Bachelor in Branch Civil engineering

Specialty *Civil Engineering*

Brief

Civil Engineering at Khemis Miliana University is one of the major branches of engineering.This specialty is extremely broad and diverse with a broad base of applications.The training in civil engineering allows students to learn the fundamental principles on the calculation of constructions in the field of civil engineering.At the Bachelor level, all students are required to follow six semesters of different courses on the basics in mathematics, physics, calculation and dimensioning of structures and an end-of-cycle project at the end of the sixth semester.

Field	Branch	Speciality
Sciences and Technologies	**Civil engineering**	**Civil engineering**

First Semester

Teaching unit	**Matter**	**Credit**	**Coefficient**	**C**	**TD**	**TP**	**Volume (hour)**
Fundamental Unit	Mathematics 1	6	3	3h00	1h30		67h30
	Physic 1	6	3	3h00	1h30		67h30
	Structure of material	6	3	3h00	1h30		67h30
Methodological unit	TP Physic 1	2	1			1h30	22h30
	TP chemistry 1	2	1			1h30	22h30
	Computer science 1	4	2	1h30		1h30	45h00
	Writing methodology	1	1	1h00			15h00
Discovery unit	Science and Technology professions 1	1	1	1h30			22h30
Transversale Unit	Ethical and deontological dimension (basics)	1	1	1h30			22h30
	Foreign language 1 (French or English)	1	1	1h30			22h30

Second Semester 2

Teaching unit	Matter	Credit	Coefficient	C	TD	TP	Volume (hour)
Fundamental Unit	Mathematics 2	6	3	3h00	1h30		67h30
	Physic 2	6	3	3h00	1h30		67h30
	Thermodynamic	6	3	3h00	1h30		67h30
Methodological unit	TP Physic2	2	1			1h30	22h30
	TP chemistry2	2	1			1h30	22h30
	Computer science2	4	2	1h30		1h30	45h00
	Presentation Methodology	1	1	1h00			15h00
Discovery unit	Science and Technology professions 2	1	1	1h30			22h30
Transversale Unit	Foreign language 2 (French or English)	2	2	3h00			45h00

Third Semester

Teaching unit	Matter	Credit	Coefficient	C	TD	Practical Work	Volume (hour)
Fundamental Unit	Mathematics 3	6	3	3h00	1h30		67h30
	Waves and vibrations	4	2	1h30	1h30		45h00
	Fluid mechanics	4	2	1h30	1h30		45h00
	Rational mechanics	4	2	1h30	1h30		45h00
Methodological unit	Probability and statistics	4	2	1h30	1h30		45h00
	Computer science 3	2	1			1h30	22h30
	Technical drawing	2	1			1h30	22h30
	TP Waves and vibrations	1	1			1h00	15h00
Discovery unit	Basic technology	1	1	1h30			22h30
	Metrology	1	1	1h30			22h30
Transversale Unit	Technical English	1	1	1h30			22h30

Fourth Semester

Teaching unit	Matter	Credit	Coefficient	C	TD	TP	HV
Fundamental Unit	Soil mechanics	4	2	1h30	1h30		45h00
	Construction materials	2	1	1h30			22h30
	Mathematics 4	4	2	1h30	1h30		45h00
	Numerical methods	4	2	1h30	1h30		45h00
	Strength of materials 1	4	2	1h30	1h30		45h00
Methodological unit	TP Soil mechanics	2	1			1h30	22h30
	TP Construction materials	2	1			1h30	22h30
	Computer aided drawing	2	1			1h30	22h30
	TP Numerical methods	2	1			1h30	22h30
	TP Fluid M &Strength M	1	1			1h00	15h00
Discovery unit	Geology	1	1	1h30			22h30
	Surveying 1	1	1	1h30			22h30
Transversale Unit	Technics of expression of information and communication	1	1	1h30			22h30

Fifth Semester

Teaching unit	Matter	Credit	Coefficient	C	TD	TP	HV
Fundamental Unit	Strength of materials 2	4	2	1h30	1h30		45h00
	Reinforced concrete 1	4	2	1h30	1h30		45h00
	Steel frame	4	2	1h30	1h30		45h00
	Soil mechanics 2	4	2	1h30	1h30		45h00
	Construction materials 2	2	1	1h30			22h30
Methodological unit	TP Surveying	2	1			1h30	22h30
	TP Soil mechanics 2	2	1			1h30	22h30
	TP Construction materials 2	2	1			1h30	22h30
	Drawing of the building and public works	3	2			2h30	37h30
Discovery unit	Surveying2	1	1	1h30			22h30
	General hydraulic	1	1	1h30			22h30
Transversale Unit	Technics and rules ofconstruction	1	1	1h30			22h30

Sixth Semester

Teaching unit	Matter	Credit	Coefficient	C	TD	TP	HV
Fundamental Unit	Calculation of structures	4	2	1h30	1h30		45h00
	SteelConstructions	4	2	1h30	1h30		45h00
	Reinforced concrete 2	6	3	3h00	1h30		67h30
	Foundations andgeotechnical works	4	2	1h30	1h30		45h00
Methodological unit	End of cycle project	4	2			3h00	45h00
	Computer aided calculation	3	2			2h30	37h30
	Quantity Survey and Price Estimate	2	1	1h30			22h30
Discovery unit	Roads and other networks	1	1	1h30			22h30
	Organization of construction sites	1	1	1h30			22h30
Transversale Unit	Entrepreneurship and company management	1	1	1h30			22h30

Detailed program by matter for the S1 semester

Semester: 1
Course unit: UEF 1.1
Subject 1: Mathematics 1
VHS: 67h30 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives
This first subject of mathematics is particularly devoted to the homogenization of the level of students at the entrance of the university. The first new elements are taught progressively in order to lead students towards more advanced mathematics. The concepts covered in this subject are fundamental and among the most used in the field of Science and Technology.

Prior knowledge recommended
Basic notions of mathematics for the Terminale classes (sets, functions, equations, etc.).

Material content:
Chapter 1. Methods of Mathematical Reasoning (1 Week)
1-1 Direct reasoning. 1-2 Reasoning by contraposition. 1-3 Absurd reasoning. 1-4 Reasoning by counterexample. 1-5 Inductive reasoning.
Chapter 2. Sets, Relations and Maps (2 Weeks)
2.1 Set theory. 2-2 Order relation, Equivalence relations. 2-3 Injective, surjective, bijective map: definition of a map, direct image, reciprocal image, characteristic of a map.
Chapter 3. Real functions in one real variable (3 Weeks)
3-1 Limit, continuity of a function. 3-2 Derivative and differentiability of a function.
Chapter 4. Application 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 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 mapping, kernel, image, rank.

Assessment method: Continuous control: 40%; Review: 60%.
Bibliographic references:
1- K. Allab, Eléments d'analyse, Fonction d'une variable réelle, 1re & 2e années d'université, Office des Publications universitaires.
2- J. Rivaud, Algèbre : Classes préparatoires et Université Tome 1, Exercices avec solutions, Vuibert.
3- N. Faddeev, I. Sominski, Recueil d'exercices d'algèbre supérieure, Edition de Moscou
4- M. Balabne, M. Duflo, M. Frish, D. Guegan, Géométrie – 2e année du 1er cycle classes préparatoires, Vuibert Université.
5- B. Calvo, J. Doyen, A. Calvo, F. Boshet, Exercices d'algèbre, 1er cycle scientifique préparation aux grandes écoles 2e année, Armand Colin – Collection U.
6- J. Quinet, Cours élémentaire de mathématiques supérieures 1- Algèbre, Dunod.
7- J. Quinet, Cours élémentaire de mathématiques supérieures 2- Fonctions usuelles, Dunod.
8- J. Quinet, Cours élémentaire de mathématiques supérieures 3- Calcul intégral et séries, Dunod.
9- J. Quinet, Cours élémentaire de mathématiques supérieures 4- Equations différentielles, Dunod.

Semester: 1
Course unit: UEF 1.1
Subject 2: Physics 1
VHS: 67h30 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives
Introduce the student to the basics of Newtonian physics through three main parts: Kinematics, Dynamics and Work and Energy.

Prior knowledge recommended
Notions of mathematics and physics.

Material content:
Math Reminders (2 Weeks)
1- The dimensional equations
2- Vector calculus: scalar product (norm), vector product, Functions with several variables, derivation. Vector analysis: gradient, rotational, etc. operators

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 the material point in the different coordinate systems. 4- Relative movement.

Chapter 2. Dynamic: (4 Weeks)
1- Generality: Mass - Force - Moment of force – Absolute and Galilean reference. 2- Newton's laws. 3- Principle of conservation of momentum. 4- Differential equation of motion. 5- Kinetic moment. 6- Applications of the fundamental law for forces (constant, time-dependent, speed-dependent, central force, etc.).

Chapter 3. Work and Energy (4 Weeks)
1- Work of a force. 2- Kinetic Energy. 3- Potential energy – Examples of potential energy (gravity, gravitational, elastic). 4- Conservative and non-conservative forces - Total energy theorem.

Assessment method: Continuous control: 40%; Review: 60%.

Bibliographic references:
1. A. Gibaud, M. Henry ; Cours de physique - Mécanique du point - Cours et exercices corrigés; 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 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives

The teaching of this subject allows the student to acquire basic formalisms in chemistry, particularly within the subject describing the atom and the chemical bond, the chemical elements and the periodic table with energy quantification. Make students more adept at solving chemistry problems.

Prior knowledge recommended

Basic notions of mathematics and general chemistry.

Material content:

Chapter 1: Fundamentals (2 Weeks)

States and macroscopic characteristics of the states of matter, changes of state of matter, notions of atom, molecule, mole and Avogadro's number, atomic mass unit, atomic and molecular molar mass, molar volume, Law of weight: Conservation of mass (Lavoisier), chemical reaction, Qualitative aspect of matter, Quantitative aspect of matter.

Chapter 2: Main constituents of matter (3 Weeks)

Introduction: Faraday's experiment: relationship between matter and electricity, Highlighting the constituents of matter and therefore of 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 the various isotopes, Separation of isotopes and determination of the atomic mass and the 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 radiation), 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 atomic model: hydrogen atom, The hydrogen atom in wave mechanics, Polyelectronic atoms in wave mechanics.

Chapter 5: Periodic Table of Elements (3 Weeks)

D. Mendeleiev's periodic table, Modern periodic table, Evolution and periodicity of the physico-chemical properties of the elements, Calculation of the radii (atomic and ionic), successive ionization energies, electron affinity and electronegativity (Mulliken scale) by Slater's rules.

Chapter 6: Chemical Bonds (3 Weeks)

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

Assessment method:
Continuous control: 40%; Review: 60%.

Bibliographic references

1. Ouahes, Devallez, Chimie Générale, OPU.
2. S.S. Zumdhal & coll., Chimie Générale, De Boeck Université.
3. Y. Jean, Structure électronique des molécules : 1 de l'atome aux molécules simples, 3e édition, Dunod, 2003.

4. F. Vassaux, La chimie en IUT et BTS.
5. A. Casalot & A. Durupthy, Chimie inorganique cours 2ème cycle, Hachette.
6. P. Arnaud, Cours de Chimie Physique, Ed. Dunod.
7. M. Guymont, Structure de la matière, Belin Coll., 2003.
8. G. Devore, Chimie générale : T1, étude des structures, Coll. Vuibert, 1980.
9. M. Karapetiantz, Constitution de la matière, Ed. Mir, 1980.

Semester: 1
Course unit: UEM 1.1
Subject 3: Physics 1
VHS: 10h30 (Practical Work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives
Consolidate the theoretical knowledge brought to the course by a certain number of practical manipulations.

Prior knowledge recommended
Notions of mathematics and physics.

Material content:
5 manipulations at least (3h00 / 15 days):

- Methodology of presentation of practical work reports and calculation of errors.
- Verification of Newton's 2nd law
- Free fall
- Simple pendulum
- Elastic collisions
- Inelastic collisions
- Moment of inertia
- Centrifugal force

Assessment method:
Continuous control: 100%.

Semester: 1
Course unit: UEM 1.1
Subject 2: Lab Chemistry 1
VHS: 10h30 (Practical Work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives
Consolidate the theoretical knowledge brought to the structure of matter course by a certain number of practical manipulations.

Prior knowledge recommended
Notions of basic chemistry.

Material content:

1. Safety in the laboratory
2. Preparation of solutions
3. Notions on uncertainty calculations applied to chemistry.
4. Acid-base determination by colorimetry and pH-metry.
5. Acid-base determination by conductivity meter.
5. Redox assay
6. Determination of water hardness
7. Determination of ions in water: determination of chloride ions by the Mohr method.

Assessment method:
Continuous control: 100%

Semester: 1
Course unit: UEM 1.1
Subject 3: Computer Science 1
VHS: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Objective and recommendations:
The objective of the subject is to enable students to learn to program with an advanced language (Fortran, Pascal or C). The choice of language is left to the discretion of each establishment. The notion of algorithm must be supported implicitly during language learning.

Prior knowledge recommended: Basics of web technology.

Material content:
Part 1. Introduction to Computers (5 Weeks)
1- Definition of IT
2- Evolution of IT and computers
3- Information coding systems
4- Operating principle of a computer
5- Hardware part of a computer
6- System part
Basic systems (operating systems (Windows, Linux, Mac OS, etc.)
Programming languages, application software
Part 2. Notions of algorithm and program (10 Weeks)
1- Concept of an algorithm
2- Organization chart representation
3- Structure of a program
4- The approach and analysis of a problem
5- Data structure: Constants and variables, Data types
6- Operators: assignment operator, Relational operators, Logical operators, Arithmetic operations, Priorities in operations
7- Entry/exit operations
8- Control structures: Conditional control structures, Repetitive control structures
Computer lab 1:
The practicals aim to illustrate the notions taught during the course. The latter must begin with the lessons according to the following schedule:
• Initiation and familiarization with the computer machine from a hardware and operating systems point of view (exploration of the different functionalities of the OS)
• Introduction to the use of a programming environment (Editing, Assembly, Compilation, etc.)
• Practical application of the programming techniques seen in class.

Assessment method: Continuous control: 40%; Review: 60%.
Bibliographic references
1- John Paul Mueller et Luca Massaron, Les algorithmes pour les Nuls grand format, 2017.
2- Charles E. Leiserson, Clifford Stein et Thomas H. Cormen, Algorithmique: cours avec 957 exercices et 158 problèmes, 2017.
3- Thomas H. Cormen, Algorithmes: Notions de base, 2013.

Semester: 1
Course unit: UEM 1.1
Subject 4: Writing Methodology
VHS: 3h00 (Lectures: 1h00)
Credits: 1
Coefficient: 1

Teaching objectives
Familiarize and train students with current concepts of writing methodology in force in the profession of Science and Technology. Among the skills to be acquired: Knowing how to introduce yourself; Know how to write a CV and a cover letter; Knowing how to position oneself in writing or orally in relation to an opinion or an idea; Mastering syntax and spelling in writing.

Prior knowledge recommended
Basic French. Basic principle of writing a document.

Material content:
Chapter 1. Notions and generalities on writing techniques (2 Weeks)
– Definitions, standards
- Applications: writing a summary, a letter, a request

Chapter 2. Information Search, Synthesis and Exploitation (3 Weeks)
- Search for information in the library (Paper format: Books, Journals)
-Search for information on the Internet (Digital: Databases; Search engines, etc.).
- Apps

Chapter 3 Writing Techniques and Procedures (3 Weeks)
- Basic principle of writing - Punctuation, Syntax, Sentences
- sentence length
- Division into paragraphs
- The use of a neutral style and writing in the third person
- Readability
- Objectivity
- Intellectual rigor and Plagiarism

Chapter 4 Writing a Report (4 Weeks)
Cover pages, Summary, Introduction, Method, Results, Discussion, Conclusion, Bibliography, Appendices, Summary and Keywords

Chapter 5. Applications (3 Weeks)
Report of a practical work

Assessment method:
Control Review: 100%.

