Democratic and Popular Republic of Algeria

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research

University

LOGO

# TRAINING OFFER
# LMD

# ACADEMIC LICENSE

## NATIONAL PROGRAM
## 2021–2022
**(2nd update)**

| Establishment | Faculty / Institute | Department |
|---|---|---|
| | | |

| Domain | Sector | Speciality |
|---|---|---|
| ***Sciences And Technologies*** | ***Telecommunications*** | ***Telecommunications*** |

# Summary

# I–License Identity Card

## 1 - Location of the training:

**Faculty (or Institute):**

**Department :**

**References of the license authorization order (attach a copy of the order)**

## 2-External partners:

**Other partner establishments:**

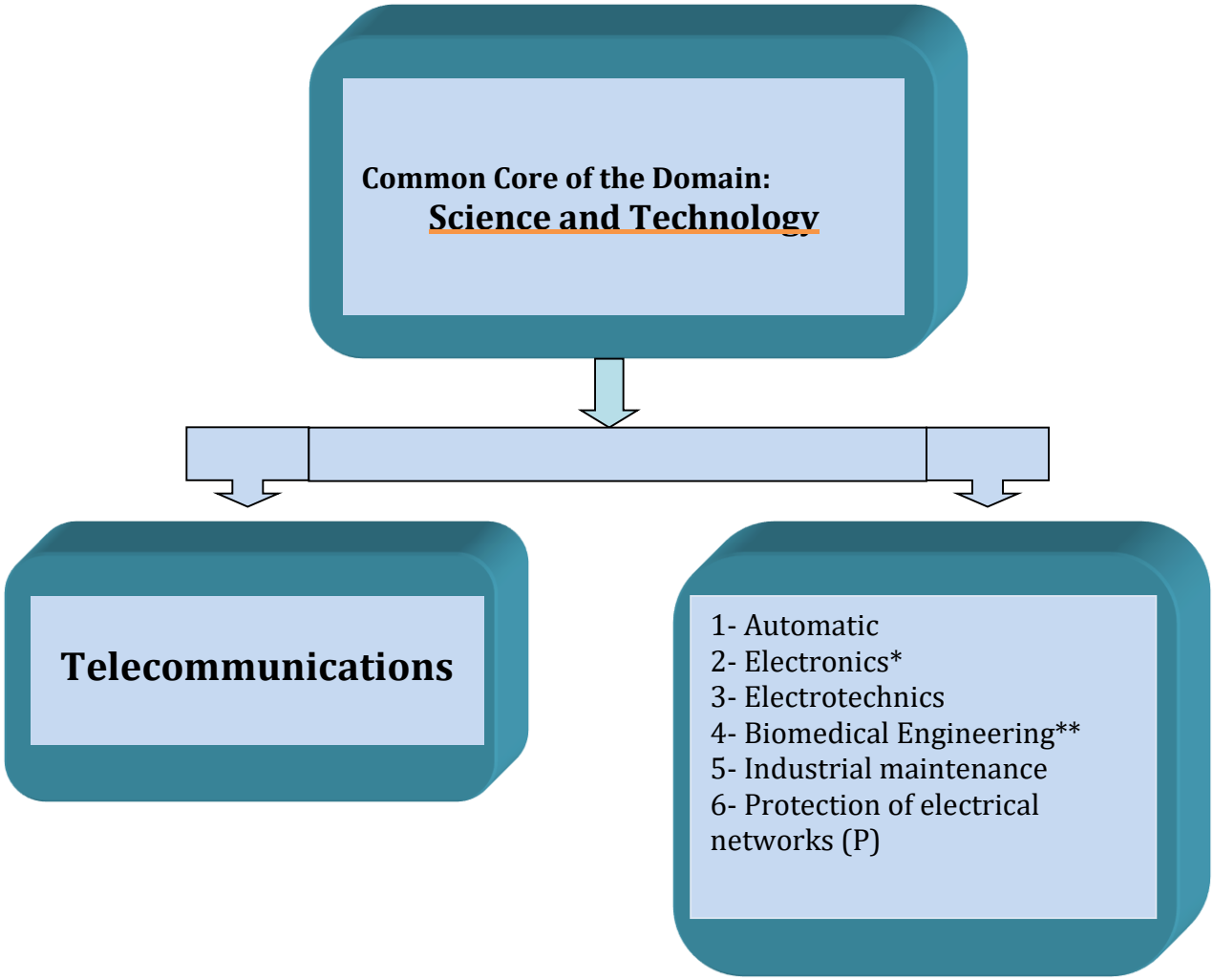
**Businesses and other socio-economic partners:**

