretical demonstrations as auxiliary work for students.

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 multiple degrees of freedom.

Chapter 2: Free Oscillations of Systems with One Degree of Freedom (2 Weeks)

2.1 Undamped oscillations
2.2 Free oscillations of damped systems.

Chapter 3: Forced Oscillations of Systems with One Degree of Freedom (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.

Chapter 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 Systems with Two Degrees of Freedom (2 Weeks)

5.1 Lagrange equations
5.2 Mass-spring-damper systems
5.3 Impedance
5.4 Applications
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 Sinusoidal progressive wave
1.5 Superposition of two sinusoidal progressive waves.

Chapter 2: Vibrating Strings (2 Weeks)

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

Chapter 3: Acoustic Waves in Fluids (1 Week)

3.1 Wave equation
3.2 Speed of sound
3.3 Sinusoidal progressive wave
3.4 Reflection and transmission.

Chapter 4: Electromagnetic Waves (2 Weeks)

4.1 Wave equation
4.2 Reflection and transmission
4.3 Different types of electromagnetic waves.

Evaluation Mode

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

Recommended Readings

1. H. Djelouah, *Vibrations and Mechanical Waves – Course & Exercises* (University of USTHB: perso.usthb.dz/~hdjelouah/Coursvom.html).
2. T. Becherrawy, *Vibrations, Waves and Optics*, Hermes Science Lavoisier, 2010.
3. J. Brac, *Propagation of Acoustic and Elastic Waves*, Hermes Science Publishing Lavoisier, 2003.
4. R. Lefort, *Waves and Vibrations*, Dunod, 2017.
5. J. Bruneaux, *Vibrations, Waves*, Ellipses, 2008.
6. J.-P. Perez, R. Carles, R. Fleckinger, *Electromagnetism Foundations and Applications*, Ed. Dunod, 2011.
7. H. Djelouah, *Electromagnetism*, Office des Publications Universitaires, 2011.

Semester: 3
Teaching Unit: UEF 2.1.2
Subject 1: Fluid mechanics
Total Hours: 45h (Lecture: 1h30, Tutorial: 1h30 per week)
Credits: 4
Coefficient: 2

Teaching Objectives:

To introduce the student to the field of fluid mechanics, fluid statics will be detailed in the first part. Then in the second part the study of the movement of inviscid fluids will be considered at the end it is the movement of the real fluid that will be studied.

Recommended Prerequisites:

Course Content:

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.
- Density, mass
- Rheology of a fluid, viscosity of fluids, surface tension of a fluid

Chapter 2: Fluid Statics (4 Weeks)

- Definition of pressure, pressure at a point in a fluid
- Fundamental law of fluid statics
- Level surface
- Pascal's theorem
- Calculation of pressure forces: Flat plate (horizontal, vertical, oblique), center of pressure, static pressure measuring instruments, atmospheric pressure measurement, barometer, Torricelli's law
- Pressure for superimposed immiscible fluids

Chapter 3: Dynamics of perfect incompressible fluids (4 Weeks)

- Steady Flow
- Continuity Equation
- Mass Flow Rate and Volume Flow Rate
- Bernoulli's Theorem, Cases Without Work Exchange and With Work Exchange
- Applications to Flow and Velocity Measurements: Venturi, Diaphragms, Pitot Tubes, etc.
- Euler's Theorem

Chapter 4: Dynamics of real incompressible fluids (4 Weeks)

- Flow regimes, Reynolds experiment
- Dimensional analysis, Vashy-Buckingham theorem, Reynolds number

- Linear pressure drops and singular pressure drops, Moody diagram
- Generalization of Bernoulli's theorem to real fluids

Evaluation Method:

- Continuous assessment: 40%
- Final exam: 60%

Recommended References:

1- Fundamentals of fluid mechanics 6th Edition, 2009, BR Munson, DF Young TH Okiishi, WW Huebsch 6th Edition John Wiley & Sons
2- Fluid mechanics**,** YA Cengel - 2010 - Tata McGraw-Hill Education
3- Fluid Mechanics Frank M. White Fourth Edition 2003 McGraw-Hill
4- Mécanique des fluids et hydraulique 2ème édition, Ronald v. Giles, Jack B Evett, Cheng Liu, McGraw-Hill
5- S. Amiroudine, J. L. Battaglia**, '**Mécanique des fluides Cours et exercices corrigés'Ed. Dunod
6- R. Comolet, 'Mécanique des fluides expérimentale', Tome 1, 2 et 3, Ed. Masson et Cie.
7- R. Ouziaux, 'Mécanique des fluides appliquée', Ed. Dunod, 1978
8- B. R. Munson, D. F. Young, T. H. Okiishi, 'Fundamentals of fluid mechanics', Wiley & sons. R. V. Gilles, 'Mécanique des fluides et hydraulique : Cours et problèmes', Série Schaum, Mc Graw Hill, 1975.

Course Overview

Semester: 3
Course Unit: UED 2.1
Subject: Metrology
Total Hours: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

To teach students the criteria for precision in manufacturing and assembly of parts; to know and be able to choose, in different cases, the methods and means of control and measurement of dimensions and manufacturing defects of mechanical parts.

Recommended Prior Knowledge

Trigonometry, optics, and others.

Course Content

Chapter 1: Generalities on Metrology (2 Weeks)

1.1 Definition of different types of metrology (scientific laboratory metrology, legal, industrial).
1.2 Metrological vocabulary, 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, fidelity, repeatability, reproducibility of a measuring instrument).
3.2 Classification of measurement errors.
3.2.1 Raw value;
3.2.2 Systematic error;
3.2.3 Corrected raw value.
3.3 Random errors.
3.3.1 Random errors;
3.3.2 Spurious errors;
3.3.3 Estimated systematic errors.
3.4 Confidence interval.
3.5 Technical uncertainty.

3.6 Total measurement uncertainty.
3.7 Complete measurement result.
3.8 Identification and interpretation of specifications in a definition drawing for control purposes.
3.9 Basic concepts of gauges, measuring tools, and simple measuring instruments.

Chapter 4: Measurement and Control (4 Weeks)

4.1 Direct measurement of lengths and angles (using rulers, calipers, micrometers, and protractors).
4.2 Indirect measurement (using comparators and standard blocks).
4.3 Dimension control (using plugs, jaws, etc.).
4.4 Measuring and control machines used in mechanical workshops (using pneumatic comparators, profile projectors, and roughness testers).

Evaluation Mode

Final exam: 100%.

Recommended Readings

(According to the availability of documentation at the institution, websites, etc.)

- *Mechanical Technology Manual*, Guillaume SABATIER, et al, Ed. Dunod.
- *Memotech: Production Materials and Machining*, BARLIER C., Ed. Casteilla.
- *Industrial Sciences*, MILLET N., Ed. Casteilla.
- *Memotech: Industrial Technologies*, BAUR D. et al, Ed. Casteilla.
- *Dimensional Metrology*, CHEVALIER A., Ed. Delagrave.
- *Drilling, Milling*, JOLYS R. and LABELL R., Ed. Delagrave.
- *Guide to Mechanical Fabrications*, PADELLA P., Ed. Dunod.
- *Technology: First Part*, Bensaada S. and FELIACHI D., Ed. OPU Alger

Course Overview

Semester: 3
Course Unit: UET 2.1
Subject: Technical English
Total Hours: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

This course aims to enable students to reach a level of proficiency where they can use scientific documents and discuss their specialty and field in English with ease and clarity.

Recommended Prior Knowledge

English 1 and English 2.

Course Content

- Oral comprehension and expression, vocabulary acquisition, grammar, etc.
- Nouns and adjectives, comparatives, following and giving instructions, identifying objects.
- Use of numbers, symbols, equations.
- Measurements: length, area, volume, power, etc.
- Describing scientific experiments.
- Characteristics of scientific texts.

Evaluation Mode

Final exam: 100%.

Recommended Readings

(According to the availability of documentation at the institution, websites, etc.)

Semester: 4
Teaching Unit: UEF 2.2.1
Subject 1: General hydraulics
Total Hours: 45h (Lecture: 1h30, Tutorial: 1h30 per week)
Credits: 4
Coefficient: 2

Teaching Objectives:

The objective of this subject is to provide the necessary bases for understanding and calculating the phenomena present in applied hydraulics, water and environmental engineering, in particular those encountered in drinking water, sanitation and rivers.