Bibliographic references:

1. J.-L. Lebrun, Guide pratique de rédaction scientifique, EDP Sciences, 2007.
2. M. Fayet, Réussir ses comptes rendus, 3e édition, Eyrolles, 2009.
3. M. Kalika, Mémoire de master - Piloter un mémoire, Rédiger un rapport, Préparer une soutenance, Dunod, 2016.
4. M. Greuter, Réussir son mémoire et son rapport de stage, l'Etudiant, 2014
5. F. Cartier, Communication écrite et orale, Edition GEP- Groupe Eyrolles, 2012.
6. M. Fayet, Méthodes de communication écrite et orale, 3e édition, Dunod, 2008.
7. E. Riondet, P. Lenormand, Le grand livre des modèles de lettres, Eyrolles, 2012.
8. R. Barrass, Scientist must write – A guide to better writing for scientists, engineers and students, 2d edition, Routledge, 2002.
9. G. Andreani, La pratique de la correspondance, Hachette, 1995.
10. Ph. Rubens, Science & Technical Writing, A Manual of Style, 2d edition, Routledge, 2001.
11. A. Wallwork, User Guides, Manuals, and Technical Writing – A Guide to Professionnal English, Springer, 2014.

Semester: 1
Course unit: UED 1.1
Subject 1: Professions in Science and Technology 1
VHS: 10h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Objective of the subject:
Introduce the student, in a first step, to all the courses that are covered by the Domain of Science and Technology and in a second step, a panoply of professions to which these courses lead. In the same context, this subject introduces the new challenges of sustainable development as well as the new professions that may arise from it.

Prior knowledge recommended
None.

Material content:
1. What are engineering sciences? (2 weeks)
The engineering profession, history and challenges of the 21st century, Search for a profession/recruitment advertisement by keyword, draw up a simple job description (job title, company, main activities, skills required (knowledge, know-how , relational

2. Electronics, Telecommunications, Biomedical Engineering, Electrotechnics, Electromechanics, Optics & Precision Mechanics: (2 weeks)
- Definitions, fields of application (Home automation, on-board automotive applications, Video surveillance, Mobile telephony, Fiber optics, State-of-the-art scientific instrumentation, Medical imaging and instrumentation, Giant mirrors, Contact lenses, Electric power transmission and distribution , Electricity production plants, Energy efficiency, Maintenance of industrial equipment, Elevators, Wind turbines, …
- Role of the specialist in these fields.

3. Automation and Industrial Engineering streams: (1 week)
- Definitions, fields of application (automated industrial chains, CNC machine tools, robotics, inventory management, goods traffic management, quality, - Role of the specialist in these fields.

4. Process Engineering, Hydrocarbons and Petrochemical Industries sectors: (2 weeks)
- Definitions, Pharmaceutical industry, Food industry, Leather and textile industry, Biotechnology, Chemical and petrochemical industry, Plastics, Energy sector (oil, gas), etc.
- Role of the specialist in these fields.

5. Sustainable development (SD): (4 weeks)
Definitions, Planetary issues (climate change, Demographic transitions, Depletion of resources (oil, gas, coal, etc.), Impoverishment of biodiversity, etc.), SD diagram (Sustainable = Viable + Livable + Equitable), SD actors (governments , citizens, socio-economic sector, international organizations, etc.), Global nature of SD challenges

6. Sustainable engineering: (4 weeks)

Definition, Principles of sustainable engineering (definitions of: sustainable energy/energy efficiency, sustainable mobility/ecomobility, valorization of resources (water, metals and minerals, etc.), sustainable production), Relevance of sustainable engineering in S&T sectors , Relationship between sustainability and engineering, Responsibility of engineers in carrying out sustainable projects, …

Personal work of the student for this subject:
The teacher in charge of this subject can let his students know that he can always evaluate them by offering to prepare job descriptions. Ask the students to watch at home a popular science film related to the chosen profession (after having given them either the film on electronic medium or having indicated the internet link to this film) and then ask them to submit a written report or to make an oral presentation of the summary of this film, etc. The improvement of these activities is left to the discretion of the teacher and the training team, who alone are able to define the best way to take account of this personal work in the overall mark of the final exam.

Group work: Development of job descriptions for professions in each sector based on recruitment advertisements found on job application sites (e.g. http: //www.onisep.fr/Decouvrir-les-metiers, www .indeed.fr, www.pole-emploi.fr) (1 sector / group).
Depending on the capacities of the establishments, recommend calling on doctoral students and former graduates of the establishment in a tutoring/mentoring system where each group can call on its tutor/mentor to develop the job description/discover the different ST professions .

Assessment method:
100% review

Bibliographic references:
1- Quels métiers pour demain ? Éditeur : ONISEP, 2016, Collection : Les Dossiers.
2- J. Douënel et I. Sédès, Choisir un métier selon son profil, Editions d'Organisation, Collection : Emploi & carrière, 2010.
3- V. Bertereau et E. Ratière, Pour quel métier êtes-vous fait ? Editeur : L'Étudiant, 6e édition, Collection : Métiers, 2015.
4- Le grand livre des métiers, Éditeur : L'Étudiant, Collection : Métiers, 2017.
5- Les métiers de l'industrie aéronautique et spatiale, Collection : Parcours, Edition : ONISEP, 2017.
6- Les métiers de l'électronique et de la robotique, Collection : Parcours, Edition : ONISEP, 2015.
7- Les métiers de l'environnement et du développement durable, Collection : Parcours, Edition : ONISEP, 2015.
8- Les métiers du bâtiment et des travaux publics, Collection : Parcours, Edition : ONISEP, 2016.
9- Les métiers du transport et de la logistique, Collection : Parcours, Edition : ONISEP, 2016.
10- Les métiers de l'énergie, Collection : Parcours, Edition : ONISEP, 2016.
11- Les métiers de la mécanique, Collection : Parcours, Edition : ONISEP, 2014.
12- Les métiers de la chimie, Collection : Parcours, Edition : ONISEP, 2017.
13- Les métiers du Web, Collection : Parcours, Edition : ONISEP, 2015.
14- Les métiers de la biologie, Collection : Parcours, Edition : ONISEP, 2016.

Semester: 1
Course unit: UET 1.3
Subject : Ethical and deontological dimension (the foundations)
VHS: 10h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:
The main objective of this course is to facilitate an individual's immersion in student life and their transition into a responsible adult. It helps to develop students' awareness of ethical principles. Introduce them to the rules that govern life at the university (their rights and obligations vis-à-vis the university community) and in the world of work, to raise awareness of the respect and enhancement of intellectual property and explain to them the risks of moral evils such as corruption and how to combat them.

Recommended prior knowledge:
None

Material content:

I. Fundamentals (2 **weeks)**
Definitions:
1. Morality:
2. Ethics:
3. Deontology "Theory of Duty":
4. The law:
5. Distinction between the different notions
A. Distinction between Ethics and Morality
B. Distinction between ethics and deontology
II. References – (2 **weeks)**
The philosophical references
The religious reference
The evolution of civilizations
The institutional reference
III. The University Franchise – (3 **weeks)**
The Concept of University Franchises
Regulatory texts
Royalties from university franchises
University campus actors
IV. University Values – (2 **weeks)**
Social Values
Community Values
Professional Values
V. Rights and Duties (2 weeks)
Student Rights
Student's homework
Teachers' rights
Obligations of the professor-researcher

Obligations of administrative and technical staff

VI. University Relations (2 weeks)

Definition of the concept of academic relations
Student-teacher relations
Student-student relationship
Student - Staff Relations
Student relationship – Association members

VII. Practices (2 weeks)

Good practices For the teacher
Good practices For the student

Bibliographic references

1. Recueil des cours d'éthique et déontologie des universités algériennes.
2. BARBERI (J.-F.), 'Morale et droit des sociétés', Les Petites Affiches, n° 68, 7 juin 1995.
3. J. Russ, La pensée éthique contemporaine, Paris, puf, Que sais-je ?, 1995.
4. LEGAULT, G. A., Professionnalisme et délibération éthique, Québec, Presses de l'Université du Québec, 2003.
5. SIROUX, D., 'Déontologie', dans M. Canto-Sperber (dir.), Dictionnaire d'éthique et de philosophie morale, Paris, Quadrige, 2004.
6. Prairat, E. (2009). Les métiers de l'enseignement à l'heure de la déontologie. Education et Sociétés, 23.
7. https://elearning.univ-annaba.dz/pluginfile.php/39773/mod_resource/content/1/Cours%20Ethique%20et%20la%20d%C3%A9ontologie.pdf .

Semester: 1
Course unit: UET 1.1
Subject 1: French language1
VHS: 10h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:
It is a question of developing in this subject the following four skills: Oral comprehension, Written comprehension and Oral expression, Written expression through reading and the study of texts.

Recommended prior knowledge:
Basic French.

Material content:
We propose below a set of themes that deal with basic sciences, technologies, economy, social facts, communication, sport, health, etc. The teacher can choose from this list of texts to develop them during the course. Otherwise, he is free to address other topics of his choice. The texts can be borrowed from various communication media: daily newspapers, sports or entertainment magazines, specialized or popular magazines, books, websites, audio and video recordings, etc.
For each text, the teacher helps the student to develop their language skills: listening, comprehension, both oral and written expression. In addition, they must use this text to identify the grammatical structures that they will develop during the same course session. We recall here, by way of illustration, a set of grammatical structures that can be developed as an example. Of course, it is not a question of developing them all or in the same way. Some can be recalled and others well detailed.
Examples of themes Grammatical structures
Climate change, Pollution, The electric car, The robots, artificial intelligence, Nobel prize , Olympic, Games, sports at school, The Sahara, The currency, The line work, ecology, Nanotechnology, The optical fiber, The profession of engineer, The power station, Energetic efficiency, The smart building Wind energy, Solar energy,
The punctuation. proper nouns, articles.
Grammatical functions: noun, verb, pronouns, adjective, adverb.
The complement pronoun “the, the, the, him, their, y, en, me, you, …”
Agreements.
The negative sentence. Don't, Don't... yet, Don't... anymore, Don't... never, Don't...
The interrogative sentence. Question with "Who, What, What", Question with "When, Where, How Much, Why, How, Which, Which".
The exclamatory sentence.
Reflexive verbs. impersonal verbs.
The tenses of the indicative, Present, Future, past tense, past simple, Imperfect.
…

Assessment method:
Review: 100%.

Bibliographic references:
1. M. Badefort, Objectif : Test de Français International, Edulang, 2006.

2. O. Bertrand, I. Schaffner, Réussir le TCF, Exercices et activités d'entrainement, Les éditions de l'école polytechnique, 2009.
3. M. Boulares, J.-L. Frerot, Grammaire progressive du Français avec 400 exercices, Niveau avancé, CLE International.
4. Collectif, Besherelles : la Grammaire pour tous, Hatier.
5. Collectif, Besherelles : la Conjugaison pour tous, Hatier.
6. M. Grégoire, Grammaire progressive du Français avec 400 exercices, Niveau débutant, CLE International, 1997.
7. A. Hasni et al., La formation à l'enseignement des sciences et des technologies au secondaire, Presses de l'université du Québec, 2006.
8. J.-L. Lebrun, Guide pratique de la rédaction scientifique, EDP Sciences, 2007.
9. J.M. Robert, Difficultés du Français, Hachette,
10. C. Tisset, Enseigner la langue française à l'école : La Grammaire, L'Orthographe et la Conjugaison, Hachette Education, 2005.
11. J. Bossé-Andrieu, Abrégé des Règles de Grammaire et d'Orthographe, Presses de l'université du Québec, 2001.
12. J.-P. Colin, Le français tout simplement, Eyrolles, 2010.
13. Collectif, Test d'évaluation de Français, Hachette, 2001.
14. Y. Delatour et al., Grammaire pratique du Français en 80 fiches avec exercices corrigées, Hachette, 2000.
15. Ch. Descotes et al., L'Exercisier : l'expression française pour le niveau intermédiaire, Presses Universitaires de Grenoble, 1993.
16. H. Jaraush, C. Tufts, Sur le Vif, Heinle Cengage Learning, 2011.
17. J. Dubois et al., Les indispensables – Orthographe, Larousse, 2009.

Semester: 1
Course unit: UET 1.1
Subject 3: English Language1
VHS: 10h30 (Lectures: 1h30)
Credits: 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
Iron and Steel
Heat Treatment of Steel.
Lubrification 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. 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:
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.

Detailed program by matter for the S2 semester

Semester: 2
Teaching unit: UEF 1.2
Subject 3: Mathematics 2
VHS: 67h30 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:
Students are gradually introduced to mathematics that are useful for their university curriculum. At the end of the course, the student 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 by several methods.

Recommended prerequisite knowledge:
Basic knowledge of mathematics (differential equation, integrals, systems of equations, ...).

Course content:
Chapter 1: Matrices and determinants (3 weeks)
1-1 Matrices (Definition, operation). 1-2 Matrix associated with a linear application. 1-3 Linear application associated with a matrix. 1-4 Change of basis, passage matrix.
Chapter 2: Linear systems of equations (2 weeks)
2-1 Generalities. 2-2 Study of the set of solutions. 2-3 Methods of solving a linear system. Solution by Cramer's method. Solution by the inverse matrix method. Solution by the Gauss method.
Chapter 3: Integrals (4 weeks)
3-1 Indefinite integral, property. 3-2 Integration of rational functions. 3-3 Integration of exponential and trigonometric functions. 3-4 Integral 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 differential equations of the second order with constant coefficient.
Chapter 5: Functions of several variables (2 weeks)
5-1 Limit, continuity, and partial derivatives of a function. 5-2 Differentiability. 5-3 Double, triple integrals.

Assessment method: Continuous assessment: 40%; Exam: 60%.
Bibliographic references:
1- F. Ayres Jr, Théorie et Applications du Calcul Différentiel et Intégral - 1175 exercices corrigés, McGraw-Hill.
2- F. Ayres Jr, Théorie et Applications des équations différentielles - 560 exercices corrigés, McGraw-Hill.
3- J. Lelong-Ferrand, J.M. Arnaudiès, Cours de Mathématiques - Equations différentielles, Intégrales multiples, Tome 4, Dunod Université.
4- M. Krasnov, Recueil de problèmes sur les équations différentielles ordinaires, Edition de Moscou
5- N. Piskounov, Calcul différentiel et intégral, Tome 1, Edition de Moscou
6- J. Quinet, Cours élémentaire de mathématiques supérieures 3- Calcul intégral et séries, Dunod.
7- J. Quinet, Cours élémentaire de mathématiques supérieures 4- Equations différentielles, Dunod.
8- J. Quinet, Cours élémentaire de mathématiques supérieures 2- Fonctions usuelles, Dunod.
9- J. Quinet, Cours élémentaire de mathématiques supérieures 1- Algèbre, Dunod.
10- J. Rivaud, Algèbre : Classes préparatoires et Université Tome 1, Exercices avec solutions, Vuibert.
11- N. Faddeev, I. Sominski, Recueil d'exercices d'algèbre supérieure, Edition de Moscou.

Semester: 2
Teaching unit: UEF 1.2
Subject 3: Physics 2
VHS: 67h30 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:
To introduce the student to the physical phenomena underlying the laws of electricity in general.

Recommended prerequisites:
Mathematics 1, Physics 1.

Subject contents:
Mathematical review: (1 week)
1- Elements of length, surface, and volume in Cartesian, cylindrical, and spherical coordinate systems. Solid angle, Operators (gradient, curl, Nabla, Laplacian, and divergence).
2- Multiple derivatives and integrals.
Chapter I. Electrostatics: (6 weeks)
1- Electric charges and fields. Electrostatic interaction force-Coulomb's law.
2- Electrostatic potential. 3- Electric dipole. 4- Flux of the electric field. 5- Gauss's theorem. 6- Conductors in equilibrium. 7- Electrostatic pressure. 8- Capacitance of a conductor and a capacitor.
Chapter II. Electrodynamics: (4 weeks)
1- Electric conductor. 2- Ohm's law. 3- Joule's law. 4- Electric circuits. 5- Application of Ohm's law to networks. 6- Kirchhoff's laws. Thevenin's theorem.
Chapter III. Electromagnetism: (4 weeks)
1- Magnetic field: Definition of a magnetic field, Biot-Savart law, Ampere's theorem, Calculation of magnetic fields created by permanent currents.
2- Induction phenomena: Induction phenomena (circuit in a variable magnetic field and a moving circuit in a permanent magnetic field), Lorentz force, Laplace force, Faraday's law, Lenz's law, Application to coupled circuits.