**International partners:**

# 3–Context and objectives of the training

## A – General organization of the training: position of the project

*Enter in the following diagram the License that is the subject of this framework as well as all the approved licenses (functional or not) at the establishment level and belonging to the same Group of sectors. Specify with an asterisk any other license whose supervision is also provided by a large part of the teachers involved in this current license. Indicate with a double asterisk the frozen licenses. Also mark with (P) any professional type license.*



## B - Training objectives:

The need for telecommunications is becoming increasingly vital for all the mechanisms that govern the different social dynamics. Indeed, itServices which, until recently, were part of the professional context (collaborative work, Cloud Computing, etc.) are now making their way into everyday life: social networks, online games, e-commerce, video on demand, mobile access to Internet services, etc.

On another note,The field of telecommunications, with its known technological progress and modern methods used, knows no boundaries to its applications. The rapid evolution in the development of new telecommunications products requires users to have a better mastery of know-how to cope with this evolution.

It is therefore essential to invest in this field through knowledge, scientific research and technological applications since their impact on socio-economic balances is becoming increasingly decisive...To master information is to master the economy.

As a corollary, this justifies, in our opinion, the training of the human framework which has always been the fundamental and essential component of all development processes. It is in this spirit that this training is proposed.

The training provided in this degree is academic in nature. It is organized in the form of semester-long teaching units over 3 years of study. Throughhierarchical and coherent teaching, the student is led towards an acquisitionprogressive development of theoretical and practical knowledge in the field of technological sciences in general and telecommunications sciences in particular.

So, the first year program(semesters S1 and S2) is organized around a hard core of fundamental subjects (mathematics, physics and chemistry) supplemented by computer science.

The third semester courses (common to the entire Electrical Engineering family) are reserved forthe acquisition of basic subjects in electronics and electrical engineering. The fourth semesterEastcharacterized by the deepening of electronics subjects and the introduction of some telecommunications subjects.

The acquisition of the fundamental scientific bases necessary for adequate specialization in the teaching of telecommunications (advanced electronics andlocal area networks, antennas and transmission media, signal processing techniques and advanced digital communications)are exclusively covered during semesters 5 and 6.

Furthermore, this training also allows the student to develop their autonomy and their scope of initiative, to evolve and adapt to changes in their profession through the End of Cycle Project and the student's Personal Project.

## C – Targeted profiles and skills:

This training aims to raise the student to a level of knowledge and skills that will enable himto continuewith easea Master's degree intelecommunications. On the other hand,the practical and professional knowledge acquired during trainingwill constitute a springboard for himguaranteeing immediate integration into the professional environment.

At the end of the training, young graduates should be able to:

- ✓ Know the fundamentals of telecommunications law;
- ✓ Understand Telecommunications systems and services;
- ✓ Engage effectively with users to understand their needs and problems;
- ✓ Participate in the development of specifications and contribute to the specifications of the topology of a network or telecommunications installation;
- ✓ Install, configure, operate and administer a computer network;
- ✓ Manage network communication tools;

- ✓ Participate in the choice, implement andlead a project to develop and extend a network based on an existing infrastructure;
- ✓ Master standards and norms in terms of protocols, topologies, security and administration platforms;
- ✓ Deal with both electronic and computer problems related to networks.