Recommended Prerequisites:

General concepts of Fluid mechanics

Course Content:

Chapter 1: HYDROSTATIC (4 Weeks)

- Fundamental equation of hydrostatics
- Absolute pressure and relative pressure
- Equation of isobaric surfaces
- Pascal's principle
- Pressure measurement
- Maximum vacuum value
- Equations of relative equilibrium
- Action of pressure forces on solid walls
- Equilibrium of floating bodies

Chapter 2: KINEMATICS OF FLUID (4 Weeks)

- Methods for studying fluid motion
- Acceleration of a fluid particle
- Classification of flows
- Continuity equation
- Analysis of fluid particle motion
- Vortex flows

Chapter 3: PERFECT FLUID DYNAMICS (4 Weeks)

- General equation of motion for a perfect fluid
- Integration of the equations of motion
- Bernoulli's equation
- Pressure measurement (Static pressure, Total pressure, Dynamic pressure)
- Flow and velocity measurement

Chapter 4: DYNAMICS OF REAL FLUID (3 Weeks)

- Reynolds experiment
- Characteristics of laminar flows
- Characteristics of turbulent flows
- Equation of motion of a real fluid
- Bernoulli equation for the flow of a real fluid
- Integration of the Navier-Stokes (NS) equations in the case of a one-dimensional flow
- Bernoulli equation applied to a flow tube
- General expression for pressure losses

Evaluation Method:

- Continuous assessment: 40%
- Final exam: 60%

Recommended References:

1- Carlier, M., (1980). Hydraulique générale et appliquée, Collection de la direction des études et recherches d'électricité de France, Volume 14, 2ème édition, Eyrolles, Paris, France
2- Graf Walter H., Altinakar M.(1998). Hydrodynamique une introduction, Collection : Traité de génie civil, Presses Polytechniques et Universitaires Romandes
3- Hug M. (1975). Mécanique des fluides appliquée, Edition Masson, Paris
4- Kremenetski N., Schterrenliht D., Alychev V., Yakovleva L. (1984). Hydraulique, édition MIR-MOSCOU
5- Laborde J.P. (2007). Eléments d'hydraulique générale Edition école polytechnique de l'université de nice - sophia antipolis
6- Lencastre, A. (1999). Hydraulique générale, Editions Eyrolles, première édition, Paris.
7- Ouragh Y. (1994). Ecoulement forcé en hydraulique, Tome 1, Edition O.P.U., Alger
8- Ouragh Y. (1994). Ecoulement forcé en hydraulique, Tome 2, Edition O.P.U., Alger

Semester: 4
Teaching unit: UEF 2.2.1
Subject 2: Hydrology I
Semester Hours: 22h30 (Course: 1h30)
Credits: 2
Coefficient: 1

Teaching Objectives:

The student should be able to understand the components of the hydrological cycle, their measurement, their interactions and their importance, as well as to understand the hydrological functioning and behavior of various systems (catchment areas).

.**Recommended Prerequisites:**

Knowledge of mathematics, topography, probability and statistics.

Course Content:

Chapter 1: Introduction to hydrology (2 Weeks)

1.1 The water cycle
1.2 Hydrological balance

Chapter 2: The catchment area (4 Weeks)

2.1 Definition of a catchment area
2.2 Shape characteristics
2.3 Characteristics of the drainage network
2.4 Physiographic factors of a catchment area

Chapter 3: Evaporation and infiltration (3 Weeks)

3.1 Definition,
3.2 Measurement and calculation,

Chapter 4: Precipitation (3 Weeks)

4.1 Precipitation classification
4.2 Precipitation measurement

Chapter 5 Hydrometry (3 Weeks)

5.1 Flow measurement
5.2 Gauging station

5.3 Station calibration

Evaluation Method:

- Exam: 100%

References:

- Audenet M.: hydrométrie appliquée aux cours d'eau, Eyrolles, 454p.
- Réménièras G.: L'hydrologie de l'ingénieur, Eyrolles, 465p.
- Dubreuil P. (1974) : Initiation à l'analyse Hydrologique, Masson et Cie Edition Paris
- Gilman, CS (1964 : Rainfall, section 9 in Handbook of Hydrology, VT Chow Editor , Mc Braw Hill Book Company New York
- Grisoni, M., Decrous, J. (1972): Cours d'Hydrologie Superficielle , Initiation à l'Hydrologie, SES, Secretatiat D'état à l'Hydraulique, Alger.
- Roche M. (1963) : Hydrologie de surface, Gauther- Villars Edition Paris.
- Sari Ahmed : Initiation à l'hydrologie de surface, Université de Bab Ezzouar, Alger. Edition Distribution Houma

Course Overview

Semester: 4
Course Unit: UEF 2.2.2
Subject: Mathematics 4
Total Hours: 45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Course Objectives

This course focuses on the differential and integral calculus of complex functions of a complex variable. Students must master various techniques for solving functions and integrals involving complex and special variables.

Recommended Prior Knowledge

Mathematics 1, Mathematics 2, and Mathematics 3.

Course Content

Complex Functions and Special Functions

Chapter 1: Holomorphic Functions. Cauchy-Riemann Conditions (3 weeks)
Chapter 2: Power Series (3 weeks)

- Radius of convergence.
- Domain of convergence.
- Expansion in power series.
- Analytic functions.
- Laurent series and expansion in Laurent series.

Chapter 3: Cauchy's Theory (3 weeks)

- Cauchy’s theorem; Cauchy formulas.
- Singular points of functions, general method for calculating complex integrals.

Chapter 4: Applications (4 weeks)

- Equivalence between holomorphic and analytic functions.
- Maximum theorem.
- Liouville's theorem.
- Rouche's theorem.
- Residue theorem.

- Integral calculation using the residue method.

Chapter 5: Special Functions (2 weeks)

- Special Euler functions: Gamma and Beta functions, applications to integral calculations.

Evaluation Mode

Continuous assessment: 40%; Exam: 60%.

Recommended Readings

1. Henri Catan, *Elementary Theory of Analytic Functions of One or More Complex Variables*. Hermann, Paris, 1985.
2. Jean Kuntzmann, *Complex Variables*. Hermann, Paris, 1967. Undergraduate manual.
3. Herbert Robbins and Richard Courant, *What is Mathematics?*, Oxford University Press, Toronto, 1978. Classic popularization work.
4. Walter Rudin, *Real and Complex Analysis*. Masson, Paris, 1975. Graduate manual.

Course Overview

Semester: 3
Course Unit: UET 2.1
Subject: Technical English
Total Hours: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

This course aims to enable students to reach a level of proficiency where they can use scientific documents and discuss their specialty and field in English with ease and clarity.

Recommended Prior Knowledge

English 1 and English 2.

Course Content

- Oral comprehension and expression, vocabulary acquisition, grammar, etc.
- Nouns and adjectives, comparatives, following and giving instructions, identifying objects.
- Use of numbers, symbols, equations.
- Measurements: length, area, volume, power, etc.
- Describing scientific experiments.
- Characteristics of scientific texts.

Evaluation Mode

Final exam: 100%.

Recommended Readings

(According to the availability of documentation at the institution, websites, etc.)

Course Overview

Semester: 4
Course Unit: UEF 2.2.2
Subject: Numerical Methods
Total Hours: 45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Course 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: Solving Nonlinear Equations f(x)=0 (3 weeks)

1. Introduction to calculation errors and approximations.
2. Introduction to methods for solving nonlinear equations.
3. Bisection method.
4. Successive approximations method (fixed point).
5. Newton-Raphson method.

Chapter 2: Polynomial Interpolation (2 weeks)

1. General introduction.
2. Lagrange polynomial.
3. Newton polynomials.

Chapter 3: Function Approximation (2 weeks)

1. Approximation methods and quadratic mean.
2. Orthogonal or pseudo-orthogonal systems. Approximation using orthogonal polynomials.
3. Trigonometric approximation.

Chapter 4: Numerical Integration (2 weeks)

1. General introduction.
2. Trapezoidal method.
3. Simpson’s method.
4. Quadrature formulas.

Chapter 5: Solving Ordinary Differential Equations (2 weeks)

(Initial condition or Cauchy problem).

1. General introduction.
2. Euler method.
3. Improved Euler method.
4. Runge-Kutta method.

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

1. Introduction and definitions.
2. Gauss method and pivoting.
3. LU factorization method.
4. Cholesky factorization method.
5. Thomas algorithm (TDMA) for tridiagonal systems.

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

1. Introduction and definitions.
2. Jacobi method.
3. Gauss-Seidel method.
4. Use of relaxation.

Evaluation Mode

Continuous assessment: 40%; Exam: 60%.