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

Bibliographic references:

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.

Semester: 2
Course unit: UEF 1.2
Subject 3: Thermodynamics
VHS: 67h30 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Teaching Objectives
To provide the necessary foundations of classical thermodynamics for applications in combustion and thermal machines. To homogenize the students' knowledge. The skills to be acquired are: The acquisition of a scientific basis of classical thermodynamics; The application of thermodynamics to various systems; The statement, explanation, and understanding of the fundamental principles of thermodynamics.

Recommended prerequisites
Basic knowledge of mathematics and general chemistry.

Course Content:
Chapter 1: Generalities on Thermodynamics (3 weeks)
1- Fundamental properties of state functions. 2- Definition of thermodynamic systems and the external environment. 3- Description of a thermodynamic system. 4- Evolution and thermodynamic equilibrium states of a system. 5- Possible transfers between the system and the external environment. 6- Transformations of the state of a system (operation, evolution). 7- Review of the ideal gas laws.
Chapter 2: The First Law of Thermodynamics: (3 weeks)
Work, heat, internal energy, concept of energy conservation. 2. The First Law of Thermodynamics: statement, concept of internal energy of a system, application to ideal gas, enthalpy function, heat capacity, reversible transformations (isochoric, isobaric, isothermal, adiabatic).
Chapter 3: Applications of the First Law of Thermodynamics to Thermochemistry (3 weeks)
Reaction heats, standard state, standard enthalpy of formation, dissociation enthalpy, enthalpy of physical state change, enthalpy of a chemical reaction, Hess's law, Kirchhoff's law.
Chapter 4: The Second Law of Thermodynamics (3 weeks)
1- The Second Law for a closed system. 2. Statement of the Second Law: Entropy of an isolated closed system. 3. Calculation of entropy variation: reversible isothermal transformation, reversible isochoric transformation, reversible isobaric transformation, adiabatic transformation, during a change of state, during a chemical reaction.
Chapter 5: The Third Law and Absolute Entropy (1 week)
Chapter 6: Free Energy and Enthalpy - Criteria for the Evolution of a System (2 weeks)
1- Introduction. 2- Free energy and enthalpy. 3- Chemical equilibria.

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

References:
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.

Semester: 2
Teaching Unit: UEM 1.2
Subject 1: Physics 2 Lab
Lecture Hours per Week: 45h00 (Lab: 1h30)
Credits: 2
Coefficient: 1

Teaching Objectives:
To reinforce, through practical work sessions, the theoretical concepts covered in the Physics 2 course.

Recommended Prerequisite Knowledge:
Mathematics 1, Physics 1.

Subject Content:

Minimum of 5 experiments (3h00 / 15 days)

Presentation of measuring instruments and tools (voltmeter, ammeter, rheostat, oscilloscopes, generator, etc.).
Kirchhoff's laws (mesh law, nodal law).
Thevenin's theorem.
Association and measurement of inductance and capacitance
Charging and discharging of a capacitor
Oscilloscope
Lab work on magnetism

Assessment Method:
Continuous assessment: 100%

Semester: 2
Teaching Unit: UEM 1.2
Subject 2: Chemistry Lab 2
VHS: 22h30 (Lab: 1h30)
Credits: 2
Coefficient: 1

Teaching Objectives
To consolidate the theoretical concepts covered in the Thermodynamics course through practical lab sessions.

Recommended Prerequisites
Thermodynamics.

Course Content:
Ideal gas laws.
Water equivalent of a calorimeter.
Specific heat: specific heat of liquids and solids.
Latent heat: latent heat of fusion of ice.
Reaction heat: Determination of the energy released by a chemical reaction (HCl/NaOH).
Hess's law.
Vapor pressure of a solution.

Assessment Method:
Continuous assessment: 100%

Semester: 2
Course unit: UEM 1.2
Subject 3: Computer Science 2
VHS: 45h00 (Lectures: 1h30, Lab: 1h30)
Credits: 4
Coefficient: 2

Teaching Objectives
To master the basic techniques in programming and algorithms, and to acquire the fundamental concepts of computer science. The skills to be acquired are: programming with some autonomy; designing algorithms from simple to relatively complex.

Recommended Prerequisites
Knowing how to use the university website, file systems, Windows user interface, and programming environment.

Course Content:
Chapter 1: Indexed Variables (4 Weeks)
One-dimensional arrays: Representation in memory, Operations on arrays.
Two-dimensional arrays: Representation in memory, Operations on two-dimensional arrays.
Chapter 2: Functions and Procedures (6 Weeks)
Functions: Types of functions, Function declaration, Function call.
Procedures: Concepts of global and local variables, Simple procedure, Procedure with arguments.
Chapter 3: Records and Files (5 Weeks)
Heterogeneous data structures.
Structure of a record (field concept).
Manipulation of record structures.
Concept of a file.
File access modes.
Reading and writing to a file.
Computer Science Lab 2:
A number of labs will be scheduled to practice the programming techniques learned during the course.

Lab applying programming techniques learned in class.

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

Bibliographical References:"
1- Les algorithmes pour les Nuls grand format Livre de John Paul Mueller (Informatiker, USA) et Luca Massaron 2017
2- Algorithmique: cours avec 957 exercices et 158 problèmes Livre de Charles E. Leiserson, Clifford Stein et Thomas H. Cormen 2017
3- Algorithmes: Notions de base Livre de Thomas H. Cormen 2013.

Semester: 2
Course unit: UEM 1.2
Subject 4: Presentation Methodology
VHS: 15h00 (Lectures: 1h00)
Credits: 1
Coefficient: 1

Teaching objectives:
To provide the main foundations for succeeding in an oral presentation. Among the skills to be acquired: knowing how to prepare a presentation; knowing how to deliver a presentation; knowing how to capture the audience's attention; being aware of the pitfalls of plagiarism and understanding the regulations of intellectual property.

Recommended prior knowledge:
Techniques of expression and communication, and methodology of writing.

Subject matter:
Chapter 1: The oral presentation (3 weeks)
Communication. Preparation of an oral presentation. Different types of outlines.

Chapter 2: Delivering an oral presentation (3 weeks)
Structure of an oral presentation. Delivering an oral presentation.

Chapter 3: Plagiarism and intellectual property (3 weeks)
1- Plagiarism: Definitions of plagiarism, sanctions for plagiarism, how to borrow from the work of other authors, quotations, illustrations, how to ensure that you avoid plagiarism.
2- Writing a bibliography: Definition, objectives, how to present a bibliography, writing a bibliography.

Chapter 4: Presenting a written work (6 weeks)
Presenting a written work. Applications: delivering an oral presentation.

Evaluation method: Exam: 100%.
Bibliographic references:
1. M. Fayet, Méthodes de communication écrite et orale, 3e édition, Dunod, 2008.
2. M. Kalika, Mémoire de master – Piloter un mémoire, Rédiger un rapport, Préparer une soutenance, Dunod, 2016.
3. M. Greuter, Réussir son mémoire et son rapport de stage, l'Etudiant, 2014
4. B. Grange, Réussir une présentation. Préparer des slides percutants et bien communiquer en public. Eyrolles, 2009.
5. H. Biju-Duval, C. Delhay, Tous orateurs, Eyrolles, 2011.
6. C. Eberhardt, Travaux pratiques avec PowerPoint. Créer et mettre en page des diapositives, Dunod, 2014.
7. F. Cartier, Communication écrite et orale, Edition GEP- Groupe Eyrolles, 2012.
8. L. Levasseur, 50 exercices pour prendre la parole en public, Eyrolles, 2009.
9. S. Goodlad, Speaking technically – A Handbook for Scientists, Engineers, and Physicians on How to Improve Technical Presentations, Imperial College Press, 2000.
10. M. Markel, Technical communication, eleventh edition, Bedford/St Martin's, 2015.

Semester: 2
Course unit: UED 1.2
Subject 1: Careers in Science and Technology 2
VHS: 22h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Objectives:
The subject aims to introduce students to the range of fields covered by the science and technology domain and the variety of careers that stem from those fields. In addition, it aims to introduce students to new challenges in sustainable development and the emerging careers that may result from these challenges.

Recommended prerequisite knowledge:
None.

Course content:

1. Industrial Hygiene and Safety (IHS) and Mining Engineering: (2 weeks)

Definitions and application areas (safety of people and property, environmental issues, exploration and exploitation of mineral resources, etc.)
Role of specialists in these areas.

2. HVAC Engineering and Transportation Engineering: (2 weeks)

Definitions and application areas (air conditioning, smart buildings, transportation safety, traffic management and road, air, and naval transportation, etc.)
Role of specialists in these areas.

3. Civil Engineering, Hydraulic Engineering, and Public Works: (2 weeks)

Definitions and application areas (construction materials, large road and rail infrastructures, bridges, airports, dams, drinking water supply and sanitation, hydraulic flow, water resource management, public works and land use planning, smart cities, etc.)
Role of specialists in these areas.

4. Aeronautical Engineering, Mechanical Engineering, Maritime Engineering, and Metallurgy: (2 weeks)

Definitions and application areas (aeronautics, avionics, automotive industry, ports, dikes, production of industrial equipment, steelmaking, metal transformation, etc.)
Role of specialists in these areas.

5. Sustainable Production Approaches: (2 weeks)

Industrial Ecology, Remanufacturing, Eco-design.

6. Measuring the Sustainability of a Process/Product/Service: (2 weeks)

Environmental Analysis, Life Cycle Assessment (LCA), Carbon Footprint, Case Studies/Applications.

7. Sustainable Development and Enterprise: (3 weeks)

Definition of the company as an economic entity (notions of profit, costs, performance) and a social entity (notion of corporate social/societal responsibility), Impact of economic activities on the environment (examples), Challenges/benefits of SD for the company, Ways of engagement in an SD approach (e.g., ISO 14001 certification, labeling (e.g., energy labeling, Ecolabel, Bio/AB label, FSC label, etc.), SD strategic plan, Global Reporting Initiative (GRI)...), World rankings of the most sustainable companies (Dow Jones Sustainable Index, Global 100, etc.), Case studies of high-

performing/eco-responsible companies in the ST sector (e.g., SIEMENS, Cisco, Henkel AG & Co, TOTAL, Peugeot, Eni SPA...).

Student work for this subject:

Work in groups/pairs: Reading articles on sustainable development and/or reports of high-performing and sustainable companies and summarizing the main actions taken in the field of SD.
Examples of documents for reading and synthesis:
ONA and ENIEM case: Kadri, Mouloud, 2009, Sustainable Development, Enterprise, and ISO 14001 Certification, Market and Organizations Vol. 1 (N° 8), p. 201-215 (freely accessible online: http://www.cairn.info/revue-marche-et-organisations-2009-1-page-201.htm)
Mireille Chiroleu-Assouline. The Sustainable Development Strategies of Companies. Ideas, The Review of Economic and Social Sciences, CNDP, 2006, p 32 "Free online access: http://halshs.archives-ouvertes.fr/hal-00306217/document

Web page on TOTAL's environmental and societal commitments: https://www.total.com/en/commitments
Sustainable mobility innovations of PSA Group: http://www.rapportannuel.groupe-psa.com/rapport-2015/engagements/dessolutions-innovantes-pour-des-transports-durables/

Evaluation method:
100% exam

Bibliographical references:
1- V. Maymo et G. Murat, La boîte à outils du Développement durable et de la RSE- 53 outils et méthodes, Edition : Dunod, 2017.
2- P. Jacquemot et V. Bedin, Le dictionnaire encyclopédique du développement durable, Edition : Sciences Humaines, 2017.
3- Y. Veyret, J. Jalta et M. Hagnerelle, Développements durables : Tous les enjeux en 12 leçons, Edition : Autrement, 2010.
4- L. Grisel et Ph. Osset, L'Analyse du cycle de vie d'un produit ou d'un service: Applications et mise en pratique, 2eme Edition : AFNOR, 2008.
5- Sh. Shaked, N. Jolliet-Gavin, P. Crettaz, M. Saadé-Sbeih et O. Jolliet, Analyse du cycle de vie: Comprendre et réaliser un écobilan, 3eme Edition : PPUR, 2017.
6- G. Pitron et H. Védrine, La guerre des métaux rares : La face cachée de la transition énergétique et numérique, Edition : Liens qui libèrent, 2018.
7- Les métiers de l'environnement et du développement durable, Collection : Parcours, Edition : ONISEP, 2015.

Semester: 2
Course unit: UET 1.2
Subject 1: French Language 2
VHS: 22h30 (Lectures: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:
The aim of this subject is to develop the following four competencies: oral comprehension, written comprehension, oral expression, and written expression through the reading and study of texts.

Recommended prior knowledge: Basic French.

Subject content:
We propose below a set of themes that cover fundamental sciences, technology, economics, social facts, communication, sports, health, etc. The teacher can choose texts from this list to develop during the course. Otherwise, he or she is free to address other themes of his or her choice. The texts can be taken 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 teacher helps the student develop his or her language competencies: listening, comprehension, and both oral and written expression. In addition, he or she must use the text to identify the grammatical structures that will be developed during the same class session. We remind here, by way of illustration, a set of grammatical structures that can be developed as examples. Of course, it is not a matter of developing them all or in the same way. Some may be recalled and others well detailed.

Examples of themes 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
Drug addiction: a social scourge
Smoking
School failure
The Algerian War
Social networks

China, an economic power
Superconductivity
Cryptocurrency
Advertising
Autism" The subjunctive. The conditional. The imperative.
The past participle. The passive form.
Possessive adjectives. Possessive pronouns.
Demonstratives. Demonstrative pronouns.
Expressions of quantity (several, some, enough, many, more, less, as much, etc.).
Numbers and measurements.
Relative pronouns 'who, whom, where, whose'.
Subordinate prepositions of time.
Cause and effect.
Purpose, opposition, condition.
Comparatives, superlatives.
...

Mode of assessment: Exam: 100%.

Bibliographic references:

1. M. Badefort, Objectif : Test de Français International, Edulang, 2006.
2. O. Bertrand, I. Schaffner, Réussir le TCF, Exercices et activités d'entrainement, Les éditions de l'école polytechnique, 2009.
3. M. Boulares, J.-L. Frerot, Grammaire progressive du Français avec 400 exercices, Niveau avancé, CLE International.
4. Collectif, Besherelles : la Grammaire pour tous, Hatier.
5. Collectif, Besherelles : la Conjugaison pour tous, Hatier.
6. M. Grégoire, Grammaire progressive du Français avec 400 exercices, Niveau débutant, CLE International, 1997.
7. A. Hasni et al., La formation à l'enseignement des sciences et des technologies au secondaire, Presses de l'université du Québec, 2006.
8. J.-L. Lebrun, Guide pratique de la rédaction scientifique, EDP Sciences, 2007.
9. J.M. Robert, Difficultés du Français, Hachette,
10. C. Tisset, Enseigner la langue française à l'école : La Grammaire, L'Orthographe et la Conjugaison, Hachette Education, 2005.
11. J. Bossé-Andrieu, Abrégé des Règles de Grammaire et d'Orthographe, Presses de l'université du Québec, 2001.
12. J.-P. Colin, Le français tout simplement, Eyrolles, 2010.
13. Collectif, Test d'évaluation de Français, Hachette, 2001.
14. Y. Delatour et al., Grammaire pratique du Français en 80 fiches avec exercices corrigees, Hachette, 2000.
15. Ch. Descotes et al., L'Exercisier : l'expression française pour le niveau intermédiaire, Presses Universitaires de Grenoble, 1993.
16. H. Jaraush, C. Tufts, Sur le Vif, Heinle Cengage Learning, 2011.
17. J. Dubois et al., Les indispensables – Orthographe, Larousse, 2009.

Semester: 2
Course unit: UET 1.2
Subject 1: English Language 2
VHS: 22h30 (Lectures: 1h30)
Credits: 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.