## D – Regional and national employability potential:

A country as vast as ours, where the entire infrastructure of telecommunications networks remains to be done or at least improved to bring it up to the level of international standards in force in developed countries, means that the job opportunities for students graduating from this training are enormous.
Young executives can apply formany functions ofin this vast sector of activity as assistants to telecommunications engineers, managers of the technical-commercial department, managers of the telecommunications infrastructure maintenance department, etc.
Graduates will work for equipment manufacturers, operators and companies that use or deploy mobile networks and services.
They can also create companies in collaboration with telecommunications engineers, innovating both in technological development and in promoting new uses.
The professional opportunities offered by this degree are numerous and concern all sectors of activity:
Ministry of Post, Information and Communication Technologies(MPTIC):
Algeria Telecom, Mobilis, Ooredoo, Djezzy, Algerian Space Agency, Directorates from Wilaya MPTIC, Third Party Telecommunications Operators.
Ministry of Communication:
Algerian Television Broadcasting Networks and Technical Structures (TDA).
Ministry of National Defense:
Transmission, Telecom Infrastructure
Ministry of the Interior:
Transmission, Telecom Infrastructure.
Ministry of Industry:
Telecom Infrastructure
Ministry of Energy:
Sonatrach (Transmission, Telecoms Infrastructure), Sonalgaz (Transmission, Telecoms Infrastructure), Third-party operators deploying a Telecommunications infrastructure.
Ministry of Transport:
Airports (Transmission, Telecom Infrastructure, Air Traffic Control), Railways (Transmission, Telecom Infrastructure),Maritime navigation (Transmission),Weather center.

## E – Gateways to other specialties:

| Semesters 1 and 2 common | |
|---|---|
| **Sector** | **Specialties** |
| Aeronautics | Aeronautics |
| Civil engineering | Civil engineering |
| Climate engineering | Climate engineering |
| Maritime engineering | Naval Propulsion and Hydrodynamics |
| | Naval construction and architecture |
| Mechanical Engineering | Energy |
| | Mechanical construction |
| | Materials Engineering |
| Hydraulic | Hydraulic |
| Transportation Engineering | Transportation Engineering |
| Metallurgy | Metallurgy |
| Optics and precision mechanics | Optics and photonics |
| | Precision mechanics |
| Public works | Public works |
| Automatic | Automatic |
| Electromechanics | Electromechanics |
| | Industrial maintenance |
| Electronic | Electronic |
| Electrical engineering | Electrical engineering |
| Biomedical Engineering | Biomedical Engineering |
| Industrial engineering | Industrial engineering |
| Telecommunication | Telecommunication |
| Process engineering | Process engineering |
| Mining engineering | Mining |
| | Valorization of mineral resources |
| Hydrocarbons | Hydrocarbons |
| Industrial hygiene and safety | Industrial hygiene and safety |
| Petrochemical industries | Refining and petrochemicals |

Table of sectors and specialties in the Science and Technology field

| A Sector group | Semester 3 |
|---|---|
| **Sector** | **Specialties** |
| Automatic | Automatic |
| Electromechanics | Electromechanics |
| | Industrial maintenance |
| Electronic | Electronic |
| Electrical engineering | Electrical engineering |
| Biomedical Engineering | Biomedical Engineering |
| Industrial engineering | Industrial engineering |
| Telecommunication | Telecommunication |

| B sector group | Semester 3 |
|---|---|
| **Sector** | **Specialties** |
| Aeronautics | Aeronautics |
| Civil engineering | Civil engineering |
| Climate engineering | Climate engineering |
| Maritime engineering | Naval Propulsion and Hydrodynamics |
| | Naval construction and architecture |
| Mechanical Engineering | Energy |
| | Mechanical construction |
| | Materials Engineering |
| Hydraulic | Hydraulic |
| Transportation Engineering | Transportation Engineering |
| Metallurgy | Metallurgy |
| Optics and precision mechanics | Optics and photonics |
| | Precision mechanics |
| Public works | Public works |

| C sector group | Common Semester 3 |
|---|---|
| **Sector** | **Speciality** |
| Process engineering | Process engineering |
| Mining engineering | Mining |
| | Valorization of mineral resources |
| Hydrocarbons | Hydrocarbons |
| Industrial hygiene and safety | Industrial hygiene and safety |
| Petrochemical industries | Refining and petrochemicals |

The courses which present common basic teachings between them (semester 3) have been grouped into 3 groups: A, B and C. These groups correspond schematically to the families of Electrical Engineering (Group A), Mechanical Engineering and Civil Engineering (Group B) and finally Process Engineering and Mining Engineering (Group C).