Recommended Readings

1. BREZINSKI (C.), *Introduction to the Practice of Numerical Computation*. Dunod, Paris (1988).
2. G. Allaire and S.M. Kaber, 2002. *Numerical Linear Algebra*. Ellipses.
3. G. Allaire and S.M. Kaber, 2002. *Introduction to Scilab: Corrected Practical Exercises in Linear Algebra*. Ellipses.
4. G. Christol, A. Cot, and C.-M. Marle, 1996. *Differential Calculus*. Ellipses.
5. M. Crouzeix and A.-L. Mignot, 1983. *Numerical Analysis of Differential Equations*. Masson.
6. S. Delabrière and M. Postel, 2004. *Approximation Methods: Differential Equations and Applications in Scilab*. Ellipses.
7. J.-P. Demailly, 1996. *Numerical Analysis and Differential Equations*. Presses Universitaires de Grenoble, 1996.
8. E. Hairer, S. P. Norsett, and G. Wanner, 1993. *Solving Ordinary Differential Equations*, Springer.
9. CIARLET (P.G.), *Introduction to Matrix Numerical Analysis and Optimization*. Masson, Paris (1982).

Course Overview

Semester: 4
Course Unit: UEF 2.2.3
Subject: Materials Resistance
Total Hours: 45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Course Objectives

To understand the calculation methods for the resistance of construction elements and to determine the variations in shape and dimensions (deformations) of elements under the action of loads.

Recommended Prior Knowledge

Function analysis; rational mechanics.

Course Content

Chapter 1: INTRODUCTIONS AND GENERALITIES (2 weeks)

1.1 Objectives and assumptions of materials resistance
1.2 Classification of solids (beam, plate, shell)
1.3 Different types of loads
1.4 Connections (supports, fixings, pins)
1.5 General principle of equilibrium – Equilibrium equations
1.6 Principles of sectioning – Reduction elements
1.7 Definitions and sign conventions for: Normal force N, Shear force T, Bending moment M

Chapter 2: TENSION AND COMPRESSION (3 weeks)

2.1 Definitions
2.2 Normal stress of tension and compression
2.3 Elastic deformation in tension/compression
2.4 Condition for resistance to tension/compression

Chapter 3: SHEAR (2 weeks)

3.1 Definitions
3.2 Simple shear – Pure shear
3.3 Shear stress
3.4 Elastic deformation in shear
3.5 Condition for shear resistance

Chapter 4: GEOMETRIC CHARACTERISTICS OF STRAIGHT SECTIONS (3 weeks)

4.1 Static moments of a straight section
4.2 Moments of inertia of a straight section
4.3 Formulas for transforming moments of inertia

Chapter 5: TORSION (2 weeks)

5.1 Definitions
5.2 Shear or sliding stress
5.3 Elastic deformation in torsion
5.4 Condition for torsion resistance

Chapter 6: SIMPLE PLANE BENDING (3 weeks)

6.1 Definitions and assumptions
6.2 Shear forces, bending moments
6.3 Shear force and bending moment diagrams
6.4 Relationship between bending moment and shear force
6.5 Deflection of a beam subjected to simple bending (sag)
6.6 Calculation of stresses and sizing

Evaluation Mode

Continuous assessment: 40%; Exam: 60%.

Recommended Readings

- Mechanics for Engineers – Statics. Ferdinand P. Beer and Russell Johnston, Jr., McGraw-Hill, 1981.
- Materials Resistance, P. STEPINE, Editions MIR; Moscow, 1986.
- Materials Resistance 1, William A. Nash, McGraw-Hill, 1974.
- Materials Resistance, S. Timoshenko, Dunod, 1986.

Course Overview

Semester: 4
Course Unit: UEM 2.2
Subject: Computer-Aided Design (CAD)
Total Hours: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

This course will enable students to acquire the principles of representing parts in industrial drawings. Furthermore, it will allow students to represent and read plans.

Recommended Prior Knowledge

Technical Drawing.

Course Content

1. PRESENTATION OF THE CHOSEN SOFTWARE (4 weeks)

(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 Reference elements of the software (software aids, tutorials, etc.).
1.4 File saving (part file, assembly file, drawing file, saving procedures for submission to the instructor).
1.5 Communication and interdependence between files.

2. SKETCHING CONCEPTS (3 weeks)

2.1 Sketch tools (point, line segment, arc, circle, ellipse, polygon, etc.).
2.2 Sketch relations (horizontal, vertical, equal, parallel, collinear, fixed, etc.).
2.3 Dimensioning of sketches and geometric constraints.

3. 3D MODELING (3 weeks)

3.1 Concepts of planes (front plane, right plane, top plane).
3.2 Basic functions (extrusion, material removal, revolution).
3.3 Display functions (zoom, multiple views, multiple windows, etc.).
3.4 Modification tools (Erase, Offset, Copy, Mirror, Adjust, Extend, Move).
3.5 Creating a cross-section view of the model.

4. 3D MODEL DRAWING (3 weeks)

4.1 Editing the drawing and title block.
4.2 Choosing views and creating the drawing.
4.3 Dressings and object properties (hatching, dimensioning, text, tables, etc.).

5. ASSEMBLIES (2 weeks)

5.1 Assembly constraints (parallel, coincident, coaxial, fixed, etc.).
5.2 Creating assembly drawings.
5.3 Drawing assembly and parts list:

1. Exploded view.

Evaluation Mode

Continuous assessment: 100%.

Recommended Readings

- *SolidWorks Bible 2013* by Matt Lombard, Wiley Edition.
- *Technical Drawing* by Frederick E. Giesecke, Editions du Renouveau Pédagogique Inc., 1982.
- *Exercises in Drawing Mechanical Parts and Assemblies with SolidWorks* by Jean-Louis Berthéol, François Mendes.
- *CAD Accessible to All with SolidWorks: From Creation to Realization, Volume 1* by Pascal Rétif.
- *Guide for Industrial Drafting* by Chevalier A, Hachette Technique Edition.

Course Overview

Semester: 4
Course Unit: UEM 2.2
Subject: Fluid Mechanics Lab
Total Hours: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

Students will apply the knowledge gained in fluid mechanics taught in Semester 3.

Recommended Prior Knowledge

Subjects: Fluid Mechanics and Physics 1.

Course Content

- Viscometer
- Determination of linear and singular head losses
- Flow measurement
- Water hammer and mass oscillations
- Verification of Bernoulli's theorem
- Jet impact
- Flow through an orifice
- Visualization of flow around an obstacle
- Determination of Reynolds number: Laminar and turbulent flow

Evaluation Mode Continue

Semester: 4

Course Unit: UEM 2.2

Subject 1: Computer-Aided Design

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 design. Furthermore, this subject will enable students to represent and read drawings.

Recommended Prior Knowledge: Technical Drawing

Course Content:

1. PRESENTATION OF THE CHOSEN SOFTWARE (4 weeks)

(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, save procedure for handing over to the teacher);

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 (Extrusion, Material Removal, Revolving):

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.

3 .4D 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:

1 .Exploded view.

Assessment method:

Continuous assessment: 100%.

References:

-Solidworks Bible 2013 Matt Lombard, Wiley Edition,

-Technical drawing, Saint-Laurent, GIESECKE, Frederick E. Éditions du renouveau pédagogique Inc., 1982.

-Mechanical parts and assembly drawing exercises using the software SolidWorks, Jean-Louis Berthéol, François Mendes,

-CAD Accessible to All with SolidWorks: From Creation to Realization Volume 1, Pascal Rétif,

-Industrial Designer's Guide, Chevalier A, Hachette Technique Publishing,

Continuous assessment: 100%.

Course Overview

Semester: 4
Course Unit: UEM 2.2
Subject: Fluid Mechanics Lab
Total Hours: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

Students will apply the knowledge gained in fluid mechanics taught in Semester 3.

Recommended Prior Knowledge

Subjects: Fluid Mechanics and Physics 1.

Course Content

- Viscometer
- Determination of linear and singular head losses
- Flow measurement
- Water hammer and mass oscillations
- Verification of Bernoulli's theorem
- Jet impact
- Flow through an orifice
- Visualization of flow around an obstacle
- Determination of Reynolds number: Laminar and turbulent flow

Evaluation Mode

Continuous assessment: 100%.

Course Overview

Semester: 4
Course Unit: UEM 2.2
Subject: Numerical Methods Lab
Total Hours: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

Programming various numerical methods for applications in mathematical calculations using a scientific programming language (MATLAB, Scilab, etc.).

Recommended Prior Knowledge

Numerical Methods, Computer Science 2, and Computer Science 3.

Course Content

1. Solving Nonlinear Equations (3 weeks)

1.1. Bisection Method
1.2. Fixed-Point Method
1.3. Newton-Raphson Method

2. Interpolation and Approximation (3 weeks)

2.1. Newton Interpolation
2.2. Chebyshev Approximation

3. Numerical Integration (3 weeks)

3.1. Rectangle Method
3.2. Trapezoidal Method
3.3. Simpson's Method

4. Differential Equations (2 weeks)

4.1. Euler's Method
4.2. Runge-Kutta Methods

5. Systems of Linear Equations (4 weeks)

5.1. Gauss-Jordan Method
5.2. Crout Decomposition and LU Factorization

5.3. Jacobi Method
5.4. Gauss-Seidel Method

Evaluation Mode

Continuous assessment: 100%.