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

Detailed program by matter for the S3 semester

Semestre:3
Course Unit: UEF 2.1.1
Subject 1: Mathematics 3
VHS: 67h30 (Class: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

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

Prior knowledge recommended

Mathematics 1 and Mathematics 2

Material content:

Chapter 1: Simple and multiple integrals (3 weeks)
1.1 Reminders on the Riemann integral and on the calculation of primitives.
1.2 Double and triple integrals.
1.3 Application to the calculation of areas, volumes, …
Chapter 2: Improper Integrals (2 weeks)
2.1 Integrals of functions defined on an unbounded interval.
2.2 Integrals of functions defined on a bounded interval, infinite at one end.
Chapter 3: Differential equations (2 weeks)
3.1 Reminder 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 Integer series, Fourrier series.
Chapter 5: Fourier Transform (3 weeks)
5.1 Definition and properties.
5.2 Application to the resolution of differential equations.
Chapter 6: Laplace Transformation (2 weeks)
6.1 Definition and properties.
6.2 Application to solving differential equations.

Assessment method:

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

Bibliographic references:

1- F. Ayres Jr, Theory and Applications of Differential and Integral Calculus - 1175 corrected exercises, McGraw-Hill.
2- F. Ayres Jr, Theory and Applications of Differential Equations - 560 corrected exercises, McGraw-Hill.
3- J. Lelong-Ferrand, J.M. Arnaudiès, Mathematics course - Differential equations, Multiple integrals, Volume 4, Dunod University.
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 in higher mathematics 3- Integral calculus and series, Dunod.
7- J. Quinet, Elementary course in higher mathematics 4- Differential equations, Dunod.
8- M. R. Spiegel, Laplace Transforms, Courses and Problems, 450 Corrected Exercises, McGraw-Hill.

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

Teaching objectives
Introduce the student to the phenomena of mechanical vibrations restricted to oscillations of low amplitude for 1 or 2 degrees of freedom as well as to the study of the propagation of mechanical waves.
Prior knowledge recommended
Mathematics 2, Physics 1 and Physics 2

Material content:
Preamble: This subject is divided into two parts, the Waves part and the Vibrations part, which can be approached independently of the other. In this regard and because of the consistency of this subject in terms of content, it is advisable to approach this subject in this order: Waves and then Vibrations for students in the Electrical Engineering streams (Group A). While for students in Groups B and C (Civil Engineering, Mechanical Engineering and Process Engineering), it makes sense to start with Vibrations. In any case, the teacher is called upon to do his best to cover both parties. We remind you that this material is intended for engineering professions in the Science and Technology Domain. Also, the teacher is asked to skim over all the parts of the course that require demonstrations or theoretical developments and to focus only on the application aspects. Moreover, the demonstrations can be the subject of an auxiliary work to be asked of the students as activities within the framework of the personal work of the student. Consult on this subject the paragraph "G- Evaluation of the student by means of continuous assessment and personal work" present in this training offer.

Part A: Vibration
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 frictional forces
1.1.4 Case of an external force depending on time
1.2 System with several 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-shock absorber system
5.3 Impedance
5.4 Apps
5.5 Generalization to systems with n degrees of freedom

Part B: Waves
Chapter 1: One-Dimensional Propagation Phenomena (2 weeks)
1.1 General and basic definitions
1.2 Propagation equation
1.3 Solution of the propagation equation
1.4 Traveling Sine Wave
1.5 Superposition of two traveling sine waves
Chapter 2: Vibrating Strings (2 weeks)
2.1 Wave equation
2.2 Harmonic Traveling Waves
2.3 Free Oscillations of a String of Finite Length
2.4 Reflection and transmission
Chapter 3: Acoustic waves in fluids (1 week)
3.1 Wave equation
3.2 Speed of sound
3.3 Traveling sine wave
3.4 Reflection-Transmission
Chapter 4: Electromagnetic waves (2 weeks)
4.1 Wave equation
4.2 Reflection-Transmission
4.3 Different types of electromagnetic waves

Assessment method: Continuous control: 40% ; Final exam: 60%.

Bibliographic references:
1. H. Djelouah; Mechanical Vibrations and Waves – Courses & Exercises (USTHB University website: 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 Publ. 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.
1. H. Djelouah; Electromagnetism ; University Publications Office, 2011.

Semester: 3
Course Unit: UEF 2.1.2
Subject 1: Fluid mechanics
VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Introducing the student to the field of fluid mechanics, the statics of fluids 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 which will be studied.

Prior knowledge recommended

Mathematics 1 and Mathematics 2

Material 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, Density , Rheology of a fluid, Viscosity of fluids, surface tension of a fluid

Chapter 2: Statics of Fluids **(4 weeks)**

Definition of pressure, pressure at a point of a fluid, Fundamental law of statics of fluids
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 2. Pressure for superimposed immiscible fluids

Chapter 3 Dynamics of perfect incompressible fluids **(4 weeks)**

Steady flow
Continuity equation
Mass flow and volume flow
Bernoulli's theorem, case without exchange of work and with exchange of work
Applications for measuring flow rates and speeds: Venturi, Diaphragms, Pitot tubes…
Euler's theorem

Chapter 4: Dynamics of real incompressible fluids **(4 weeks)**

Flow regimes, Reynolds experiment
Dimensional analysis, Vashy-Buckingham theorem, Reynolds number 3. Linear pressure drops and singular pressure drops, Moody diagram.
Generalization of Bernoulli's theorem to real fluids

Assessment method:

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

Bibliographic references:

1- R. Comolet, 'Experimental fluid mechanics', Volume 1, 2 and 3, Ed. Masson et Cie.
2- R. Ouziaux, 'Applied fluid mechanics', Ed. Dunod, 1978
3- B. R. Munson, D. F. Young, T. H. Okiishi, 'Fundamentals of fluid mechanics', Wiley & sons.
4- R. V. Gilles, 'Fluid Mechanics and Hydraulics: Courses and Problems', Schaum Series, Mc Graw Hill, 1975.
5- C.T. Crow, D.F. Elger, J.A. Roberson, 'Engineering fluid mechanics', Wiley & sons
6- R. W. Fox, A. T. McDonald, 'Introduction to fluid mechanics', fluid mechanics'
7- V.L. Streeter, B.E. Wylie, 'Fluid mechanics', McGraw Hill
8- F.M. White, ''Fluid mechanics', McGraw Hill
9- S. Amiroudine, J. L. Battaglia, 'Fluid mechanics Course and corrected exercises', Ed. Dunod.

Semester: 3
Course Unit: UEF 2.1.2
Subject 2: Rational mechanics
VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

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

Prior knowledge recommended

Physics 1 and Mathematics 2

Subject content:

Chapter 1. Mathematical reminders (elements of vector calculus)(1 week)

Chapter 2. Generalities and basic definitions (2 weeks)

2.1 Definition and physical meaning of force 2.2 Mathematical representation of force

2.3 Operations on force (composition, decomposition, projection)

2.4 Type of force: point, line, surface, volume 2.5 Classification of forces: internal forces, external forces. 2.6 Mechanical models: the material point, the solid body

Chapter 3. Statics. (3 weeks)

3.1 Axioms of statics 3.2 Connections, support and reactions

3.3 Axiom of liaisons 3.4 Equilibrium conditions:

3.4.1 Concurrent Forces 3.4.2 Parallel forces 3.4.3 Plane forces

Chapter 4. Rigid solid kinematics.(3 weeks)

4.1 Brief reminders of the kinematic quantities for a material point. 4.2 Solid body kinematics

4.2.1 Translation motion 4.2.2 Rotational movement around a fixed axis

4.2.3 Plane motion 4.2.4 Compound movement.

Chapter 5. Mass geometry. (3 weeks)

5.1 Mass of a hardware system 5.1.1 Continuous system 5.1.2. Discreet system

5.2 Integral formulation of the center of mass 5.2.1. Definitions (linear, surface and volumetric cases)

5.2.2 Discrete formulation of the center of mass 5.2.3 GULDIN's theorems

5.3. Moment and product of inertia of solids 5.4. Inertia tensor of a solid

5.4.1 Special cases 5.42 Principal Axes of Inertia 5.5. Huyghens' theorem

5.6. Moment of inertia of solids with respect to any axis.

Chapter 6. Dynamics of the rigid solid. (3 weeks)

6.1 Brief reminders of the dynamic quantities for a material point.

6.2 Element of rigid body kinetics:

6.2.1 Momentum 6.2.2 Kinetic momentum 6.2.3 Kinetic Energy

6.3 Equation of dynamics for a solid body6.4 Theorem of angular momentum 6.5 Kinetic energy theorem

6.6 Apps: 6.6.1 Case of pure translation 6.6.2 Case of rotation around a fixed axis

6.6.3 Combined case of translation and rotation

Assessment method:

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

Bibliographic references:

1. Elements of Rational Mechanics. S.Targ. Editions Mir Moscow
2. Mechanics for the use of engineers. STATIC. Edition Russell. Ferdinand P. Beer
3. General mechanics. Courses and corrected exercises. Sylvie Pommer. Yves Berthaud. DUNOD.
4. General mechanics - Theory and application, Serial editions. MURAY R. SPIEGEL schaum, 367p.
5. General mechanics – Exercises and solved problems with course reminders, University Publications Office, Tahar HANI 1983, 386p.

Semester: 3
Course unit: UEM 2.1
Subject 1: Probability & Statistics
VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
This module allows students to see the essential notions of probability and statistics, namely: statistical series with one and two variables, probability over a finite universe and random variables.

Prior knowledge recommended
Mathematics 1 and Mathematics 2

Subject content:
Part A: Statistics
Chapter 1: Basic Definitions (1 week)
A.1.1 Concepts of population, sample, variables, modalities
A.1.2 Different types of statistical variables: qualitative, quantitative, discrete, continuous.
Chapter 2: One-variable statistical series (3 weeks)
A.2.1 Number, Frequency, Percentage.
A.2.2 Cumulative number, Cumulative frequency.
A.2.3 Graphical representations: bar chart, pie chart, bar chart. Polygon of effectives (and frequencies). Histogram. Cumulative curves.
A.2.4 Position characteristics
A.2.5 Dispersion characteristics: range, variance and standard deviation, coefficient of variation.
A.2.6 Shape characteristics.
Chapter 3: Bivariate Statistical Series (3 weeks)
A.3.1 Data tables (contingency table). A cloud of dots.
A.3.2 Marginal and conditional distributions. Covariance.
A.3.3 Linear correlation coefficient. Regression line and Mayer line.
A.3.4 Regression curves, regression corridor and correlation ratio.
A.3.5 Functional adjustment.

Part B: Probabilities
Chapter 1: Combinatorial Analysis (1 Week)
B.1.1 Arrangements B.1.2 Combinations B.1.3 Permutations.
Chapter 2: Introduction to Probability (2 weeks)
B.2.1 Algebra of events B.2.2 Definitions B.2.3 Probability spaces
B.2.4 General probability theorems
Chapter 3: Conditioning and Independence (1 week)
B.3.1 Packaging, B.3.2 Independence, B.3.3 Bayes formula.
Chapter 4: Random Variables 1 Week
B.4.1 Definitions and properties, B.4.2 Distribution function,
B.4.3 Mathematical expectation, B.4.4 Covariance and moments.
Chapter 5: Usual Discrete and Continuous Probability Laws 3 Weeks
Bernoulli, binomial, Poisson, ...; Uniform, normal, exponential,...

Assessment method:
Continuous control: 40%; Final exam: 60%.

Bibliographic references:

1. D. Dacunha-Castelle and M. Duflo. Probability and Statistics: Fixed Time Problems. Masson, 1982.
2. J.-F. Delmas. Introduction to the calculus of probabilities and statistics. Handout ENSTA, 2008.
3. W.Feller. an Introduction to Probability Theory and its Applications, Volume 1. Wiley & Sons, Inc., 3rd edition, 1968.
4. G. Grimmett, D. Stirzaker, Probability and Random Processes, Oxford University Press, 2nd edition, 1992.
5. J. Jacod and P. Protter, Probability Essentials, Springer, 2000.
6. A.Montfort. Mathematical statistics course. Economica, 1988.
7. A.Montfort. Introduction to statistics. Polytechnic School, 1991

Semester: 3
Course unit: UEM 2.1
Subject 2: Computer Science 3
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 2

Teaching objectives:

Teach the student programming using easily accessible software (mainly: Matlab, Scilab, Mapple, etc.). This subject will be a tool for the realization of the practical work of numerical methods in S4.

Prior knowledge recommended

IT 1 and 2

Material content:

TP 1: Presentation of a scientific programming environment (1 week)
TP 2: Script Files and Data Types and Variables (2 weeks)
TP 3: Reading, displaying and saving data (2 weeks)
TP 4: Vectors and matrices (2 weeks)
TP 5: Control instructions (For and While loops, If and Repeat instructions)(2 weeks)
TP 6: Function files (2 weeks)
TP 7: Graphic design (Management of graphic windows, plot (2 weeks)
TP 8: Using Toolbox (2 weeks)

Assessment method:

Continuous control: 100%.

Bibliographic references:

1. start in algorithmics with MATLAB and SCILAB / Jean-Pierre Grenier, . - Paris: Ellipses, 2007 . - 160 p.
2. Scilab from theory to practice / Laurent Berger, . - Paris: D. Booker, 2014.
3. Programming and simulation in Scilab / Bégyn Arnaud, Gras Hervé, Grenier Jean-Pierre, - Paris: Ellipses,2014 . - 160 p.
4. Computer science: programming and scientific computing in Python and Scilab scientific preparatory classes 1st and 2nd years / Thierry Audibert,; Amar Ossalah; Maurice Nivat, . - Paris: Ellipses, 2010 . - 520p

Semester: 3
Course unit: UEM 2.1
Subject 3: Technical drawing
VHS: 10:30 p.m.(TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

This teaching will allow students to acquire the principles of representation of parts in industrial design. Even more, this material will allow the student to represent and read the plans.

Prior knowledge recommended

Content of the material

Chapter 1. General. (2 Weeks)

1.1 Usefulness of technical drawings and different types of drawings.
1.2 Drawing materials.
1.3 Normalization (Types of lines, Writing, Scale, Drawing format and folding, Title block, etc.).

Chapter 2.Elements of Descriptive Geometry (6 Weeks)

2.1 Notions of descriptive geometry.
2.2 Orthogonal projections of a point - Sketch of a point - Orthogonal projections of a straight line (any and particular) - Sketch of a straight line - Traces of a straight line - Projections of a plane (Positions whatever and particular) - Traces of a plan.
2.3 Views: Choice and layout of views - Dimension - Slope and conicity - Determination of the 3rd view from two given views.
2.4 Method of executing a drawing (layout, 45° straight, etc.)
Application exercises and evaluation (TP)

Chapter 3. Perspectives (2 Weeks)

Different types of perspectives (definition and purpose). Application exercises and evaluation (TP).

Chapter 4. Cuts and Sections (2 Weeks)

4.1 Sections, standard representation rules (hatching).
4.2 Projections and sections of simple solids (Projections and sections of a cylinder, a prism, a pyramid, a cone, a sphere, etc.…).
4.3 Half Cuts, Partial Cuts, Broken Cuts, Sections, etc.
4.4 Technical vocabulary (terminology of machined shapes, profiles, piping, etc.
Application exercises and evaluation (TP).

Chapter 5. Quotation (2 Weeks)

5.1 General principles.
5.2 Dimensioning, tolerance and adjustment.
Application exercises and evaluation (TP).

Chapter 6. Notions on definition and assembly drawings and schedules. (1 Week)

Application exercises and evaluation (TP).

Assessment method:

Continuous control: 100%.

Bibliographic references:

1. Guide to industrial draftsman Chevalier A. Edition Hachette Technique;
2. The technical drawing 1st part descriptive geometry Felliachi d. and Bensaada s. Edition OPU Algiers;
3. The technical drawing 2nd part the industrial drawing Felliachi d. and bensaada s. Edition OPU Algiers;
4. First notions of technical drawing AndreRicordeauEditionAndreCasteilla;
5.
6. *مبادئ أساسية في الرسم الصناعي عمر أبو حنيك المعهد الجزائري للتقييس والملكية الصناعية طبع الحميد المطب*

Semester: 3
Course unit: UEM 2.1
Subject 4: Waves and Vibrations Lab
VHS: 3:00 p.m. (TP: 1:00 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

The objectives assigned by this program relate to the initiation of students to put into practice the knowledge received on the phenomena of mechanical vibrations restricted to low amplitude oscillations for one or two degrees of freedom as well as the propagation of mechanical waves.