This degree offers multidisciplinary and cross-disciplinary teaching programs:

Multidisciplinary, in the sense that the courses in this specialty are 100% identical for semesters 1 and 2 with all the specialties in the Science and Technology field. On the other hand, the courses in semester 3 for all the specialties in the same group of sectors are also 100% identical.

| Semester | Group of sectors | Common lessons |
|---|---|---|
| Semester 1 | A - B - C | (30/30) Credits |
| Semester 2 | A - B - C | (30/30) Credits |
| Semester 3 | A – B | (18 / 30) Credits |
| | A – C | (18 / 30) Credits |
| | B – C | (24 / 30) Credits |

In a transversal manner, this Licence offers the student the choice of joining, if he expresses the desire and depending on the teaching places available:

- All other specialties in the ST field atthe end of semester 2.

- All specialties of the same group of sectors atthe end of semester 3.

- All specialties of another group of sectors atthe end of semester 3
(Subject to conditions of equivalence and opinion of the training team).

- All specialties of the same group of sectors atthe end of semester 4
(Subject to conditions of equivalence and opinion of the training team).

## F – Expected performance indicators of the training:

All training must meet the quality requirements of today and tomorrow. As such,pto better appreciate themexpected performance of the trainingproposedon the one hand anden exploiting the flexibility and adaptability of the LMD system on the other hand,For this degree, a number of mechanisms are proposed, for information purposes, to evaluate and monitor the progress of teaching, the training programs, student/teacher and student/administration relationships, the future of graduates of this degree as well as the assessments of the university's partners regarding the quality of the graduates recruited and/or the teaching provided. It is up to the training team to enrich this list with other criteria according to its own means and objectives.

The evaluation methods can be implemented through surveys, on-site monitoring of students in training and surveys of recruited graduates as well as their employers. For this, a report must be established,archiveand widely disseminated.

## 1. Evaluation of the training progress:

In addition to the regular meetings of the teaching committee, a meeting is held at the end of each semester. It brings together teachers and students from the class to discuss any problems encountered, possible improvements to teaching methods in particular, and the quality of training in general.

To this end, a more or less exhaustive list of indicators and methods envisaged for the evaluation and monitoring of this training project by the educational committee is proposed below:

### Before the training:

- ✓ Evolution of the rate of students having chosen this Degree (Rsupply/demand contribution).
- ✓ Rateand quality of studentswho choose this license.

### During training:

- ✓ Regularity of educational committee meetings.
- ✓ Compliance of the themes of the End of Cycle Projects with the nature of the training.
- ✓ Quality of the relationship between students and the administration.
- ✓ Support provided to students in difficulty.
- ✓ Student satisfaction rate with teaching and teaching methods.

### Downstream of the training:

- ✓ Student success rate per semester in this degree.
- ✓ Rateof student loss (failures and dropouts).
- ✓ Identification of the causes of student failure.
- ✓ Reorientation alternatives are offered to students who fail.
- ✓ Ratestudents who graduate on time.
- ✓ Ratestudentswho continue their studies after the bachelor's degree.

## 2. Evaluation of the progress of the lessons:

The teaching in this course is subject to regular evaluation (once a year) by the training team which will be made available, upon request, to the various institutions: National Educational Committee for the Field of Science and Technology, Regional Conferences, Vice-rectorate responsible for education, Faculty, etc.

Therefore, a system for evaluating programs and teaching methods can be established based on the following indicators:

- ✓ Equipping teaching rooms and laboratories with materials and supports necessary for improving teaching (projection systems (data shows), Wi-Fi connection, etc.).
- ✓ Existence of a communication and teaching platform in which courses, tutorials and practical work are accessible to students and their questions are answered.
- ✓ Equipping educational laboratories with materials and equipment appropriate to the content of the courses.
- ✓ Number of actual teaching weeks provided during a semester.