Recommended Readings

1. *Algorithmic and Numerical Computing: Practical Work and Programming with Scilab and Python* by José Ouin. - Paris: Ellipses, 2013.
2. *Mathematics with Scilab: A Guide to Calculation, Programming, and Graphical Representations; Conforming to the New MPSI Program* by Bouchaib Radi and Abdelkhalak El Hami. - Paris: Ellipses, 2015.
3. *Applied Numerical Methods: For Scientists and Engineers* by Jean-Philippe Grivet. - Paris: EDP Sciences, 2009.

Course Overview

Semester: 4
Course Unit: UEM 2.2
Subject: Hydrology Lab
Total Hours: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

The aim is to introduce students to the hydro-climatological instruments that hydrologists can use to analyze and evaluate hydro-climatological factors: air temperature, absolute and relative air pressure, precipitation, humidity, evaporation, evapotranspiration, infiltration, and runoff.

Recommended Prior Knowledge

Course in Hydrology.

Course Content

- Hydro-climatic measurements at a meteorological station
- Precipitation measurement
- Flow measurement
- Evapotranspiration
- Infiltration
- Sediment measurement

Evaluation Mode

Continuous assessment: 100%.

Course Overview

Semester: 4
Course Unit: UED 2.2
Subject: Geology
Total Hours: 22h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

Students will be able to read and interpret geological maps and better understand geotechnical problems. They will also learn about geophysical methods used in geology.

Recommended Prior Knowledge

Fundamental subjects from Semesters 1, 2, and 3.

Course Content

Chapter 1: Introduction to Geology (2 weeks)

1.1 Definition of geology
1.2 Paleontology
1.3 Origin of the Earth
1.4 Division of geology

Chapter 2: Minerals and Rocks (4 weeks)

2.1 Concept of mineralogy
2.2 Unconsolidated rocks
2.3 Igneous rocks
2.4 Sedimentary rocks
2.5 Metamorphic rocks

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

3.1 Action of air on rocks
3.2 Action of water on rocks
3.3 Action of glaciers on rocks

Chapter 4: Concept of Geodynamics (3 weeks)

4.1 Internal geodynamics (earthquakes, volcanoes, etc.)
4.2 External geodynamics (weathering, erosion, landslides, etc.)

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

5.1 Geological mapping
5.2 Use of graphic constructions
5.3 Geological surveying of discontinuity surfaces
5.4 Use of stereographic projection

Evaluation Mode

Exam: 100%.

Recommended Readings

1. *Hydrogeology and Concepts of Engineering Geology* by G. Bogomolov
2. *Geology: Foundations for Engineers* by Aurèle Parriaux and Marcel Arnould, 2009
3. *Engineering Geology: Bilingual French/English* by Roger Cojean and Martine Audiguier, 2011
4. *Hydrogeology, Engineering Geology* by Éditions du BRGM, 1984
5. *Geology Dictionary* by A. Faucault and J-F Raoult, 4th edition, Editions Masson, 325p
6. *Elements of Geology* by Pomerol C., Lagabrielle Y., Renard M., 13th edition, Editions Dunod, 762p

Semester: 5

Course Unit: UEM 3.1

Subject 1: Topography Practical Work

VHS: 22:30 (Practical work: 1:30)

Credits: 2

Course Objectives:

This practical work will allow students to put into practice the theoretical knowledge acquired during Topography 1 and 2 courses. Students will therefore have the opportunity to perform all the calculations, measurements, and transfers known in the subject of topography.

Recommended Prior Knowledge:

Knowledge acquired in the subject of Topography.

Subject Content:

Practical Work 1: Measurement of Angles and Distances.

Angles: Horizontal and Vertical.

Distances: Direct Method, Indirect Method.

Practical Work 2: Polygonation

Site reconnaissance, Selection of stations, Location sketches, Measurements (Angles and distances), Calculations and transfer.

Practical Work 3: Tacheometry

Preparation of the field sketch, Survey of details by radiation, Calculations and transfer.

Practical Work 4: Survey by abscissa and ordinate and quasi-ordinate

Choice of operating lines, Measurements, Calculations and transfer.

Practical Work 5: Lateral oblique measurements

Preparation of the field sketch, Survey of details by radiation, Calculations and transfer.

Practical Work 6: Layout

Layout of alignments: Preliminary calculations (office), Layout on the ground, Layout of a bend, Preliminary calculations (office), Layout on the ground, Layout of a building.

Assessment method:

Continuous assessment: 100%.

Bibliographic references:

1 .L. Lapointe, G. Meyer, "Topography Applied to Public Works, Buildings, and Urban Surveys," Eyrolles, Paris, 1986.

2 .R. D'hollander, "General Topography, Volumes 1 and 2," Eyrolles, Paris, 1970.

M. Brabant, "Mastering Topography," Eyrolles, Paris, 2003.

Course Overview

Semester: 4
Course Unit: UET 2.2
Subject: Expression and Communication Techniques
Total Hours: 22h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

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

Recommended Prior Knowledge

Languages (Arabic, French, English).

Course Content

Chapter 1: Researching, Analyzing, and Organizing Information (3 weeks)

- Identify and use documentary resources, tools, and locations
- Understand and analyze documents
- Compile and update documentation

Chapter 2: Improving Expression Skills (3 weeks)

- Consider the communication situation
- Produce written messages
- Communicate orally
- Create visual and audiovisual messages

Chapter 3: Enhancing Communication in Interaction Situations (3 weeks)

- Analyze the process of interpersonal communication
- Improve face-to-face communication skills
- Enhance group communication abilities

Chapter 4: Developing Autonomy, Organizational Skills, and Communication in Project-Based Learning (6 weeks)

- Position oneself within a project and communication framework
- Anticipate actions

- Implement a project: Presentation of a practical work report (Homework)

Evaluation Mode

Final exam: 100%.

Recommended Readings

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*, 2008.

Course Overview

Semester: 4
Course Unit: UET 2.2
Subject: Expression and Communication Techniques
Total Hours: 22h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

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

Recommended Prior Knowledge

Languages (Arabic, French, English).

Course Content

Chapter 1: Researching, Analyzing, and Organizing Information (3 weeks)

- Identify and use documentary resources, tools, and locations
- Understand and analyze documents
- Compile and update documentation

Chapter 2: Improving Expression Skills (3 weeks)

- Consider the communication situation
- Produce written messages
- Communicate orally
- Create visual and audiovisual messages

Chapter 3: Enhancing Communication in Interaction Situations (3 weeks)

- Analyze the process of interpersonal communication
- Improve face-to-face communication skills
- Enhance group communication abilities

Chapter 4: Developing Autonomy, Organizational Skills, and Communication in Project-Based Learning (6 weeks)

- Position oneself within a project and communication framework
- Anticipate actions

- Implement a project: Presentation of a practical work report (Homework)

Evaluation Mode

Final exam: 100%.

Recommended Readings

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*, 2008.
3. Matthieu Dubost, *Improving Written and Oral Expression: All the Keys*, Editions Ellipses, 2014.

3. Matthieu Dubost, *Improving Written and Oral Expression: All the Keys*, Editions Ellipses, 2014.

Course Overview

Semester: 5
Course Unit: UEF 3.1.1
Subject: Hydrology II
Total Hours: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Course Objectives

This course aims to familiarize students with hydrological phenomena and their genesis, as well as the foundations for estimating and evaluating parameters related to these phenomena (precipitation, flow rates, floods, etc.). Hydrology is crucial in hydraulic studies.

Recommended Prior Knowledge

Probability and Statistics, Hydrology I.

Course Content

Chapter 1: Concepts of Probability and Statistics (4 Weeks)

- Descriptive statistics; frequency analysis

Chapter 2: Statistical and Probabilistic Study of Precipitation (4 Weeks)

- Analysis and representation of rainfall data related to a station; study of the homogeneity of rainfall series

Chapter 3: Study of River Flow Rates (3 Weeks)

- Measurement of flow rates in rivers; presentation of data related to flow rates; study of flow regimes

Chapter 4: Study of Flood Flow Rates (4 Weeks)

- Basic data; probabilistic methods; empirical methods; hydrometeorological methods; analysis of flood hydrographs

Evaluation Mode

Continuous assessment: 40%; Exam: 60%.

Recommended Readings

1. Réméniéras G., *Hydrologie de l'Ingénieur*, Ed. Eyrolles.

2. José Lamas, *Hydrologie générale*, Ed. Gaëtan Morin.
3. Dubreuil P., *Initiation à l'analyse hydrologique*, Ed. Masson et Cie, 1997.
4. Banton, Bangoy, *Hydrogéologie multi sciences environnementale des eaux souterraines*, Presses de l'université du Québec.