Prior knowledge recommended

Vibrations and waves, Mathematics 2, Physics 1, Physics 2.

Material content:

TP.1 Mass – spring
TP.2 Simple pendulum
TP.3 Torsion pendulum
TP.4 Oscillating electric circuit in free and forced mode
TP.5 Coupled pendulums
TP.6 Transversal oscillations in vibrating strings
TP.7 Grooved pulley according to Hoffmann
TP.8 Electromechanical systems (The electrodynamic loudspeaker)
TP.9 Pohl's pendulum
TP.10 Propagation of longitudinal waves in a fluid.

Note: It is recommended to choose at least 5 labs among the 10 offered.

Assessment method:

Continuous control: 100%.

Bibliographic references:

(Depending on the availability of documentation at the level of the establishment, Websites ... etc.)

Semester: 3
Course unit: UED 2.1
Material 1: Core Technology
VHS: 10:30 p.m.(Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

This teaching will allow students to acquire knowledge on the processes of obtaining and manufacturing parts and the techniques of their assemblies.

Prior knowledge recommended

Content of the material

Chapter 1. Materials (3 Weeks)

1.1 Metals and alloys and their designations
1.2 Plastics (polymers)
1.3 Composite materials
1.4 Other materials

Chapter 2. Processes for obtaining parts without removing material (4 Weeks)

2.1 Casting, Forging, stamping, Rolling, Drawing, extrusion…. etc.
2.2 Cutting, bending and stamping, etc...
2.3 Sintering and powder metallurgy
2.4 Sections and Pipes (steel, aluminium);
- Workshop visits.

Chapter 3. Processes for obtaining parts by removing material (4 Weeks)

Turning, milling, drilling; adjustment, etc...
Workshop visits and demonstrations.

Chapter 4. Assembly Techniques (4 Weeks)

Bolting, riveting, welding, etc....

Assessment method:

Final exam: 100%.

Bibliographic references:

1. Manual of mechanical technology, Guillaume SABATIER, et al Ed. Dunod.
2. MemoTech: materials production and machining BARLIER C. Ed. Casteilla
3. Industrial Sciences MILLET N. ed. casteilla
4. MemoTech: Industrial Technologies BAUR D. et al, Ed. Casteilla
5. Dimensional metrology CHEVALIER A. Ed. Delagrave
6. Drilling, milling JOLYS R and LABELL R. Ed. Delagrave
7. Guide to mechanical manufacturing PADELLA P. Ed. Dunod
8. Technology: first part, Ben Saada S and FELIACHI d. Ed. OPU Algiers
9.. تكنولوجيا عمليات التصنيع خرير ز و فواز د. ديوان المطبوعات الجامعية الجزائر

Semester: 3
Course unit: UED 2.1
Subject 2: Metrology
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

Teach the student the precision criteria for manufacturing and assembling parts; Know and know how to choose, in different cases, the methods and means of checking and measuring the dimensions and manufacturing defects of mechanical parts.

Prior knowledge recommended

Trigonometry, optics and more.

Content of the material

Chapter 1. General Metrology (2 Weeks)

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

Chapter 2. The International SI Measurement System (3 Weeks)

2.1 Basic quantities and their units of measurement;
2.2 Additional sizes;
2.3 Derived quantities.

Chapter 3. Metrological characteristics of measuring devices (6 Weeks)

3.1 Error and uncertainty (Accuracy, precision, reliability, reproducibility of a measuring device
3.2 Classification of Measurement Errors:(Raw Value;Systematic Error;Raw Corrected Value)
3.3 Unexpected errors: (Random errors; spurious errors; Estimated systematic errors.
3.4 Confidence interval;Technical uncertainty;Total measurement uncertainty;
3.7 Complete measurement result;
3.8 Identification and interpretation of definition drawing specifications for inspection;
3.9 Basics of calibers gauges and simple measuring instruments.

Chapter 4. Measurement and Control (4 Weeks)

4.1 Direct measurement of lengths and angles (use of ruler, vernier caliper, micrometer and angle protractor);
4.2 Indirect measurement (use of dial gauge, gauge blocks);
4.3 Control of dimensions (use of buffers, jaws,);
4.4 Measuring and control machines used in mechanical workshops (use of the pneumatic comparator, profile projector and roughness meter.

Assessment method:

Final exam: 100%.

Bibliographic references:

1. Manual of mechanical technology, Guillaume SABATIER, et al Ed. Dunod.
2. Memotech: materials production and machining BARLIER C. Ed. Casteilla
3. Industrial Sciences MILLET N. ed. casteilla
4. Memotech: Industrial technologies BAUR D. et al , Ed. Casteilla
5. Dimensional metrology CHEVALIER A. Ed. Delagrave
6. Drilling, milling JOLYS R and LABELL R. Ed. Delagrave
7. Guide to mechanical manufacturing PADELLA P. Ed. Dunod
8. Technology: first part, Bensaada S and FELIACHI d. Ed. OPU Algiers
9. تكنولوجيا عمليات التصنيع خرير ز و فواز د. ديوان المطبوعات الجامعية الجزائر

Semester: 3
Course Unit: UET 2.1
Subject 1: Technical English
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:
This course must allow the student to have a level of language where he can use a scientific document and talk about his specialty and sector in English at least with ease and clarity.

Prior knowledge recommended
English 1 and English 2

Content of the material
Oral comprehension and expression, acquisition of vocabulary, grammar...etc. - nouns and adjectives, comparatives, following and giving instructions, identifying things.
Use of numbers, symbols, equations.
Measurements: Length, area, volume, power...etc.
Describe science experiments.
Characteristics of scientific texts.
NB: Classes are taught largely or totally in English.

Assessment method:
Final exam: 100%.
Bibliographic references:

Detailed program by matter for the S4 semester

Semester: 4
eaching Unit: UEF 2.2.1
Subject 1: Soil Mechanics
VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
The student will be able to characterize the physical parameters of soils, classify them based on identification tests in the laboratory and in-situ, and become familiar with flow in soils.

Recommended Prerequisites:
Fundamental subjects from Semesters 1 and 2

Subject Content:
Chapter 1. Introduction to Soil Mechanics (2 weeks)
Object of soil mechanics (history and scope), definitions of soils, origin and formation of soils, soil structure (coarse-grained and fine-grained soils).
Chapter 2. Soil Identification and Classification (4 weeks)
Physical characteristics, particle size analysis, consistency of fine-grained soils (Atterberg limits), soil classification.
Chapter 3. Soil Compaction (4 weeks)
Compaction theory, laboratory compaction tests (standard and modified Proctor tests), special in-situ compaction equipment and methods, compaction specifications and control.
Chapter 4: Water in Soil (5 weeks)
Water flow in soils: velocity, gradient, discharge, Darcy's law, permeability,
Measurement of permeability in the laboratory and in-situ, effective stress principle,
Study of flow networks.

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

Bibliographic References:

COSTET J. and SANGLERAT G, "Practical Course in Soil Mechanics", Volume 1, Dunod, 1981.
SANGLERAT G., CAMBOU B., OLIVARI G. "Practical Problems in Soil Mechanics, Volume 1, Dunod, 1983.
AMAR S. and MAGNAN J.P. "Laboratory and In-Situ Soil Mechanics Tests", published by LCPC, 1980.
SCHLOSSER F. "Elements of Soil Mechanics, 2nd Ed., Presses de l'E.N.P.C.", 1997.

Semester: 4
Teaching unit: UEF 2.2.1
Subject 2: Construction Materials
VHS: 22h30 (Class: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:
The student will be able to characterize the physico-mechanical parameters of construction materials.

Recommended prerequisite knowledge:
All fundamental subjects from the common core S1 and S2.

Subject content:
Chapter 1: Generalities (2 weeks)
History of construction materials, Classification of construction materials, Properties of construction materials.
Chapter 2: Aggregates (4 weeks)
Granularity, Classification of aggregates, Characteristics of aggregates, Different types of aggregates.
Chapter 3: Binders (6 weeks)
Classification, Air binders (air lime), Hydraulic binders (Portland cement), Main constituents and additions.
Chapter 4: Mortars (3 weeks)
Composition, Different types of mortars (lime mortar, cement mortar), Main characteristics.

Assessment method:
Exam: 100%.
Bibliographic references:

Materials Volume 1, Properties, Applications and Design: Course and Exercises: Bachelor's Degree, Master's Degree, Engineering Schools, Dunod Edition, 2013.
Concrete admixtures, Afnor, 2012.
Aggregates, soils, cements and concretes: characterization of civil engineering materials by laboratory tests: Civil Engineering STI terminal, Building BTS, Public Works BTS, Civil Engineering DUT, Master Pro geosciences civil engineering, engineering schools, Casteilla, 2009.
The physico-chemical properties of construction materials: matter & materials, rheological & mechanical properties, safety & regulation, thermal, hygroscopic, acoustic and optical behavior, Eyrolles, 2012.

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

Teaching objectives:

This course focuses on the differential and integral calculus of complex functions of a complex variable. The student must master the different techniques for solving functions and integrals with complex and special variables.

Recommended prior knowledge:
Mathematics 1, Mathematics 2 and Mathematics 3.

Material content:
Functions with complex variables and Special Functions

Chapter 1: Holomorphic functions. Conditions of Cauchy Riemann 3 weeks

Chapter 2: Entire series (3 weeks)
Convergence radius. Area of Convergence. Development in whole series. Analytical functions. Series of Laurent and development in series of Laurent

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

Chapter 4: Applications (4 weeks)
Equivalence between holomorphy and Analyticity. Maximum theorem. Liouville's theorem. Rouché's theorem. Residue theorem. Calculation of integrals by the method of residues.

Chapter 5: Special Functions (2 weeks)
Special Euler functions: Gamma and Beta functions, applications to integral calculations

Assessment method:
Continuous control: 40%; Review: 60%.

Bibliographic references:
1- Henri Catan, Elementary theory of analytical functions of one or more complex variables. Publisher Hermann, Paris 1985.
2- Jean Kuntzmann, Complex variable. Hermann, Paris, 1967. Undergraduate textbook.
3- Herbert Robbins Richard Courant. What is Mathematics?, Oxford University Press, Toronto, 1978. Classic popular work.
4- Walter Rudin, Real and Complex Analysis. Masson, Paris, 1975. Second cycle textbook.

Semester: 4
Course Unit: UEF 2.2.2
Subject 2: Numerical methods
VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Familiarization with numerical methods and their applications in the field of mathematical calculations.
Recommended prior knowledge:
Mathematics 1, Mathematics 2, Computing 1 and Computing 2
Material content:
Chapter 1: Solving Nonlinear Equations f(x)=0 (3 weeks)
Introduction to calculation errors and approximations, Introduction to methods for solving nonlinear equations, Bisection method, Method of successive approximations (fixed point), Newton-Raphson method.
Chapter 2: Polynomial Interpolation (2 weeks)
General introduction, Lagrange polynomial, Newton polynomials.
Chapter 3: Function Approximation:(2 weeks)
Approximation method and quadratic average, Orthogonal or pseudoOrthogonal systems, Approximation by orthogonal polynomials, Trigonometric approximation.
Chapter 4: Digital Integration (2 weeks)
General introduction, Trapezium method, Simpson's method, Quadrature formulas.
Chapter 5: Solving ordinary differential equations (problem of the initial or Cauchy condition). (2 weeks)
General introduction, Euler method, Improved Euler method, Runge-Kutta method.
Chapter 6: Method for direct resolution of systems of linear equations (2 weeks)
Introduction and definitions, Gaussian method and pivoting, LU factorization method, ChoeleskiMMt factorization method, Thomas algorithm (TDMA) for tri-diagonal systems.
Chapter 7: Approximate Solving Method for Systems of Linear Equations (2 weeks)
Introduction and definitions, Jacobi method, Gauss-Seidel method, Use of relaxation.
Assessment method:
Continuous control: 40%; Final exam: 60%.
References:
1- C. Brezinski, Introduction to the practice of numerical calculation, Dunod, Paris 1988.
2- G. Allaire and S.M. Kaber, Numerical Linear Algebra, Ellipses, 2002.
3- G. Allaire and S.M. Kaber, Introduction to Scilab. Corrected practical exercises in linear algebra, Ellipses, 2002.
4- G. Christol, A. Cot and C.-M. Marle, Differential calculus, Ellipses, 1996.
5- M. Crouzeix and A.-L. Mignot, Numerical analysis of differential equations, Masson, 1983.
6- S. Delabrière and M. Postel, Approximation methods. Differential equations. Scilab applications, Ellipses, 2004.
7- J.-P. Demailly, Numerical analysis and differential equations. Grenoble University Press, 1996.
8- E. Hairer, S. P. Norsette and G. Wanner, Solving Ordinary Differential Equations, Springer, 1993.
9- P. G. Ciarlet, Introduction to matrix numerical analysis and optimization, Masson, Paris, 1982.

Semester: 4
Course Unit: UEF 2.2.3
Material: Strength of materials
VHS: 45h00 (Class: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
Learn the basic notions of the resistance of materials, the goals and assumptions of RDM, the notion of internal forces, geometric characteristics of sections, the law of behavior of materials, the notion of allowable stresses and the dimensioning of parts under simple requests.

Recommended prerequisites:
Rational mechanics and analysis of functions.

Subject content:
Chapter 1. Introduction and general (2 weeks)
Goals and hypotheses of the resistance of materials, Different types of loadings, Connections (supports, embeddings, hinges), General principle of equilibrium - Equilibrium equations, Method of sections - Concept of internal forces: Normal force N, Force cutting edge T, Bending moment M, Definitions, conventions of signs and units.
Chapter 2. Geometric characteristics of straight sections (2 weeks)
Center of gravity, Static moments, Moments of inertia of a straight section, Transformation of moments of inertia. Central principal axes, principal moments of inertia.
Chapter 3. Simple traction and simple compression (3 weeks)
Definitions, Tensile and compressive normal forces, Normal stress, Elastic deformation, Hooke's law, Young's modulus, Stress-strain diagram, Resistance condition and concept of allowable stress.
Chapter 4. Simple bending (4 weeks)
Definitions and Assumptions, Shear Force, Bending Moments, Differential Relationship Between Load, Shear Force and Bending Moment. Diagram of shear forces and bending moments, Stresses in simple bending, Concept of the neutral axis and dimensioning. Deformation of a beam subjected to simple bending (concept of the deflection), Calculation of the tangential stress.
Chapter 5. Shearing (2 weeks)
Definitions, Simple shear, Pure shear, Shear stress, Elastic deformation in shear, Shear strength condition.
Chapter 6. Torsion (2 weeks)
Definitions, Tangential or sliding stress, Elastic deformation in torsion, Condition of resistance to torsion.

Assessment method:
Continuous Control: 40%; Review: 60%.

Bibliographic references:
1. F. Beer, Mechanics for the use of engineers – statics, McGraw-Hill, 1981.
2. G. Pissarenko et all, Checklist of resistance of materials.
3. I. Mirolioubov et al, "Problems of resistance of materials", Moscow Editions.
4. L. Aleinik & J. Durler, "Resistance of materials", Ed. Spes, Dunod.
5. M. Kerguignas&G. Caignaert, "Resistance of materials", Ed. Dunod Université.
6. P. Stepine, Resistance of materials, Editions MIR; Moscow, 1986.
7. S. Timoshenko, Resistance of materials, Dunod, 1986.
8. William and Nash, Resistance of materials, course and problem, Schaum series, 1983.

Semester: 4
Course unit: UEM 2.2
Subject 1: TP Soil mechanics
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:
The student will be able to characterize the physical parameters of soils, to classify them from in-situ and laboratory identification tests and to control their compaction.

Recommended prior knowledge:
Soil mechanics course.

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

Assessment method:
Continuous control: 100%.

Bibliographic references:
1. Costet and Sanglerat,"Practical courses in soil mechanics", Dunod – Paris.
2. Caquot and Kerisel,"Treatise on soil mechanics", Gauthier, Villars – Paris.

Semester: 4
Course unit: UEM 2.2
Material 2: TP Materials of construction
VHS: 10:30 p.m., (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:
The student will be able to characterize the physico-mechanical parameters of building materials.