- ✓ Rate of completion of teaching programs.
- ✓ Digitization and conservation of End of Study and/or End of Cycle dissertations.
- ✓ Number of practical work carried out as well as the multiplication of the type of practical work per subject (diversity of practical work).
- ✓ Quality of the establishment's documentary collection in relation to the specialty and its accessibility.
- ✓ Support from the socio-economic sector for training (company visits, company internships, courses and seminars given by professionals, etc.).

### 3. Integration of graduates:

A coordination committee is created, composed of training managers and members of the Administration, which is mainly responsible for monitoring the integration of graduates of the sector into professional life, for creating a monitoring file of graduates of the sector, for identifying and/or updating existing economic and industrial potential at regional and national level, for anticipating and encouraging new professions related to the sector in association with the chamber of commerce, the various employment support agencies, public and private operators, etc., for participating in any action concerning the professional integration of graduates (organization of events with socio-economic operators).
To carry out these missions, this committee has full latitude to carry out or commission any study or survey on the employment and post-employment of graduates. Below is a list ofindicators and methods that could be considered to evaluate and monitor this operation:

- ✓ Recruitment rate of graduates in the socio-economic sector in a position directly related to training.
- ✓ Nature of jobs held by graduates.
- ✓ Diversity of opportunities.
- ✓ Establishment of an association of former graduates of the sector.
- ✓ Creation of small businesses by graduates of the specialty.
- ✓ Employer satisfaction level.

## G- Student assessment through continuous assessment and personal work:

### G1- Evaluation by Continuous Assessment:

The importance of continuous assessment methods on student training in terms of educational outcomes is no longer in doubt. In this regard,Articles 20, 21 and 22 of decree 712 of 3 November 2011 define and specify the procedures and organization of the continuous assessment of students according to the training course. The calculation of the averages of the continuous assessment (supervised work and practical work) is done from a weighting of all the elements that constitute this assessment. These articles specify that this weighting is left to the discretion of the teaching team.

A survey conducted by the CPND-ST among all teachers in the various university establishments showed heterogeneity in the implementation of continuous assessment of students. Therefore, we are led toadmit a real deficit in the effective management of this educational activity, which required serious reflection on our part on this subject which, combined with proposals from several establishments, resulted in the recommendations below.

The analysis of the various proposals from these establishments showed that, indeed, Articles 21 and 22 of Order 712 of 3 November 2011 are not explicit enough and deserve more clarification. These articles could be enriched by taking into account the following points, which represent a summary of the proposals collected.

## 1. Proposals relating to subjects with supervised work:

### 1.1. Preparation of the exercise series:

The teacher responsible for the subject must organize himself by proposing a series of exercises for each chapter of the course. This series must be exhaustive, with exercises for understanding the course and standard exercises to be solved during tutorial sessions.
These exercises must be prepared by the student before attending the tutorial. This preparation may be assessed. The assessment method is left to the discretion of the instructor in charge of the tutorial.
Exercises not resolved in TD can be the subject of personal work to be completed by groups of 3 to 4 students and submitted for assessment (deadline: 1 week).

### 1.2. Written questions:

Each end of a series of exercises (i.e. each end of a chapter) will be marked by a short written test. This test must be organized in collaboration with the subject head in order to ensure a fair assessment for all students (essentially when several teachers are involved in the tutorials).

### 1.3. Student participation in tutorials:

This participation must be assessed. The assessment method is left to the discretion of the teacher in charge of the tutorial.

### 1.4. Student attendance:

Student attendance is mandatory for tutorials and practical work. In lectures, it is difficult to monitor attendance for undergraduate students, where class sizes are very large (lectures in lecture halls). For master's students, where class sizes are small, attendance must be mandatory for lectures and practical work.

## 2. Case of methodological units (Practical work):

Just like the tutorials, the practical work must be prepared by the student. A test to check this preparation must be organized by the teacher before each manipulation (in the form of short comprehension questions, multiple choice questions, diagram of the manipulation, etc.). A report (by working group) must be submitted at the end of the practical work session. As such, the teacher must prepare a standard report (outline) to facilitate the work for the students so that they can actually submit it at the end of the practical work session.
At the end of the semester, the teacher organizes a practical test which summarizes all the manipulations carried out by the student.