Course Overview

Semester: 5
Course Unit: UEF 3.1.1
Subject: Hydrogeology
Total Hours: 22h30 (Lectures: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

The course aims to provide students with knowledge about the hydrogeological characteristics of aquifers and concepts related to pumping tests.

Recommended Prior Knowledge

General hydraulics, Topography, Geology.

Course Content

Chapter 1: General Concepts (1 week)

Chapter 2: Hydrogeological Characteristics of Different Types of Aquifers (3 weeks)

Chapter 3: Concept of Aquifers and Different Types of Aquifers (3 weeks)

- Aquifers in porous media; aquifers in fractured media.

Chapter 4: Fundamental Concepts of Hydrodynamics in Porous Media (4 weeks)

- Hydrogeological applications of head concepts and Bernoulli's theorem; head losses in porous media (Darcy's experiment); application to interpreting hydrotype and transmissivity maps; permeability; generalization of Darcy's law; continuity equation; general equation of hydrodynamics in porous media.

Chapter 5: Groundwater Flow to Extraction Works (4 weeks)

- Practice of pumping tests: introduction; equilibrium or permanent regime; Dupuit's formula; various graphs and parameters; non-equilibrium or transient regime; Theis formula; Jacob's formula.

Evaluation Mode

Exam: 100%.

Recommended Readings

1. Braillon, J-M, *Hydrogéologie : travaux pratiques. Exercices*. Alger, Institut National Agronomique, 1981.
2. Castany, Gilbert, *Hydrogéologie: principes et méthodes*, Paris, Dunod, 1998.

3. Gilli, *Hydrogéologie : objets, méthodes, applications*, E. Paris, Dunod, 2004.
4. Metreveli, *Hydrogéologie et phénomènes de transport: recueil de problèmes avec corrigés*, Alger: OPU, 1993.
5. G. De Marsily, *Hydrogéologie quantitative*, Paris, Masson, 1981.
6. Fetter, C.W, *Applied Hydrogeology*, New Jersey, Prentice-Hall, 2001.
7. Fetter, C.W, *Applied Hydrogeology*, USA: Pearson Education, 2001.

Course Overview

Semester: 5
Course Unit: UEF 3.1.2
Subject: Hydraulic Structures
Total Hours: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Course Objectives

Students will be able to master the calculations for the design of hydraulic structures.

Recommended Prior Knowledge

Students should have knowledge in fundamental subjects such as mathematics, physics, fluid mechanics, and water distribution.

Course Content

Part A: Dams

Chapter 1: General Concepts, Statistics, Roles, and Failures (2 weeks)

Chapter 2: Different Types of Dams and Selection of Standard Profiles (2 weeks)

Chapter 3: Determination of Dam Height and Reservoir Sizing (2 weeks)

Chapter 4: Sizing of Dam Components and Definition of Template (1 week)

Chapter 5: Preliminary Sizing of Auxiliary Structures and Construction Measures (2 weeks)

Chapter 6: Flood Discharge Structures (2 weeks)

- Intake tower and hydromechanical equipment; bottom drainage; temporary diversion galleries and inspection.

Part B: Water Intakes

Chapter 1: Modes of Withdrawal (1 week)

- Withdrawn flows; development of intake points; capturing.

Chapter 2: Diversion Structures (2 weeks)

- Principle of diversion; preliminary designs.

Chapter 3: Channels and Sizing Principles - River Stability (1 week)

Evaluation Mode

Continuous assessment: 40%; Exam: 60%.

Recommended Readings

1. P. Gourdault Montagne, *Le droit de riveraineté, propriétés, usages, protection des cours d'eau*, Édition Tec et Doc, 1994.
2. Marc Soutter, André Mermoud, André Musy, *Ingénierie des eaux et du sol, Processus et aménagements*, Editions Presses Polytechniques et Universitaires Romandes (PPUR), 2007.
3. Richard McCuen, *Hydrologic Analysis and Design*, Ed. Pearson Education, Prentice Hall, 2004.
4. R. Therond, *Recherche sur l'étanchéité des lacs de barrage en pays karstique*, Edition EDF, 1973.

Semester: 5
Teaching Unit: UEF 3.1.2
Subject 1: Hydraulic Structures
Total Hours: 45h (Lecture: 1h30, Tutorial: 1h30 per week)
Credits: 4
Coefficient: 2

Course Objectives:
The student will be able to master the sizing calculations of hydraulic structures.

Recommended Prerequisites:
The student should have a solid foundation in fundamental subjects such as mathematics, physics, fluid mechanics, and water distribution.

Course Content:

Part A: Dams

- **Chapter 1**: Generalities, statistics, functions, and failures (2 weeks)
- **Chapter 2**: Different types of dams and selection of the typical profile (2 weeks)
- **Chapter 3**: Determination of dam height and reservoir sizing (2 weeks)
- **Chapter 4**: Sizing of dam components and definition of the dam's overall dimensions (1 week)
- **Chapter 5**: Preliminary sizing of ancillary structures and constructive measures (2 weeks)
- **Chapter 6**: Spillways (2 weeks)
    - Intake towers and hydromechanical equipment; Bottom outlets; Temporary and inspection diversion tunnels.

Part B: Water Intakes

- **Chapter 1**: Methods of water withdrawal (1 week)
    - Withdrawn flows; Development of intake points; Water catchment.
- **Chapter 2**: Diversion structures (2 weeks)
    - Principle of diversion; Basic design concepts.
- **Chapter 3**: Canals and basic sizing principles – Riverbed stability (1 week)

Evaluation Method:

- Continuous assessment: 40%
- Final exam: 60%

Bibliographic References:

1. 1. P. Gourdault Montagne,"Le droit de riveraineté, propriétés, usages, protection des cours d'eau", Édition tec et doc, 1994.

2. 2. Marc Soutter, André Mermoud, André Musy," Ingénierie des eaux et du sol, Processus et ménagements,

3. Edition Presses Polytechniques et Universitaires Romandes (PPUR), 2007.

4. 3. Richard McCuen, "Hydrologic Analysis and Design", Ed. Pearson Education , Prentice Hall, 2004.

5. 4. R. Therond, "Recherche sur l'étanchéité des lacs de barrage en pays karstique", Edition EDF, 1973.

Course Overview

Semester: 5
Course Unit: UEF 3.1.2
Subject: Soil Mechanics
Total Hours: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Course Objectives

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

Recommended Prior Knowledge

Fundamental subjects from Semesters 1 and 2.

Course Content

Chapter 1: Introduction to Soil Mechanics (3 weeks)

- Objective of soil mechanics (historical background and application domain)
- Definitions of soils
- Origin and formation of soils
- Soil structure (coarse and fine soils)

Chapter 2: Identification and Classification of Soils (3 weeks)

- Physical characteristics
- Granulometric characteristics
- Consistency of fine soils (Atterberg limits)
- Geotechnical classification of soils

Chapter 3: Soil Compaction (3 weeks)

- Compaction theory
- Laboratory compaction tests (Proctor and CBR tests)
- Special in-situ compaction materials and processes
- Specifications and control of compaction

Chapter 4: Soil Hydraulics (3 weeks)

- Water flow in soils: speed, gradient, flow rate, Darcy's law, permeability
- Flow networks: use for calculating interstitial pressure and flow rate
- Flow forces: principle of effective stress, buoyancy, Renard;

- Groundwater drawdown through pumping: exploitation of results in steady state.

Chapter 5: Soil Deformations: Settlement and Consolidation (3 weeks)

- General concepts and reconnaissance methods
- Settlements (different types, causes, calculations of settlements…)
- Compressibility
- Theory of consolidation

Evaluation Mode

Continuous assessment: 40%; Exam: 60%.

Recommended Readings

1. *Foundation Design: Shallow Foundations, Deep Foundations, Retaining Walls*, Scientific and Technical Center for Building, 2011.
2. Guy Sanglerat, *Soil Mechanics and Foundation Course*, 1st and 2nd Edition, Dunod, 1983.
3. Denis Tremblay and Vincent Robitaille, *Soil Mechanics: Theory and Practice*, Edition, 2014.
4. François Schlosser, *Elements of Soil Mechanics*, Presses Ponts et Chaussées, 1997.
5. Roberto Nova, *Foundations of Soil Mechanics*, Edition Hermès Lavoisier, 2004.

Semester: 5

Course Unit: UEM 3.1

Subject 1: Topography Practical Work

VHS: 22:30 (Practical work: 1:30)

Credits: 2

Coefficient: 1

Course Objectives:

This practical work will allow students to put into practice the theoretical knowledge acquired during Topography 1 and 2 courses. Students will therefore have the opportunity to perform all the calculations, measurements, and transfers known in the subject of topography.