Recommended prior knowledge:
Course in building materials.

Subject content:
TP1: Densities of cement, sand and gravel
TP2: Particle size analysis of sand and gravel
TP3: Water content and expansion of sand
TP4: Porosity of sand and gravel
TP5: Volumetric coefficient of gravel
TP6: Sand Equivalent
TP7: Cement consistency and setting test

Assessment method:
Continuous control: 100%.

Semester: 4
Course unit: UEM 2.2
Subject 3: Computer Aided Drafting
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:
This teaching will allow students to acquire the principles of representation of parts in industrial design. Moreover, this material will allow the student to represent and read the plans.

Recommended prior knowledge: Technical Drawing..

Material content:
1. PRESENTATION OF THE CHOSEN SOFTWARE (4 weeks)
(SolidWorks, Autocad, Catia, Inventor, etc.)
1.1 Introduction and history of DAO;
1.2 Configuration of the selected software (interface, shortcut bar, options, etc.);
1.3 Software References (Software Help, Tutorials, etc.);
1.4 Saving files (part file, assembly file, drawing file, saving procedure for delivery to the teacher);
1.5 Communication and interdependence between files.
2. NOTION OF SKETCHES (3 weeks)
2.1 Sketching tools (point, line segment, arc, circle, ellipse, polygon, etc.);
2.2 Sketch relations (horizontal, vertical, equal, parallel, hilly, fixed, etc.);
2.3 Sketch dimensioning and geometric constraints.
3. D MODELING (3 weeks)
3.1 Concepts of planes (front plane, right plane and top plane);
3.2 Basic functions (extrusion, material removal, revolution):
3.4 Display functions (zoom, multiple views, multiple windows etc.):
3.5 Editing tools (Erase, Offset, Copy, Mirror, Trim, Extend, Move):
3.6 Making a sectional view of the model.
4. DRAWING OF THE 3D MODEL (3 weeks)
4.1 Editing the plan and title block:
4.2 Choice of views and drawing:
4.3 Dressings and object properties (Hatching, dimensioning, text, tables, etc...
5. ASSEMBLIES(2 weeks)
5.1 Assembly constraints (parallel, coincidence, coaxial, fixed, etc.):
5.2 Production of assembly drawings:
5.3 Assembly Drawing and Parts List:
1. Exploded view.

Assessment method:
Continuous control: 100%.
References:
- Solidworks bible 2013 Matt Lombard, Edition Wiley,
- Technical drawing, Saint-Laurent, GIESECKE, Frederick E. Editions du renouveau pédagogique Inc., 1982.
- Drawing exercises for mechanical parts and assemblies with SolidWorks software, Jean-Louis Berthéol, François Mendes,
- CAD accessible to all with SolidWorks: from creation to completion tome1 Pascal Rétif,
- Industrial designer's guide, Chevalier A, Edition Hachette Technique,

Semester: 4
Course unit: UEM 2.2
Subject 4: Practical Numerical Methods
VHS: 10:30 p.m. (PT: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:
Programming of different numerical methods for their applications in the field of mathematical calculations using a scientific programming language.

Recommended prior knowledge:
Numerical method, Informatics 2 and Informatics 3.

Material content:
Chapter 1: Solving Nonlinear Equations (3 weeks)
1.Bisection method. 2. Fixed point method, 3. Newton-Raphson method
Chapter 2: Interpolation and Approximation (3 weeks)
1.Newton's interpolation, 2. Chebyshev's approximation
Chapter 3: Digital Integrations (3 weeks)
1.Rectangle Method, 2. Trapezium Method, 3. Simpson Method
Chapter 4: Differential Equations (2 weeks)
1.Euler method, 2. Runge-Kutta methods
Chapter 5: Systems of Linear Equations (4 weeks)
1. Gauss-Jordon method, 2. Crout decomposition and LU factorization, 3. Jacobi method, 4. Gauss-Seidel method

Assessment method:
Continuous control: 100%.

References:
1. Algorithms and numerical computation: resolved practical work and programming with Scilab and Python software / José Ouin, . - Paris: Ellipses, 2013 . - 189 p.
2. Mathematics with Scilab: calculation guide programming graphical representations; compliant with the new MPSI / Bouchaib Radi program; Abdelkhalak El Hami. - Paris: Ellipses, 2015 . - 180 p.
3. Applied numerical methods: for scientists and engineers / Jean-Philippe Grivet, - Paris: EDP sciences, 2009 . - 371 p.

Semester: 4
Course unit: UEM 2.2
Material 5: TP MDF and RDM
VHS: 3:00 p.m. (TP: 1:00 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:
Apply the different notions studied in the subjects "Fluid mechanics" taught in semester 3 and the subject "Resistance of materials" of the current semester.

Recommended prior knowledge:
Part I: Fluid mechanics
Part II: Resistance of materials.

Material content:

Part I: Practical work: Fluid mechanics
Practical work N°1: Measurement of the density and density of liquids
Practical work N°2: Measurement of the viscosity of liquids
Exercise N°3: Measuring the pressure of liquids and calibrating a manometer
Practical work N°4: Measurement of hydrostatic force and determination of the center of pressure
Practical work N°5: Liquid flow measurement

Part II: Practical work: Strength of materials
TP No. 1. Tensile tests – simple compression
TP No. 2. Torsion test
TP N°3. Simple bending test
TP N°4. Resilience test
TP N°5. Hardness test

Assessment method:
Continuous control: 100%.

Semester: 4
Course unit: UED2.2
Subject 1: Geology
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

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

Recommended prerequisites:
Core subjects of S1, S2 and S3

Material content:
Chapter 1: Introduction to Geology (2 weeks)
1.1 Geology Definition
1.2 Paleontology
1.3 Origin of the Earth
1.4Geology Division
Chapter 2: Minerals and Rocks (4 weeks)
2.1 Concept of mineralogy
2.2 Loose rocks
2.3 Eruptive 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, …)
4.2 External Geodynamics (Alteration, Erosion, Falls and Landslides, …)
Chapter 5: Adaptation of geological techniques to the needs of civil engineering (3 weeks)
5.1 Geological maps
5.2 The use of graphic constructions
5.3 Geological survey of discontinuity surfaces
5.4 Use of stereographic projection

Assessment method:
Review: 100%.

References:
1. Hydrogeology and notions of engineering geology, G. BOGOMOLOV
2. Geology: Basics for the engineer, Aurèle Parriaux and Marcel Arnould, 2009
3. Engineering geology: Engineering geology. Bilingual French/English, Roger Cojean and Martine Audiguier, 2011
4. Hydrogeology, engineering geology, Éditions du BRGM, 1984.
Faucault A.Raoult J-F (1995) – Geology Dictionary, 4 edition. Editions Masson, 325p
5. Pomerol C., Lagabrielle Y., Renard M. (2005) – Elements of Geology, 13th edition. Editions Dunod, 762p

Semester: 4
Course unit: UED2.2
Subject 1: Surveying 1
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:
The student will be able to learn the basics of topography in order to later carry out and control the implementation of a construction, leveling, measurement of angles and coordinates, and the drawing of topographic maps.

Recommended Prior Knowledge:
Mathematics; Physics 1; Technical Drawing

Course Content:
Chapter 1. General Information (3 weeks)
Topography in the construction process, Different topographic measuring instruments, Scales (plans, maps), Mistakes and errors

Chapter 2. Distance Measurement (3 weeks)
Direct measurement of distances, Alignment and precision methods, Measuring practices, Indirect distance measurements

Chapter 3. Angle Measurement (3 weeks)
Principle of operation of a theodolite, Theodolite setup (Adjustment, Reading), Horizontal angle reading, Vertical angle reading

Chapter 4. Determination of Surfaces (3 weeks)
Calculation of the surface area of a polygon, Determination of surface areas of contours represented on a map, Planimeter and surface measurement

Chapter 5. Direct and Indirect Leveling (3 weeks)
Direct leveling, Indirect leveling.

Assessment method:
Review: 100%.
Bibliographic references:
1. Antoine, P., Fabre, D., Modern Topography and Topometry (Volumes 1 and 2) – Serge Milles and Jean Lagofun, 1999.
2. Bouquillard , Topography Course BepTech.geo T1, 2006
3. Dubois, F. and Dupont, G. (1998) precis of topography, Principles and methods, Editions Eyrolles Paris
4. Herman, T. (1997a) Parameters for the ellipsoid. Edition Hermès, Paris
5. Herman, T. (1997b) Parameters for the sphere. Edition Dujardin, Toulouse
6. Meica (1997), Digital levels, MiecaGeosystems, Paris
7. Tchin, M. (1976) Applied Topography, Course at the National School of Arts and Industries of Strasbourg, Topography Specialty.

Semester: 4
Course unit: UET 2.2
Subject 1: Expression and Communication Techniques
VHS: 10h30 (Lectures: 1h30)
Coefficient: 1

Teaching objectives:
This teaching aims to develop the student's skills, on a personal or professional level, in the field of communication and expression techniques.

Recommended prior knowledge:
Languages (Arabic; French; English)

Material content:
Chapter 1: Finding, Analyzing and Organizing Information (3 weeks)
Identify and use places, tools and documentary resources, Understand and analyze documents, Create and update documentation.
Chapter 2: Improving Expressive Ability (3 weeks)
Take into account the Communication situation, Produce a written message, Communicate orally, Produce a visual and audiovisual message.
Chapter 3: Improving communication skills in interactive situations (3 weeks)
Analyze the Interpersonal communication process, Improve face-to-face communication skills, Improve group communication skills.
Chapter 4: Developing autonomy, organizational and communication skills within the framework of a project approach (6 weeks)
Position yourself in a project and communication process, Anticipate action, Implement a project: Presentation of a report of practical work (Homework).

Assessment method:
Final exam: 100%.

References:
1- Jean-Denis Commeignes 12 methods of written and oral communication – 4th edition, Michelle Fayet and Dunod 2013.
2- Denis Baril; Sirey, Techniques of written and oral expression; 2008. 3- Matthieu Dubost Improve his written and oral expression all the keys; Edition Ellipses 2014.

Detailed program by matter for the S5 semester

Semester: 5
Teaching Unit: UEF 3.1.1
Subject 1: Strength of Materials 2
VHS: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
This subject is a continuation of the Strength of Materials taught in the fourth semester. It will cover compound stress, energy methods, and hyperstatic systems.

Recommended prerequisites:
Strength of Materials 1, Materials Science, Mathematics.

Subject Content:

Chapter 1: Planar bending of symmetric beams - review (2 weeks)
• Review of bending moment - shear force.
• Normal stresses in simple bending
• Tangential stresses in simple bending

Chapter 2: Displacement of symmetric beams in planar bending (2 weeks)
• Displacement of beams of constant section
• Initial parameter method
• Moment of area method
• Superposition method

Chapter 3: General theorems of elastic systems (Applications) (3 weeks)
• Elastic deformation energy in tension • Elastic deformation energy in torsion
• Elastic deformation energy in shear • Elastic deformation energy in bending
• General expression of elastic deformation energy
• Castigliano's theorem
• Generalized virtual force method

Chapter 4: Compound stress (3 weeks)
• Generalities • Deviated bending (generalities, stresses, strains)
• Compound bending • Bending-torsion

Chapter 5: Solution of hyperstatic systems (4 weeks)
• Generalities (bar systems, nodes, articulations, frames, porticos, etc...)
• Initial parameter method
• Superposition method of force effects
• Three-moment equations method
• Force method

Chapter 6: Examples of design - Applications (1 week)

Assessment: Continuous assessment: 40%; Examination: 60%.

Bibliographic references:
A. Giet; L. Geminard. Strength of Materials, Dunod Editions, 1986, Paris.
S. P. Timoshenko. Strength of Materials, Dunod Editions, Paris.
M. Albiges; A Coin. Strength of Materials, Eyrolles Editions, 1986; Paris.
Jean-Claude Doubrère. Strength of Materials, Eyrolles Editions, 2013
YoudeXiong. Solved exercises in Strength of Materials, Eyrolles Editions, 2014.
Claude Chèze. Strength of Materials - Dimensioning of structures, simple and compound stresses, buckling, internal energy, hyperstatic systems, Ellipses, 2012.

Semester: 5
Teaching unit: UEF 3.1.1
Subject 2: Reinforced Concrete 1
VHS: 45 hours (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
To teach the physical and mechanical characteristics of reinforced concrete. To learn the design of sections subject to simple stresses (tension, compression, and bending) according to the rules BAEL, CBA93.

Recommended prerequisite knowledge:
Strength of Materials 1, Building Materials.

Content of the course:
Chapter 1. Formulation and mechanical properties of reinforced concrete (2 weeks)
Definition and generalities, Components of reinforced concrete, Mechanical properties.
Chapter 2. Regulatory requirements (3 weeks)
Pivot rules, Limit states, Combination of actions, Non-fragility condition.
Chapter 3. Adhesion and anchoring (3 weeks)
Adhesion stress, Anchoring of a straight isolated bar, Anchoring by bending, Overlap.
Chapter 4. Simple compression (4 weeks)
Ultimate strength limit state, serviceability limit state.
Chapter 5. Simple tension (3 weeks)
Ultimate strength limit state, serviceability limit state.

Mode of evaluation:
Continuous Assessment: 40%; Examination: 60%.

Bibliographic references:

D.T.R-B.C.2-41, "Design and Calculation Rules for Reinforced Concrete Structures", (CBA 93).
Jean-Pierre Mouguin, "Reinforced Concrete Course", B.A.E.L. 91", BERTI Edition.
Jean Perchat and Jean Roux, "Mastery of B.A.E.L. 91 and associated D.T.U", EYROLLES.
Jean Perchat and Jean Roux, "Practice of B.A.E.L. 91 (Course with corrected exercises)", EYROLLES.
Pierre Charon," Reinforced Concrete Exercise according to B.A.E.L. 83 rules", EYROLLES, 2nd edition.
Jean-Marie Paillé, "Calculation of concrete structures Application Guide", Eyrolles, 2013.

Semester: 5
Teaching unit: UEF 3.1.1
Subject 3: Steel structure
VHS: 45 hours (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
At the end of this course, the acquired knowledge should enable the student to understand the basic calculation of metal elements and knowledge of the regulations in force (EC3 and CCM97) and to have general knowledge of the design philosophy and operation of assemblies.
Recommended prerequisite knowledge:
Applied Mathematics, Rational Mechanics, Strength of Materials 1.
Content of the course:

Chapter 1. Generalities (1 week)
Steel in construction, Steel materials, Mechanical properties of steel.

Chapter 2. Basic notions and safety (3 weeks)
Safety concepts, Characteristic values of actions, Technical steps in CM calculation, Regulations (CCM97 and Eurocode3), Safety verification principle, Stresses and actions combinations (EC3 and CCM97).

Chapter 3. Assemblies (4 weeks)
Generalities on connections, Means of assembly (Rivets, bolts, welding), Technological aspects and operating principle.

Chapter 4. Calculation of parts subjected to simple tension (3 Weeks)
Use of tensioned parts, Behavior of tensioned parts, Calculation of net sectional area, Verification of tensioned parts at the ultimate limit state (ULS), Consideration of effects of assembly eccentricities in the calculation of tensioned parts.

Chapter 5. Calculation of bent parts (4 Weeks)
Use of bent parts, Elastic calculation of resistance against bending moments, Introduction to plastic calculation of sections, Resistance against shear force, Verification of bent parts at the ULS (bending moments, shear forces, combined forces), Verification of bent parts at the serviceability limit state (SLS) (calculation of deflections).

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

Bibliographic references:
J. MOREL, "Calculation of Steel Structures according to Eurocode 3".
"Design Rules for Steel Structures CCM97", CGS Edition, Algiers 1999.
"Eurocode 3 version", 2008.
J. BROZZETTI, M.A. HIRT, R. BEZ, "Metal Construction, Numerical Examples adapted to Eurocodes", Presses Polytechniques et Universitaires Romandes.
S.P. TIMOSHENKO, "Theory of Elastic Stability", DUNOD.