## 3. Regarding cross-curricular and discovery subjects that do not have tutorials or practical work:

It is very difficult to carry out continuous assessments in these subjects due to the absence of tutorial sessions and the very large number of students in most cases, particularly for universities with very large numbers of students.

However, the teacher in charge of this subject may, if he wishes, inform the students that he may possibly assess them (ongoingly) by asking them to prepare presentations, to make reports, to research the course supplement, to use free software, to ask the students to watch at home a popular science film related to the subject (after having given them either the film on electronic media or having given them 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 whoare the only ones able to define the best way to take this personal work into account inthe overall grade of the final exam.

Along the same lines, and in the case where the number of students in this subject is reasonable (20 to 30 students), which may be the case for many masters, the head of the subject may consider continuous assessments of the student similar to what is done in subjects with tutorials. The only obligation to respect is that students should be informed of this procedure and validated during the first Academic Council.

In any case, the teacher and the teaching team are free to include any type of assessment they deem appropriate to encourage students to take better charge of their course and, at the same time, combat the phenomenon of student absenteeism from classes.

## 4. Harmonization of continuous monitoring:

Using a common assessment grid would promote the harmonization of these practices from one teacher to another, from one department to another, and from one institution to another. It would also constitute a structuring and reassuring benchmark for students. To this end, we propose below an indicative assessment grid that presents the various continuous assessments allowing us to evaluate the degree of acquisition of students' skills, whether in terms of knowledge, analytical skills, or synthesis abilities.
It should be noted that these assessments are not intended to "trap" students by imposing very difficult continuous assessments on them. On the contrary, it is a matter of "honestly" assessing the degree of assimilation of the various skills and knowledge taught to the student in complete objectivity. In the same spirit, we would gain by promoting the contractualization of the assessment of learning by specifying, for example, the success criteria and good practices that would lead to correct and precise answers to the questions. Thus, the assessment would mainly focus on the acquired knowledge that has been the subject of training by giving exercises related to what has been prepared in TD without forgetting, however, to assess the ability of students to mobilize their skills in more complex situations.

### 4-1 Practical work:

| | | |
|---|---|---|
| Preparation of exercise series and personal work (homework to be submitted, presentations, etc.) | 30% | 06 points |
| Written questions (minimum 2 questions including one proposed by the subject manager) | 50% | 10 points |

| | | |
|---|---|---|
| Student participation in tutorials | 20% | 04 points |
| **Total** | **100%** | **20 points** |

**4.2 Practical work:**

| | | |
|---|---|---|
| Practical work preparation tests | 20% | 04 points |
| Report (must be submitted at the end of the practical session) | 40% | 08 points |
| Practical test at the end of the semester on all the manipulations carried out by the student. | 40% | 08 points |
| **Total** | **100%** | **20 points** |

**G2-Student's personal work:**

The student's personal work is part of the LMD spirit. A very substantial amount of time has been allocated to it each week: approximately 50% of the total training time (see the "Overall Training Summary" table in this training offer).
A survey conducted by the CPND-ST among training teams across all university establishments indicated that time spent on student personal work could be used wisely, under good teacher supervision, rationally and in various forms. The tasks that would then be completed by volunteer students would be evaluated and counted (as a bonus) in their overall continuous assessment grade. The rate of this bonus is left to the discretion of the teaching teams.

The synthesis of the different proposals can be summarized in the following points:

**1. Homework:**

In order to enrich the knowledge and strengthen the training of students, they will be asked to carry out additional homework guided by their course or tutorial teachers. This type of work will involve, for example, encouraging students to do research to answer specific and/or conflicting questions raised during the course, solving a difficult exercise, reviewing in detail the demonstration of a theorem, researching the complement to a course, using free software or a CAD-CAM tool to make applications and simulations related to the course, etc. These activities can be evaluated, graded and registered as a bonus for the students who complete them.