Recommended Prior Knowledge:

Knowledge acquired in the subject of Topography.

Subject Content:

Practical Work 1: Measurement of Angles and Distances.

Angles: Horizontal and Vertical.

Distances: Direct Method, Indirect Method.

Practical Work 2: Polygonation

Site reconnaissance, Selection of stations, Location sketches, Measurements (Angles and distances), Calculations and transfer.

Practical Work 3: Tacheometry

Preparation of the field sketch, Survey of details by radiation, Calculations and transfer.

Practical Work 4: Survey by abscissa and ordinate and quasi-ordinate

Choice of operating lines, Measurements, Calculations and transfer.

Practical Work 5: Lateral oblique measurements

Preparation of the field sketch, Survey of details by radiation, Calculations and transfer.

Practical Work 6: Layout

Layout of alignments: Preliminary calculations (office), Layout on the ground, Layout of a bend, Preliminary calculations (office), Layout on the ground, Layout of a building.

Assessment method:

Continuous assessment: 100%.

Bibliographic references:

1 .L. Lapointe, G. Meyer, "Topography Applied to Public Works, Buildings, and Urban Surveys," Eyrolles, Paris, 1986.

2 .R. D'hollander, "General Topography, Volumes 1 and 2," Eyrolles, Paris, 1970.

M. Brabant, "Mastering Topography," Eyrolles, Paris, 2003.

Semester: 5

Course Unit: UEM 3.1

Subject 2: Water Treatment and Purification

VHS: 45 hours (Lecture: 1.5 hours, Tutorial: 1.5 hours)

Credits: 4

Coefficient: 2

Course Objectives:

In this subject, students will learn the different methods and stages of treatment and purification

of drinking water and wastewater.

Recommended Prior Knowledge:

Basic knowledge of chemistry and biological sciences.

Subject Content:

Part 1: Water Treatment

Chapter 1. General Information and Standards (2 Weeks)

Characteristics of Natural Waters; Water Quality Standards; Water Uses and Their Requirements;

Typical Diagram of a Treatment Plant.

Chapter 2. Clarification Treatment (1 Week)

Coagulation – Flocculation; Settling; Filtration.

Chapter 3. Complementary Treatments (2 Weeks)

Disinfection; Adsorption and Ion Exchange; Iron Removal – Manganese Removal; Carbon Removal; Fluoride Removal. Part 2: Wastewater Treatment

Chapter 1. Pollution Parameters and Discharge Standards (2 Weeks)

Pollution Parameters; Water Pollution Assessment; Discharge Standards; Population Equivalent Concept

Chapter 2. Pretreatments (2 Weeks)

Screening; Grit Removal; Oil Removal; Grease Separators

Chapter 3. Primary Treatments (2 Weeks)

Settling Processes; Settling with Chemical Reagents

Chapter 4. Secondary Treatments (2 Weeks)

Biological Treatment with Suspended Biomass (Activated Sludge); Biological Treatment with Fixed Biomass;

Biological Treatment with Free Biomass

Chapter 5. Additional Treatments (2 Weeks)

Nitrification and Denitrification; Physicochemical Removal of Ammonia; Disinfection;

Dephosphorization; Filtration; Adsorption on Activated Carbon

Assessment Method:

Continuous Assessment: 40%; Exam: 60%

Bibliographic References:

1. Olivier Atteia, "Chemistry and Groundwater Pollution", Tec et Doc, 2005, 400 p.

2. Laura Sigg, Philippe Behra, and Werner Stumm, "Chemistry of Aquatic Environments - Chemistry of Natural Waters and Interfaces in the Environment", Dunod, 2006

3. Jean Rodier, "Water Analysis: Natural Waters, Wastewater, Seawater", Dunod, 1993

4. F. Edeline, "Biological Water Treatment: Theory and Technology of Reactors", Cebedoc, Liège, 1993, 298 p.

5. A. Gaid, "Biological Treatment of Urban Wastewater," Volume 1, OPU Publishing, Algiers, 1984, 261 p.

6. A. Gaid, "Biological Treatment of Urban Wastewater," Volume 2, OPU Publishing, Algiers, 1984, 234 p.

7. C. Gomella and H. Guerree, "Wastewater in Urban and Rural Areas, Volume 2: Treatment," Eyrolles Publishing, 1982, Paris, 260 p.

8. Anonymous, "Water Technical Handbook (Volumes 1 and 2)," Degremont-Suez Publishing, 10th edition, 2005, 1904 p.

Course Overview

Semester: 5
Course Unit: UEM 3.1
Subject: Soil Mechanics Laboratory
Total Hours: 22h30 (Lab: 1h30)
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 master compaction procedures.

Recommended Prior Knowledge

Soil Mechanics course.

Course Content

Laboratory Sessions

- **Lab 1**: Measurement of weight characteristics (bulk density – moisture content).
- **Lab 2**: Measurement of consistency parameters (Atterberg limits).
- **Lab 3**: Granulometric analysis (by sieving and sedimentation).
- **Lab 4**: Measurement of compaction and bearing characteristics (Proctor and CBR tests).
- **Lab 5**: Measurement of in-situ density (using a membrane density gauge).
- **Lab 6**: Soil permeability (using constant and variable head permeameters).

Evaluation Mode

Continuous assessment: 100%.

Recommended Readings

1. Costet and Sanglerat, *Practical Course in Soil Mechanics*, Dunod – Paris.
2. Caquot and Kerisel, *Treatise on Soil Mechanics*, Gauthier, Villars – Paris.

Course Overview

Semester: 5
Course Unit: UEM 3.1
Subject: Soil Mechanics Laboratory
Total Hours: 22h30 (Lab: 1h30)
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 master compaction procedures.

Recommended Prior Knowledge

Soil Mechanics course.

Course Content

Laboratory Sessions

- **Lab 1**: Measurement of weight characteristics (bulk density – moisture content).
- **Lab 2**: Measurement of consistency parameters (Atterberg limits).
- **Lab 3**: Granulometric analysis (by sieving and sedimentation).
- **Lab 4**: Measurement of compaction and bearing characteristics (Proctor and CBR tests).
- **Lab 5**: Measurement of in-situ density (using a membrane density gauge).
- **Lab 6**: Soil permeability (using constant and variable head permeameters).

Evaluation Mode

Continuous assessment: 100%.

Recommended Readings

1. Costet and Sanglerat, *Practical Course in Soil Mechanics*, Dunod – Paris.
2. Caquot and Kerisel, *Treatise on Soil Mechanics*, Gauthier, Villars – Paris.

Course Overview

Semester: 5
Course Unit: UED 3.1
Subject: Irrigation
Total Hours: 22h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Course Objectives

By the end of this semester, students will acquire basic knowledge of the functioning of an irrigation system.

Recommended Prior Knowledge

Basic concepts of hydraulics.

Course Content

Chapter 1: General Concepts of Soil (3 weeks)

- Definition; characteristics and physical properties of soils; soil water in relation to irrigation.

Chapter 2: Principles of Irrigation (3 weeks)

- Definition of irrigation; supplementary or additional water; water in plants; secondary effects of irrigation; classification of irrigation; conditions for rational irrigation.

Chapter 3: Irrigation Network (3 weeks)

- Description; determination of canal reach; losses in canals.

Chapter 4: Irrigation Techniques (3 weeks)

- Definition of an irrigation technique; surface irrigation; subsurface irrigation; infiltration irrigation; sprinkler irrigation; drip irrigation.

Chapter 5: Study of a Sprinkler and Drip Irrigation Project (3 weeks)

- Estimation of crop water needs (evapotranspiration; rainfall deficit; usable reserve; readily available reserve; agricultural deficit; characteristic flows); equipment calculations.

Evaluation Mode

Exam: 100%.

Recommended Readings

1. CEMAGREF, *Practical Guide to Irrigation*.
2. PHOCAIDES, A., *Manual of Pressure Irrigation Techniques* (2nd Ed.).
3. DONEEN, I.D., *Irrigation Techniques and Water Management. FAO Bulletin on Irrigation and Drainage No. 1*, Rome, 1972.

Semester: 5

Course Unit: UED 3.1

Subject 2: Geographic Information Systems Concepts

VHS: 22:30 (Lecture: 1.5 hours)

Credits: 1

Coefficient: 1

Course Objectives:

Understand the fundamental concepts of GIS and their importance in various fields - Identify the main components of a GIS - Perform basic visualization and query operations on spatial data using GIS software - Understand the basic principles of thematic mapping and spatial data representation

Chapter I: Introduction to GIS (2 Weeks)

Chapter II: Geographic Data: Fundamental Concepts (2 Weeks)

Chapter III: Geographic Data Sources (2 Weeks)

Chapter IV: Introduction to GIS Software (e.g., QGIS) - Interface and Navigation (2 Weeks)

Chapter V: Visualizing and Querying Raster Data (2 Weeks)

Chapter VI: Introduction to Spatial Analysis (2 Weeks)

Chapter VII: GIS Lab on Open Source Software (e.g., QGIS) - Applications in the Water Sector (3 Weeks)

Assessment Method :Exam: 100%.