Semester: 5
Teaching unit: UEF 3.1.2
Subject 1: Soil Mechanics 2
VHS: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
The aim of this course is to enable students to expand on the knowledge acquired in Soil Mechanics 1 in S4. Students will receive instruction on stress calculations in soils, settlement calculations, and soil consolidation. They will also gain knowledge on soil behavior under shear and soil reconnaissance methods.

Recommended prerequisite knowledge:
Soil Mechanics 1, Strength of Materials 1.

Course content:
Chapter 1: Stress and Deformation (3 weeks)
Introduction to mechanics of continuous media, Principal stresses, Distribution of stresses based on facet orientation around a point, Mohr's circle, Notion of effective stress (Terzaghi's principle), Geostatic stresses in a soil.

Chapter 2: Settlement and Soil Consolidation (5 weeks)
Determination of stresses due to a surcharge, Boussinesq theory (point and distributed loads), Magnitude of settlements: instantaneous settlement, primary settlement, and secondary settlement, Soil compressibility: Characteristics of the compressibility curve, Determination of the compressibility curve from laboratory tests, Terzaghi's one-dimensional consolidation theory.

Chapter 3: Shear Strength of Soils (4 weeks)
Notions of soil plasticity, Intrinsic curve, Laboratory shear tests: Casagrande's box test and triaxial test (determination of cohesion and internal friction angle of a soil), Drained and undrained behavior: distinction between granular and fine-grained soils.

Chapter 4: Soil Reconnaissance and Exploration (3 weeks)
Importance of a reconnaissance campaign in a civil engineering project, General outline of a geotechnical study, Geophysical reconnaissance; Geotechnical reconnaissance, Sampling tools and techniques.

Evaluation method:
Continuous assessment: 40%; Examination: 60%.

Bibliographic references:
COSTET J. and SANGLERAT G, "Practical Soil Mechanics Course", Dunod, 1981.
AMAR S., MAGNAN J.P, "Laboratory and In Situ Soil Mechanics Tests", Memory aid, 1980,
FILLIAT G, "Soil and Foundation Practice", Editions du Moniteur. 1981
SCHLOSSER F, "Elements of Soil Mechanics, Presses de l'Ecole Nationale des Ponts et Chaussées", 1988.
J. COLLAS and M. HAVARD, "Geotechnical Guide: Glossary and Tests", Editions Eyrolles, 1983.

Semester: 5
Teaching unit: UEF 3.1.2
Subject 2: Construction Materials 2
VHS: 22h30 (Course: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:
The objective is to enable the student to build upon the material taught in S4, particularly on concrete components and their behavior in the fresh state (workability) and in the hardened state (mechanical strength), while also describing the different types of concrete based on current normative texts. Additionally, the student will learn about the various processes involved in the production of different materials, from raw materials to finished products.

Recommended prerequisite knowledge:
During S4, the student will have acquired preliminary and basic knowledge on the physical and mechanical characteristics of binders and aggregates. The student will be able to differentiate between types of mortars.

Subject matter content:
Chapter 1. Concrete (7 weeks)
Definition and classification, Physical and/or mechanical characteristics, Additions, Admixtures, Concrete formulation, Tests on fresh concrete, Tests on hardened concrete, Introduction to new types of concrete and their applications.
Chapter 2. Ceramic products (4 weeks)
Overview, Classification of ceramic products, Raw materials, Production of ceramic products (bricks, tiles, wall and floor covering tiles, sanitary ceramics, etc.).
Chapter 3. Ferrous and non-ferrous metals (2 weeks)
Overview, Properties of metals (physical, chemical, and mechanical), Classification of steels according to composition, Protection of ferrous metals against corrosion.
Chapter 4. Glass (2 weeks)
Production, Manufacturing process, Properties and uses.

Assessment:
Exam: 100%.

Bibliographic references:

1. Materials Volume 1, "Properties, Applications, and Design: Course and Exercises: Bachelor's Degree, Master's Degree, Engineering Schools," Edition, Dunod, 2013.
2. "Concrete Admixtures," Afnor, 2012.
3. "Aggregates, Soils, Cements, and Concrete: Characterization of Civil Engineering Materials by Laboratory Tests: Engineering Schools," Castilla, 2009.
4. G. Dreux, "The New Guide to Concrete." Editions Eyrolles.
5. "Current Cements and Concrete," CIIC, Paris, 1987.

Semester: 5
Teaching unit: UEM 3.1
Subject 1: Surveying Practical Work
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

The themes covered in practical work will allow students to apply the theoretical knowledge acquired during Topography 1 and 2 courses. Students will therefore have the opportunity to carry out all measurements, calculations, and reports known in the subject of topography.

Recommended prerequisites:

Knowledge acquired in Topography 1 and 2 courses.

Course content:

TP.1: Measurement of angles and distances

Angles: horizontal and vertical; Distances: Direct method, Indirect method.

TP.2: Polygonation

Recognition of locations, Choice of stations, Sketching for locating, Measurements (Angles and distances), Calculations, and reports.

TP.3: Tacheometry

Establishment of the field sketch, Detailed survey by radiation, Calculations, and reports.

TP.4: Survey by abscissa and ordinate and quasi-ordinate

Choice of operation lines, Measurements, Calculations, and reports.

TP.5: Measurements by lateral obliques

Establishment of the field sketch, Detailed survey by radiation, Calculations, and reports.

TP.6: Implementation

Implementation of alignments: Preliminary calculations (Office), Implementation on the field, Implementation of a turn, Preliminary calculations (Office), Implementation on the field, Implementation of a building.

Assessment method:

Continuous assessment: 100%.

Bibliographic references:

L. Lapointe, G. Meyer, "Topography applied to public works, building, and urban surveys", Eyrolles, Paris, 1986.
R. D'Hollander, "General topography, volume 1 and 2", Eyrolles, Paris, 1970.
M. Brabant, "Mastering topography", Eyrolles, Paris, 2003.

Semester: 5
Teaching unit: UEM 3.1
Course 2: Soil Mechanics Lab 2
VHS: 22h30 (Lab: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

The student will have the opportunity to perform practical laboratory tests related to the knowledge acquired in the course of Soil Mechanics 2.

Recommended prerequisites:

Soil Mechanics 1 and 2.

Course Content:

Lab N.1: Soil Permeability

Constant and variable head permeameters.

Lab N.2: Consolidation Test in Oedometer

Lab N.3: Direct Shear Test in Casagrande Apparatus

Mode of Assessment:

Continuous assessment: 100%.

Bibliographic references:

J. Collas and M. Havard, "Guide to Geotechnics: Glossary and Tests," Eyrolles, 1983.

Semester: 5
Teaching unit: UEM 3.1
Subject 3: TP Construction Materials 2
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:
The main objective of these practical sessions is to develop in students an interest in knowing certain specific properties of materials while respecting current standards, and especially to introduce them to a key material in the field of civil engineering: concrete. Students will also have the opportunity to work with laboratory techniques.
Having acquired basic knowledge in terms of practical work on materials, it is necessary to deepen students' knowledge with more specific tests on concrete.

Recommended prerequisites:
Construction Materials, TP Construction Materials, Strength of Materials 1.

Subject matter:
TP 1: Determination of the fineness modulus and fines content of sand.
TP 2: Use of the Dreux-Gorisse method for determining the composition of concrete.
TP 3: Preparation and testing of mortars.
TP 4: Workability test with the Abrams cone.
TP 5: Crushing test on concrete.
TP 6: Non-destructive testing.

Mode of assessment:
Continuous assessment: 100%.

Bibliographic references:
G. Dreux, Le nouveau guide du béton, Editions Eyrolles.
F. Gorisse, Essais et contrôle des bétons, Editions Eyrolles.

Semester: 5
Teaching Unit: UEM 3.1
Subject 4: Building Drawing
VHS: 37h30 (TP: 2h30)
Credits: 3
Coefficient 2

Teaching objectives:
The student should be able to:

Optimize their technological culture (understanding and communication of information through graphical means)
Know the common vocabulary and conventions of graphical representation
Take into account the link between design and execution (feasibility)

Recommended prerequisites:
Technical Drawing

Course Content:
Chapter 1. Principles of Technical Drawings (3 Weeks)
Technical drawing conventions (lines, hatching, writing, formats, title blocks), object presentation (scales, orthographic projections, sections, dimensions, perspectives)
Chapter 2. Building Drawing (4 Weeks)
Terminology and consistency of architectural drawings, common scales, façade designations, plans, room identification, sections, execution drawings of metal and reinforced concrete structures, plan representation of floors and their elements, building dimensions, schematic and symbolic representation of doors, windows, and conduits in walls, various symbols, layout and arrangement of figures.
Chapter 3. Specific Rules and Conventions for Drawing Presentation (5 Weeks)
Landscaping and soil recognition (conventional representation of terrains, lithological legend of foundation soils, geological cross-sections, reconnaissance drilling surveys), masonry (representation principles for different categories of masonry), reinforced and prestressed concrete (formwork and reinforcement plans), metal framework (assembly drawings).
Chapter 4. Drawing of Sanitation Structures (3 Weeks)
Sanitation structures (network plans, general presentation rules for networks).

Assessment Method:
Continuous assessment: 100%.

Bibliographical References:
G. Kienert and J. Pelletier, "Technical Drawing for Civil Engineering and Building". Eyrolles.
Jean Pierre Gousset, "Building Drawing Techniques - Technical Drawing and Plan Reading: Principles and Exercises", Eyrolles Editions, 2012.

Semester: 5
Subject 1: Surveying 2
VHS (hours per week): 22.30 (Course: 1.30)
Credits: 1
Coefficient: 1

Teaching objectives:
At the end of this course, the student should be able to carry out and verify the layout of a construction or parts of a construction on the field.

Recommended Prerequisite Knowledge:
Knowledge acquired in the subject Surveying1 in semester 4

Subject Content:
Chapter 1. Polygonation (3 weeks)
The different types of polygonal paths, Attached polygonal path, Polygonal calculations, Report.
Chapter 2. Tachometry (4 weeks)
Definitions, Use of the tachometry method, Work preparation: Its destination, Basic document; Site survey: Framework, Field sketch; Fieldwork: Composition of a brigade, Field measurements; Office work: Calculations, Report.
Chapter 3. Survey by abscissa and ordinate and quasi-ordinate (2 weeks)
Definitions, Survey method, Calculations.
Chapter 4. Lateral oblique survey (2 weeks)
Definitions, Survey method, Calculations.
Chapter 5. Layout (4 weeks)
Definitions, Layout of straight alignments, Layout of curves (Circular connections), Layout of buildings.

Evaluation Method:
Exam: 100%.

Bibliographic References:
A.G. Heerbrugg, "Topography and Navigation, Laica - Wild GPS System", Gosystems 1992.
L. Lapointe, G. Meyer "Applied Topography to Public Works, Building and Urban Surveys", Eyrolles, Paris, 1986.
R. D'hollander, "General Topography, Volume 1 and 2", Eyrolles, Paris, 1970.
M. Brabant, "Mastering Topography", Eyrolles, Paris, 2003.
S. Milles, J. Lagofun, "Modern Topography and Topometry", Eyrolles, Paris, 1999.

Semester: 5
Teaching Unit: UED 3.1
Subject 2: General Hydraulics
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:
To teach the fundamental basics of hydraulics, the fundamental equations of flow, the evaluation of pressure drop, and an introduction to network calculations.

Recommended Prerequisites:
Fluid Mechanics

Subject Content:
Chapter 1. Hydrostatics (2 weeks)
Physical characteristics and properties of liquids
Notion of pressure
Fundamental equation of hydrostatics
Pressure at a point on a wall
Pressure forces on walls
Chapter 2. Fundamental Equations of Hydrodynamics (2 weeks)
Streamlines, current tube
Continuity equation
Bernoulli's theorem
Venturi phenomenon
Pitot tube
Chapter 3. Dynamics of Real Fluids (3 weeks)
Flow of liquids
Pressure drop
Generalized Bernoulli's theorem
Energy diagram
Chapter 4. Flow Regimes in Pipes, Hydraulic Resistances (3 weeks)
Laminar flow - turbulent flow
Reynolds number
Calculation of pressure drops, application of Manning's Equation
Chapter 5. Flow through Orifices (2 weeks)
Flow through Orifices
Flow at constant head
Flow at varying head
Chapter 6: Open Channel Flow and Weirs (3 weeks)
Classification of flows
Geometric characteristics of flows
Flow through weirs

Assessment Method: Exam: 100%
Bibliographical References:

1. "Fluid Mechanics and Hydraulics (course and problems)" Schaum series.
2. Armando Lencastre, "General Hydraulics", Edition: Eyrolles.
3. Michel Carlier, "General and Applied Hydraulics", Edition: Eyrolles.

Semester: 5
Teaching Unit: UET 3.1
Subject: Techniques and Construction Regulations
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:
This subject consists of two parts. The first part aims to present to students the technical and technological aspects of the construction process. The second part aims to introduce students to the basic concepts of the different regulations applied in the design of civil and industrial constructions with an application of the rules for the justification of reinforced concrete structures according to the RPA.

Recommended Prerequisites:
The subjects taught in semester 4.

Subject Content:
Chapter 1. Techniques for developing a project. (1 week)
Construction project realization process, design and preparatory arrangements for the execution of work, site selection and construction site layout, geotechnical investigations.
Chapter 2. Site preparation techniques (3 weeks)
Preparation of work and organization techniques for building sites, site surveying and demarcation, earthworks and backfilling, techniques for removing soil, pit excavations, ramming, topsoil recovery, trenches and shoring, sloping.
Chapter 3. Techniques for the construction of reinforced concrete structures (2 weeks)
Execution techniques for shallow and deep foundations. Formwork and reinforcement techniques for building structures.
Chapter 4. Metal and mixed structures (2 weeks)
Welding and bolting, assembly of metal structures in buildings and industrial halls.
Chapter 5. Introduction to different regulations (2 weeks)
Generalities and necessity of regulations, introduction to different construction standards, BAEL and Eurocodes standards.
Chapter 6. Seismic regulations RPA 99 version 2003 (1 week)
(General design rules for seismic zones, classification criteria for structures).
Chapter 7. Reinforced concrete structure justification (2 weeks)
(Action combinations, justification with respect to strength, overall balance and foundation stability, definition and justification of joints).
Chapter 8. Specification of structure elements (2 weeks)
Specifications for main elements (columns, beams, floors, slabs, walls, and panels). Specifications for secondary elements, specifications concerning materials.

Assessment Method: Exam: 100%.
Bibliographic References:
J. MATHIVAT and C. BOITEAU, "General Construction Processes Volume 1: Formwork and Concreting", ENPC, Eyrolles.
J. MATHIVAT and FENOUX, "General Construction Processes Volume 2: Foundations and Structures", ENPC, Eyrolles.
J. MATHIVAT and J. F. BOUGARD, "General Construction Processes Volume 3: Underground Works", ENPC, Eyrolles.
Algerian seismic regulations RPA 99 version 2003. DTR-BC-2.48.

Detailed program by matter for the S6 semester

Semester: 6
Teaching Unit: UEF 3.2.1
Subject 1: Structural Analysis
Total Hours: 45h00 (Lecture: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
The aim of this course is to enable students to deepen their knowledge of materials strength and acquire methods for solving hyperstatic two-dimensional systems and structures.

Recommended Prerequisite Knowledge:
Materials Strength 1, Materials Strength 2.

Course Contents:
Chapter 1. Isostatic Truss Systems (4 Weeks)
Overview; Calculation of forces in bars; Analytical method; Nodal method; Section method.
Chapter 2. Isostatic Frames (2 Weeks)
Overview; Calculation of internal forces, drawing diagrams (N, T, M).
Chapter 3. Influence Lines (3 Weeks)
Definition and principle of influence line, principle of moving load. Isostatic systems: Effect of concentrated load, effect of uniform load, influence line of reactions, influence line of shear force, influence line of bending moment.
Chapter 4. Hyperstatic Systems (6 Weeks)
Overview, Degree of hyperstaticity, Force method, Application to hyperstatic frames.