Bibliographic references:1. Guy Lebègue, "From space to public works: virtual models", with the collaboration of Éric Lebègue, CSTB and Laurent Lebègue, CNES, AAAF Cannes Letter, special March 2007, published on archive-host.com, reprinted in AAAF Letter no. 6 of June 2007, (ISSN 1767-0675).2. Jean Denègre and François Salgé, "Geographic information systems" 2nd edition 2004 PUF editions collection Que sais-je?

Semester: 5
Teaching Unit: UET 3.1
Subject 1: Water legislation
Total Hours: 22h 30 (Lecture: 1h30 per week)
Credits: 1
Coefficient: 1

Recommended Prerequisites:

Knowledge of the principles and rules of the legal and legislative aspects of water

Course Content:

Chapter 1: Water code (3 Weeks)

Hydraulic public domain; Right to use water; Easements; Useful effects of water; Harmful effects of water; Pollution control and protection of water resources; Resource use planning; Unconventional water resources; Financial sanctions.

Chapter 2: Legal and institutional aspects relating to the hydraulics sector (4 Weeks)

Chapter 3: Skills and responsibilities of local authorities in the hydraulics sector (4 Weeks)

Chapter 4: Water in developing countries (4 Weeks)

Evaluation Method:

- Final exam: 100%

Recommended References:

1. M. Bouvard, "Economie et techniques essentielles des aménagements hydrauliques", Eyrolles, 358p.
2. J.R. Vaillant, "Accroissement et gestion des ressources en eau", Eyrolles, 246p. Journal officiel de RADP.

Course Overview

Semester: 6
Course Unit: UEF 3.2.1
Subject: Hydraulic Structures
Total Hours: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Course Objectives

The goal of this course is to provide students with the necessary knowledge for the design and implementation of hydraulic structures aimed at the management of watercourses.

Recommended Prior Knowledge

General Hydraulics I and II.

Course Content

Chapter 1: Objectives of Hydraulic Developments (3 weeks)

Chapter 2: Hydrography (2 weeks)

- General overview of watercourses
- Characteristics of the riverbed and flow pattern

Chapter 3: Erosion Protection Structures (3 weeks)

- Erosion in watercourses

Chapter 4: Flow Through Weirs (3 weeks)

- Classification; general equation of weirs

Chapter 5: Flood Protection Structures (3 weeks)

Chapter 6: Case Study: Protecting an Urban Area from Flooding (3 weeks)

Evaluation Mode

Continuous assessment: 40%; Exam: 60%.

Recommended Readings

1. M. Carlier, *General and Applied Hydraulics*, Eyrolles, Paris.

2. W.H. Graf and M.S. Altinakar, *Fluvial Hydraulics Volume 1: Steady Flow*.
3. W.H. Graf and M.S. Altinakar, *Fluvial Hydraulics Volume 2: Unsteady Flow and Transport Phenomena*, Presses Polytechniques et Universitaires Romandes, Lausanne.

Semester: 6
Teaching unit: UEF 3.2.1
Subject 2: Drinking water supply
Semester Hours: 45h00 (Course: 1h30, Direct work 1h30)
Credits: 4
Coefficient: 2

Students will learn the principles of sizing and designing drinking water distribution networks.

.**Recommended Prerequisites:**

General hydraulics.

Course Content:

Chapter 1: Overview (2 Weeks)

Chapter 2: General water distribution scheme (2 Weeks)

Classification of drinking water systems, the principal schemes for drinking water systems (case of a surface source, case of an underground source).

Chapter 3: Water needs (3 Weeks)

Domestic water requirements, Localised water requirements (equipment), Water requirements for fire-fighting, Calculating total flow, Flow versus time: hourly flow histogram.

Chapter 4: Water adduction (3 Weeks)

Dimensions method), Pressure supply (Definition, Piping, Corrosion protection, Accessories, Optimum pipe diameter (Bresse, Bonin, Vibert formula).

Chapter 5: The tanks (3 Weeks)

Reservoir roles, Reservoir classification, Reservoir layout, Calculating reservoir characteristics, Calculating reservoir capacity, cross-section and invert dimensions, Reservoir equipment, Technical requirements for building a good reservoir

Chapter 6: Water supply networks Water distribution systems (2 Weeks)

Description of the distribution system, Calculation of a branched network, Dimensions of a meshed network

Evaluation Method:

- Continuous control: 40%
- Exam: 60%

Recommended References:

1. Briere F. G. "Distribution et collecte des eaux", Editions de l'Ecole Polytechnique de Montréal, 1994, 365 p.
2. Valiron F., "Lyonnaise des Eaux. Mémento du Gestionnaire de l'alimentation en eau et de l'assainissement. Tome I Eau dans la ville Alimentation en Eau". Paris, Technique et documentation Lavoisier, 1994.
3. Dupont A. "Hydraulique urbaine, Tome 2: Ouvrages de transport Elévation et distribution des eaux", Paris, Eyrolles, 1979, 4ème éd.

Course Overview

Semester: 6
Course Unit: UEF 3.2.1
Subject: Construction Materials
Total Hours: 22h30 (Lectures: 1h30)
Credits: 2
Coefficient: 1

Course Objectives

Students will be able to characterize the physicomechanical parameters of construction materials.

Recommended Prior Knowledge

Soil Mechanics, Concrete.

Course Content

Chapter 1: General Concepts (3 weeks)

- History of construction materials
- Classification of construction materials
- Properties of construction materials

Chapter 2: Aggregates (3 weeks)

- Granularity
- Classification of aggregates
- Characteristics of aggregates
- Different types of aggregates

Chapter 3: Binders (4 weeks)

- Classification
- Air binders (lime)
- Hydraulic binders (Portland cement)
- Main constituents and additives

Chapter 4: Mortars (5 weeks)

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

Evaluation Mode

Exam: 100%.

Recommended Readings

1. *Materials Volume 1, Properties, Applications, and Design: Course and Exercises: Bachelor's, Master's, Engineering Schools*, Dunod Edition, 2013.
2. Afnor, *Concrete Admixtures*, 2012.
3. Casteilla, *Aggregates, Soils, Cements, and Concretes: Characterization of Civil Engineering Materials through Laboratory Tests: Final Year STI Civil Engineering, BTS Building, BTS Public Works, DUT Civil Engineering, Professional Master's Geosciences Civil Engineering, Engineering Schools*, 2009.
4. *Physicochemical Properties of Construction Materials: Material & Materials, Rheological & Mechanical Properties, Safety & Regulations*.

Semester: 6
Teaching Unit: UEF 3.2.2
Subject 1: Urban Sanitation
Total Hours: 45h (Lecture: 1h30, Tutorial: 1h30 per week)
Credits: 4
Coefficient: 2

Teaching Objectives:

Enable students to master the various stages of designing an urban sanitation system.

Recommended Prerequisites:

- Hydrology
- General Hydraulics

Course Content:

Chapter 1: Introduction to Wastewater Types and Properties (3 Weeks)

- Introduction
- Classification of wastewater
- Domestic wastewater
- Stormwater runoff
- Industrial wastewater
- Physicochemical and biological characteristics of wastewater

Chapter 2: Overview of Sanitation Systems and Network Schematics (3 Weeks)

- Definition of various sanitation systems
- Conventional systems
- Pseudo-separated systems
- Combined systems
- Wastewater disposal diagrams

Chapter 3: Estimating Stormwater and Wastewater Flow Rates (3 Weeks)

- Rainwater flow rate calculations
- Rational method
- Surface method
- Series and parallel catchment basins
- Estimation of wastewater flow rates

Chapter 4: Hydraulic Design of Sanitation Networks (3 Weeks)

- Introduction
- Water transport conditions (velocity, slope, etc.)

- Calculation methods for a sanitation network

Chapter 5: Ancillary Structures in Urban Drainage Systems (3 Weeks)

Semester: 6
Course Unit: UEM 3.2
Subject: Final Year Project
Total Hours: 45h00 (Lab: 3h00)
Credits: 4
Coefficient: 2

Ealuation Method:

- Continuous assessment: 40%
- Final exam: 60%

Recommended References:

1. Coste C. et Coudet M, "Guide de l'assainissement en milieu urbain et rural", édition Eyrolles,1988.
1. Valentin A, "Ouvrages d'assainissement", édition Eyrolles, 1972.
2. Bourier. R," Les réseaux d'assainissement", édition TEC et DOC, 1992.
3. Bennis Saad, "Hydraulique et hydrologie", Edition Multimondes, 2007.
4. Valiron F, "Lyonnaise des Eaux. Mémento du Gestionnaire de l'alimentation en eau et de l'assainissement. Tome I Eau dans la ville Alimentation en Eau. Paris", Technique etdocumentation Lavoisier, 1994. 435 p.