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

Bibliographical References:
1. F. Beer, Mechanics for Engineers – Statics, McGraw-Hill, 1981.
2. G. Pissarenko et al., Handbook of materials strength.
3. I. Mirolioubov et al., "Problems of Materials Strength", Moscow Editions.
4. L. Aleinik& J. Durler, "Materials Strength", Ed. Spes, Dunod.
5. M. Kerguignas&G. Caignaert, "Materials Strength", Ed. Dunod Université.
6. P. Stepine, Materials Strength, MIR Editions, Moscow, 1986.
7. S. Timoshenko, Materials Strength, Dunod, 1986.
8. William and Nash, Materials Strength, course and problems, Schaum series, 1983.
9. R. Soltani, Influence Lines of Isostatic Beams and Arches, O.P.U, 2003.

Semester: 6
Teaching unit: UEF 3.2.1
Subject 2: Steel constructions
VHS: 45h00 (Lectures: 1h30, Tutorials: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
At the end of this subject, the knowledge acquired in metal structures (semester 5) should allow the student to complete their general knowledge on elastic instability phenomena of thin profiles: theoretical and regulatory aspects.

Recommended prerequisites:
To follow this subject, it is necessary to have followed the teachings of the CM1 subject in S5 and to have knowledge of the theory of elastic stability.

Subject content:
Chapter 1. Elastic instability phenomena (2 weeks)
Presentation of instability; different types of instability; regulations.
Chapter 2. Calculation of pieces subjected to simple compression (5 weeks)
Use of compressed parts, buckling theory, buckling length, notions of slenderness and imperfection, verification of compressed parts at the ELU.
Chapter 3. Calculation of pieces subjected to compound buckling (6 weeks)
Theoretical and regulatory aspects of compound buckling (EC3 and CCM97).
Chapter 4. Buckling of metal pieces (2 weeks)
Presentation of the buckling phenomenon, torsional moment of inertia of open sections, Reminders on torsion with warping (non-uniform torsion).

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

Bibliographical references:

1. Lecture notes prepared by the teacher.
2. J. MOREL, "Calculation of Metal Structures according to EUROCODE 3".
3. P. BOURRIER; J. BROZZETTI, "Metal and Composite Steel-Concrete Construction - Volumes 1 and 2", EYROLLES.
4. M.A. HIRT; R. BEZ, "Metal Construction - Volumes 10 and 11" - Presses Polytechniques et Universitaires Romandes.
5. "Design Rules for Steel Structures", CCM97 edition CGS, Algiers, 1999.
6. "Practical Calculation of Metal Structures", University Publications Office, Algiers.
7. J. BROZZETTI; M.A. HIRT; R. BEZ, "Metal Construction: Numerical Examples Adapted to Eurocodes", Presses Polytechniques et Universitaires Romandes.
8. S.P. TIMOSHENKO, "Theory of Elastic Stability", DUNOD.

Semester: 6
Teaching Unit: UEF 3.2.2
Subject 1: Reinforced Concrete 2
VHS: 67h30 (Lectures: 3h00, Tutorials: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:
To teach the design of common cross-sections (rectangular and T-shaped) under simple and combined loadings, taking into account shear force and torsion.

Recommended prerequisite knowledge:
Strength of Materials, Building Materials, Reinforced Concrete 1

Course content:
Chapter 1. Design of reinforced concrete sections under simple bending (3 weeks)
Rectangular section and T-shaped section: Ultimate limit state of strength and serviceability limit state.
Chapter 2. Shear Force (3 weeks)
Design of transverse reinforcements, Verification in zones of application of concentrated forces, Punching shear resistance check, Verification in junction zones with the beam web.
Chapter 3. Design of reinforced concrete sections under combined bending (7 weeks)
Design of sections at ultimate limit state / rectangular and T-shaped sections, Buckling of compressed columns.
Chapter 4. Torsion (2 weeks)
Overview of the torsion phenomenon and justification of concrete and reinforcements (hollow and solid sections).

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

Bibliographic references:

1. D.T. R-B.C.2-41, "Design and Calculation Rules for Reinforced Concrete Structures".
2. Jean-Pierre Mouguin, "Reinforced Concrete Course B.A.E.L. 91", BERTI Edition.
3. Jean Perchat and Jean Roux, "Mastery of B.A.E.L. 91 and associated D.T.U.", EYROLLES.
4. Jean Perchat and Jean Roux, "Practice of B.A.E.L. 91 (Course with corrected exercises)", EYROLLES.
5. Pierre Charon, "Reinforced Concrete Exercises according to B.A.E.L. 83 rules", EYROLLES 2nd edition.

Semester: 6
Teaching unit: UEF 3.2.2
Subject 2: Foundations and Geotechnical Structures
VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:
In this subject, students will have the opportunity to acquire knowledge on foundations and geotechnical structures. They will be able to calculate and verify the stability of certain structures such as retaining walls, foundations, and slopes.

Recommended prerequisites:
Knowledge acquired in MDS1, MDS2, RDM1, RDM2, BA1 subjects.

Content of the subject:
Chapter 1. Limit Equilibrium States (3 weeks)
Lower and upper limit equilibrium of Rankine (earth pressure and bearing coefficients), Boussinesq equilibrium (general case), Prandtl equilibrium (pressure due to surcharges). Determination of failure planes using the Mohr circle in cases of pressure and bearing.
Chapter 2. Retaining Structures (4 weeks)
Definition and classification of retaining structures; Earth actions: pressure and bearing; Stability of retaining walls.
Chapter 3. Shallow Foundations (4 weeks)
Definition and classification of foundations; Theory and calculation of the bearing capacity of shallow foundations.
Chapter 4. Slope Stability (4 weeks)
Introduction and general concepts on methods for calculating slope stability (notions of safety factor).

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

Bibliographical references:
1.J. Costet; G. Sanglerat, "Practical Course on Soil Mechanics", Volume 2, Dunod, 1981.
2. G. Sanglerat; B. Cambou, G. Olivari, "Practical Problems in Soil Mechanics", Volume 2, Dunod, 1983.
3. G. Phillipponat, B. Hubert "Foundations and Earth Structures", Edition Eyrolles, 1997
4. F. Schlosser, "Elements of Soil Mechanics", 2nd Ed., Presses des Ponts, 1997
5. F. Schlosser, "Soil Mechanics Exercises", 2nd Ed., Presses des Ponts, 1989
7. Schlosser F., 1988, "Elements of Soil Mechanics", Presses de l'Ecole Nationale des Ponts et Chaussées.

Semester: 6
Teaching unit: UEM 3.2
Subject 1: End of Cycle Project
VHS: 45h00 (TP: 3h00)
Credits: 4
Coefficient: 2

Teaching objectives:
They contribute to the assimilation of the knowledge provided by the program. They are more specifically dedicated to the practical application of concepts. They aim to encourage the intellectual openness of students. They develop in a privileged way the sense of initiative and autonomy in the pursuit of work, while leaving certain points very open:
The project can be individual or collective.

Recommended prerequisites:
RDM, BA, MDS, MDC, Building Drawing, CAD, Foundation and Geotechnical Structures

Subject content:
- Presentation and description of the project
- Presentation of the different calculation stages of a project
- Calculation assumptions
- Materials used
- Norms and regulations used
- Choice of the supporting system
- Preliminary sizing of structural elements and assessment of loads
- Calculation of reinforcement for slabs (hollow core slabs, slabs)
- Calculation of secondary elements (a balcony, a parapet)
- Calculation and reinforcement of stairs
- Calculation and reinforcement of a portal frame
- Foundation system.
- Production of plans (Formwork plan, reinforcement plan....) for the calculated elements.
- Conclusions and perspectives

Evaluation method:
Continuous assessment: 100%.

Bibliographic references:
1. A. GUERRIN, R.C. LAUVAUR, "Treatise on reinforced concrete Volume 1-3-4-11", Dunod Edition.
2. Jean-Pierre Mouguin, "Reinforced concrete course B.A.E.L. 91", BERTI Edition.
3. Jean Perchat and Jean Roux, "Mastering B.A.E.L. 91 and associated D.T.U", EYROLLES.
4. Jean Perchat and Jean Roux, "Practice of B.A.E.L. 91 (Course with corrected exercises)", EYROLLES.

Semester: 6
Teaching unit: UEM 3.2
Subject 2: Computer-Aided Design
Lecture hours: 37.5 (Lab: 2.5)
Credits: 3
Coefficient: 2

Teaching objectives:
To familiarize students with civil engineering software. The student must understand the essential functionalities of a calculation software based on an existing project and must be able to master the software interface, enter data correctly and retrieve results.

Recommended prerequisite knowledge:
Computer Science 1 and 2 and Computer Science 3

Content of the subject:
Chapter 1. Basic concepts of calculation software (3 weeks)
Operation mode and calculation methods used, closed and open software, advantages, and limitations of software.

Chapter 2. Introduction to an available software (6 weeks)
Presentation of the interface, the working environment, data, options, results (numerical and graphical), interpretation.

Chapter 3. Study and follow-up of a real project (6 weeks)
End-of-cycle project preferably

Evaluation mode:
Continuous assessment: 100%.

References:
User manual of the host software.

Semester: 6
Teaching Unit: UEM 3.2
Subject 3: Measurement and Price Estimation
VHS: 22h30 (Lecture: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:
The objective of this course is to provide students with basic knowledge of preparing preliminary measurements and cost estimates, as well as knowledge of the different acts of measurement.

Prerequisites:
This course requires essential prerequisites such as BTP drawing and CAD.

Course Contents:
Chapter 1. General Notions (1 week)
Definition and purpose of measurement and preliminary measurement, the role of the surveyor in construction, necessity and degree of accuracy of the evaluation of works, documents of measurement and preliminary measurement.
Chapter 2. The acts of measurement and preliminary measurement (2 weeks)
Rough estimates, estimates, attachments, work situations, measurements and memoranda.
Chapter 3. Methods of measurement and preliminary measurement of works (2 weeks)
Writing and presentation of preliminary measurements, order of preliminary measurements; reminders of common formulas: measurement of areas and volumes (planes, polyhedra, etc.), measurement of classical volumes - three-level method, Simpson's formula, and Poncelet's formula.
Chapter 4. Preliminary measurement of excavations and earthworks (2 weeks)
Preliminary measurement of excavations for foundations, calculation of earthwork quantities.
Chapter 5. Preliminary measurement in masonry (2 weeks)
Masonry of rubble, brick or aggregates.
Chapter 6. Preliminary measurement of reinforced concrete (3 weeks)
Concrete, formwork, reinforcements.
Chapter 7. Study of prices (3 weeks)
Definition and purpose, price sub-detail, calculation methods, diagram and presentation of the price sub-detail.

Mode of evaluation:
Exam: 100%.

Bibliographic References:

1. Michel Manteau, "Building Measurement", 7th Edition, Eyrolles, 1990.
2. Jean-Pierre Gousset, Jean-Claude Capdebielle, René Pralat, "Measurement, CAD-CAD with Autocad-Price Study", Eyrolles Editions, 2011.

Semester: 6
Teaching Unit: UED 3.2
Subject 1: Roads and various networks
VHS: 22.5 hours (Course: 1.5 hours)
Credits: 1
Coefficient: 1

Teaching objectives:
In this subject, the student will learn about all the infrastructure works related to the construction and development of access and circulation routes on the periphery of buildings: roads, sidewalks, bike lanes, green spaces, public lighting, urban furniture, etc.

Recommended Prerequisite Knowledge:
Prior knowledge of construction materials, soil mechanics, technical drawing, and reading plans.

Subject Content:
Chapter 1. Roadworks (3 weeks)
Definition, classification, and characteristics of roads; Road layout, composition of the roadway (different layers of the roadway); Parking areas (sidewalks, pedestrian paths, curbstones, accessibility for people with disabilities; Emergency vehicle lanes, machine lanes, ladder lanes.
Chapter 2. Sewage (5 weeks)
Sewage networks definition, principles, and provisions, Water to be evacuated, quantity and quality, rainwater, runoff water, domestic wastewater, industrial discharge. Sizing of pipes, composition of sewage networks (collectors and pipes, manholes, inspection chimneys, connections), collection facilities for rainwater and runoff water, ancillary facilities.
Chapter 3. Various networks (5 weeks)
Water supply networks (water requirements, distribution network (types and materials), connections, fire service and reserves, electricity distribution network; natural gas distribution network; telecommunications network.
Chapter 4. Green spaces (2 weeks)
Designing green spaces, Components of green spaces, Green space management.

Evaluation Method:
Exam: 100%.

Bibliographic References:

1. R. Bayon, "Roads and various networks", Eyrolles.
2. La pratique des VRD. Le moniteur.

Semester: 6
Teaching Unit: UED 3.2
Subject 2: Construction Site Organization
VHS: 22h30 (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:
Acquire theoretical and practical knowledge necessary to master the problems of organization and planning of construction work.

Prerequisites:
Knowledge acquired in the subject General Construction Procedures.

Subject Content:

Chapter 1. Construction Site Installation (1 week)
Construction site installation and preparation, Specificities of construction sites.

Chapter 2. Construction Equipment (1 week)
Equipment and its use, Choice of equipment to be used, Calculation of equipment efficiency, Equipment maintenance.

Chapter 3. Work Planning (3 weeks)
Definition of unit labor time, Equipment efficiency, Relationship between unit labor time and equipment efficiency, Determination of unit labor time and efficiency, Calculation of total predicted labor and equipment time.

Chapter 4. Scheduling and Sequencing (3 weeks)
Generalities on scheduling, Common objectives of scheduling, Different categories of scheduling, Methods of scheduling presentation.

Chapter 5. PERT Language (3 weeks)
Definition and graphic representation of the PERT network, Combination of PERT network tasks, Conversion of the PERT network into a BAR (GANTT) schedule.

Chapter 6. Site Management (4 weeks)
Key installations, Determination of detailed and simplified execution programs, Determination of simplified execution program, Site monitoring and work control.

Evaluation Method:
Exam: 100%.

Bibliographic References:
1."Organization and Management of Works: Part 1: Construction Machinery and Equipment", IUT of Saint Nazaire, Department of Civil Engineering.
2. Olivier EMILE, "Practical Organization of Construction Sites, Volume 1. Collection « Technicians of Construction ».
3. MEAT, "Study and Preparation for the Opening of a Site", INPE, -Rouiba, 1994
4. The PERT Method, Federal Electric Corporation. Collection « Technicians of Construction ».

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

Teaching objectives:
To prepare and master the methodological tools necessary for professional integration at the end of studies, to prepare for job search, to be sensitized to entrepreneurship through the presentation of an overview of useful management knowledge for the creation of activities, and to be able to implement a project.

Course Content:
Chapter 1: The Company and Society (3 weeks)
The Company: Definition and objectives of the company. Different types of companies, structure of the company, personnel and partners of the company.
Different types of companies (SMEs, micro-enterprises, small and medium-sized enterprises, intermediate-sized enterprises, large enterprises)
Society: Definition and objectives of the company.
Different types of companies (LLC, Sole proprietorship, Joint-stock company, General partnership)
Difference between a company and a society.
Chapter 2: Functioning and Organization of the Company (2 weeks)
Modes of organization and operation of the company.
The main functions of the company (production company, service company, etc.).
Company structure (definition and characteristics).
Different types of structures (functional structure, divisional structure, multidivisional structure, hierarchical-functional "staff and line").
Ancillary activities of the company (partnership, subcontracting, etc.).
Chapter 3: How to Access a Company (3 weeks)
Needs and qualities of personnel (senior executives, managers, technicians, workers, etc.).
Where to find job offers (ANEM, classifieds, internet, etc.).
How to proceed (application, CV).
Different types of job interviews and how to prepare for an interview.
Types of employment contracts (permanent and fixed-term contracts).
Salary (how to calculate a payslip).
Chapter 4: How to Create Your Own Company (3 weeks)
The path of the business creator (the idea, capital, financial assistance, etc.).
How to find a good idea.
Financial assistance programs 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 make the effort to anticipate and write in detail the phases and steps that he/she will have to take to start his/her business.
Market study (marketing, sales, etc.).
Technical study (location, equipment and machinery needs, production capacity, etc.).
Financial study (revenue, payroll expenses, expenditures and consumption, taxes, etc.).
Mini-project for the study of a business creation project.

Assessment Method: 100% Exam
Bibliography:
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 Alger Edition 1994
5. Financial Technology Institute "Accounting Initiation" OPU Alger 1993
6. Christian Bultez "Guide and Handbook of Procedures" Nathan Paris Edition 1993