Semester: 6

Teaching Unit: UEF 3.2.2

Subject 2: Pumps and Pumping Stations

Total Volume: 45 hours (Lectures: 1h30, Tutorials: 1h30)

Credits: 4

Coefficient: 2

Teaching Objectives

This course aims to provide students with the fundamental knowledge required for the design and sizing of water pumping stations within hydraulic systems.

Recommended Prerequisite Knowledge

Fluid Mechanics, Hydraulics.

Course Content

Chapter 1: Pumps (6 weeks)

- Fundamental equation of hydraulic machines;
- Flow within the impeller;
- Velocity triangle;
- Hydraulic machines similarity laws;
- Types of pumps and turbines;
- Characteristic curves;
- Cavitation.

Chapter 2: Pumping Stations (6 weeks)

- Pressurized installations;

- Suction installations.

Chapter 3: Water Hammer Analysis (3 weeks)

- Introduction;
- Pipe compressibility;
- Pipe elasticity;
- The water hammer phenomenon;
- Wave propagation velocity;
- Sudden and gradual valve operations;
- Water hammer effect in pumps.

Evaluation Method

- Final Examination: 60%
- Continuous Assessment: 40%

Bibliographic References

1. "Les stations de pompage d'eau: Collection IEP, industrie, production, environnement",Technique et documentation – 11 rue Lavoisier - Paris.
2. "Les installations des pompes: AFEE, Association Françaises pour l'Etude des eaux" 21 rue de Madrid – Paris.
3. "Les pompes. Manuel de sélection, application à la vitesse variable". (Coll. Technique, réf. MD1 POMPES). Auteur(s) Manon Jean - 01-2002 - 260p. 21x29.6 Broché.

Course Overview

Semester: 6
Course Unit: UEM 3.2
Subject: Final Year Project
Total Hours: 45h00 (Lab: 3h00)
Credits: 4
Coefficient: 2

Course Objectives

The objective of this course is to comprehensively integrate knowledge from various subjects. Students will apply the concepts learned during their training in a concrete manner, encouraging autonomy and initiative. It aims to teach students to work collaboratively while fostering intellectual curiosity.

Recommended Prior Knowledge

The entire Bachelor's program.

Course Content

The theme of the Final Year Project must be chosen in collaboration between the supervising teacher and a student (or a group of students: pairs or trios). The subject matter must align with the training objectives and the actual skills of the student (Bachelor's level). It is preferable that the theme also considers the social and economic environment of the institution. If necessary, the project can be divided into several parts.

Note:
During the weeks when students are familiarizing themselves with the project's purpose and feasibility (literature review, searching for necessary software or materials, reviewing and reinforcing teachings directly related to the subject, etc.), the course coordinator should utilize this time to remind students of the essential content from the two subjects "Writing Methodology" and "Presentation Methodology" covered during the first two semesters of the common core.

At the end of this study, the student must submit a written report detailing:

- A comprehensive presentation of the study theme, emphasizing its relevance in the socio-economic environment.
- The means implemented: methodological tools, bibliographic references, contacts with professionals, etc.
- An analysis of the results obtained and their comparison with the initial objectives.
- A critique of the discrepancies observed and any additional details.
- Identification of difficulties encountered, highlighting the limitations of the work done and the future steps to be taken.

Finally, the student or group of students will present their work (in the form of a brief oral presentation or a poster) to their supervising teacher and an examining teacher, who may ask questions and evaluate the work completed both technically and in terms of the presentation.

Evaluation Mode

Continuous assessment: 100%.

Course Overview

Semester: 6
Course Unit: UEM 3.2
Subject: Concepts of Reinforced Concrete
Total Hours: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Course Objectives

To teach the characteristics and mechanical properties of reinforced concrete. Students will learn how to size sections subjected to simple stresses (compression, tension, and simple bending) according to the BAEL 91 modified 99 and CBA 93 standards.

Recommended Prior Knowledge

Material Resistance (RDM) and Construction Materials (MDC).

Course Content

Chapter 1: Formulation and Mechanical Properties of Reinforced Concrete (2 weeks)

- General overview of reinforced concrete (properties of constituents, advantages and disadvantages, applications, etc.)
- Mechanical properties (strengths, deformation modules, stress-strain behavior)

Chapter 2: Regulatory Requirements (2 weeks)

- Rule of three pivots
- Limit states (ULS and SLS)
- Action combinations
- Non-fragility condition

Chapter 3: Calculation of Sections Under Simple Compression (2 weeks)

- Calculation of the reinforcement section (Asc)
- Buckling verification
- Calculation of ultimate normal force

Chapter 4: Calculation of Sections Under Simple Tension (2 weeks)

- Cracking in concrete
- Calculation of the reinforcement section (Ast)
- Verification of the non-fragility condition

Chapter 5: Calculation of Sections Under Simple Bending (4 weeks)

- Rectangular sections, T-sections
- Calculation using flowcharts
- Reinforcement verification

Chapter 6: Steel-Concrete Bond and Bar Anchorage (3 weeks)

- Bond stress between steel and concrete
- Anchorage of a straight isolated bar
- Anchorage by curvature
- Lap splicing of bars

Evaluation Mode

Continuous assessment: 40%; Exam: 60%.

Recommended Readings

1. D.T.R-B.C.2-41, *Rules for the Design and Calculation of Reinforced Concrete Structures* (CBA 93).
2. Jean-Pierre Mouguin, *Reinforced Concrete, BAEL 91 Modified 99 and Associated DTUs*, Eyrolles.
3. José Ouin, *Reinforced Concrete at Limit States* according to the BAEL91 addendum, EL Educalivre.
4. Jean Perchat and Jean Roux, *Practice of BAEL 91 (Course with Corrected Exercises)*, Eyrolles.
5. Pierre Charon, *Exercises in Reinforced Concrete According to BAEL 83 Rules*, Eyrolles, 2nd edition.
6. Jean-Marie Paillé, *Calculation of Concrete Structures: Application Guide*, Eyrolles, 2013.

Course Overview

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

Course Objectives

To prepare and master the methodological tools necessary for professional integration at the end of studies, to prepare for job searching. To raise awareness about entrepreneurship by presenting an overview of management knowledge useful for creating activities and implementing a project.

Course Content

Chapter 1: The Company and Society (3 weeks)

- Definition and objectives of a company.
- Different forms of companies, company structure, personnel, and partners.
- Types of companies (TPE, PME, PMI, ETI, GE)
- Definition and objectives of society.
- Different types of companies (SARL, EURL, SPA, SNC).
- Difference between company and society.

Chapter 2: Operation and Organization of the Company (2 weeks)

- Modes of organization and operation of the company.
- Main functions of the company (production company, service company, etc.).
- Definition and characteristics of company structure.
- Different types of structures (functional structure, divisional structure, multidivisional structure, hierarchical-functional "staff and line").
- Ancillary activities of the company (partnerships, subcontracting, etc.).

Chapter 3: How to Access a Company (3 weeks)

- Personnel needs and qualities (executives, managers, technicians, workers, etc.).
- Where to find job offers (ANEM, internet, etc.).
- How to proceed (application, CV).
- Different types of job interviews and how to prepare for an interview.
- Types of employment contracts (CDI and CDD).
- Salary (how to calculate a payslip).

Chapter 4: How to Create Your Own Company (3 weeks)

- The journey of a business creator (idea, capital, financial aid, etc.).
- How to find a good idea.
- Financial aid mechanisms for investment (ANSEJ, CNAC, ANDI, ANGEM, PNR).

Chapter 5: Study of a Business Creation Project (4 weeks)

- The study of a business creation project requires the promoter to anticipate and write in detail the phases and steps they must take to start their business.
- Market study (commercial service, marketing, etc.).
- Technical study (location, material and machine needs, production capacity, etc.).
- Financial study (revenue, payroll costs, expenses and consumption, taxes, etc.).
- Mini project for the study of a business creation project.

Evaluation Mode

Exam: 100%.

Recommended Readings

1. Antoine Melo, *Business Management*, Melo France Edition, 2016.
2. Thomas Durand, *Business Management*, Broché Edition, 2016.
3. Philippe Guillermic, *Business Management Step by Step*, Poche Edition, 2015.
4. Guy Raimbault, *Management Tools*, Chihab Edition, Algiers, 1994.
5. Financial Technology Institute, *Introduction to Accounting*, OPU Algiers, 1993.
6. Christian Bultez, *Guide and Manual for Procedures*, Nathan Edition, Paris, 1993.