**2. Mini course project:**

The mini-course project (1 to 3 weeks) is an effective way to prepare students for the methodology of expression, writing, and documentary research. It allows them to put into practice the techniques learned in cross-curricular subjects. It also allows them to develop a teamwork spirit.

The theme of the mini course project must be well targeted and decided by the teacher for a group of students (2 to 5 maximum), sanctioned by a single report (10 pages maximum) and a short collective oral presentation (preferably with audio-visual support). A mark, common to

the group, is awarded according to an evaluation grid (presentation of the document and use of bibliographic resources, oral presentation, respect for time, answers to questions, etc.) and will then be counted, as a bonus, in the continuous assessment mark.

**3. Report of a visit, an educational outing or a discovery and/or immersion course:**

Visits, educational outings, discovery and/or immersion courses are opportunities for students that can help them better understand the reality of the working world and help them achieve better professional integration later on.
Administrative managers and teachers must encourage, as much as possible, this very important aspect of training and ensure the organization of educational visits and outings throughout the training course.
They must also help/encourage students to prospect in economic institutions with the aim of finding (in L3 and M1) discovery and/or immersion internships of one to two weeks in the industrial environment during the winter and spring holidays.
In this context, teachers must ensure that students take notes during these outings and require reports (reports of a few pages). This activity can be evaluated, graded, and recorded as a bonus for the student who completes it. Students can be offered templates to help them present their internship report effectively.

**4. Participation in scientific events:**

In order to instill in students a scientific mindset (especially for higher education students), they should be guided and encouraged to participate in round tables, laboratory seminars and conferences organized within their faculty and/or institution. It is even advisable to encourage these students to attend conferences related to their specialty outside their university at exhibitions, fairs and other events. This activity can be evaluated, graded and recorded as a bonus for the student who completes it.

**5. Use of New Information and Communication Technologies:**

ICTs are very attractive to students. Teachers should encourage them to use these technologies to create spaces for exchange among themselves (promotion pages, discussion forums on a specific course issue, etc.). The teacher can also participate in the group as an online evaluator. This activity can be evaluated, graded, and recorded as a bonus for students who participate.

**Conclusion :**

Student autonomy, considered a lever for success, is largely based on the personal work that the student is required to do, by appropriating the resources and tools made available to them. All of this must, of course, be supervised and formalized within the framework of educational monitoring and support that must be provided jointly by the university teacher and the administrative manager throughout the training course.
This autonomy will allow him to build his professional identity based on his aspirations, his abilities and his achievements or even to build his academic career in the pursuit of higher education.

## 4 - Human resources available:

### A: Supervisory capacity (expressed in the number of students that can be supported):

Number of students:

### B: Internal teaching team mobilized for the specialty:(To be completed and endorsed by the faculty or institute)

| First and last name | Graduation Diploma | Specialized diploma (Magister, doctorate) | Grade | Subjects to be taught | Signing in |
|---|---|---|---|---|---|
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**Departmental visa** **Faculty or institute visa**

C: External teaching team mobilized for the specialty:(To be completed and endorsed by the faculty or institute)

| First and last name | Establishment of attachment | Graduation Diploma | Specialized diploma (Magister, doctorate) | Grade | Subjects to be taught | Signing in |
|---|---|---|---|---|---|---|
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**Departmental visa** **Faculty or institute visa**

D: Overall summary of human resources mobilized for the specialty (L3):

| Grade | Internal Staff | External Staff | Total |
|---|---|---|---|
| Teachers | | | |
| Lecturers (A) | | | |
| Lecturers (B) | | | |
| Assistant Professor (A) | | | |
| Assistant Professor (B) | | | |
| Other (*) | | | |
| Total | | | |

(*) Technical and support staff

## 5 - Material resources specific to the specialty

### A- Educational Laboratories and Equipment:**Sheet of existing teaching equipment for the practical work of the planned training (1 sheet per laboratory)**

**Lab title:**

**Student capacity:**

| No. | Equipment designation | Number | Observations |
|---|---|---|---|
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B- Internships and training in companies:(see agreements/conventions section)

| Internship location | Number of students | Duration of the internship |
|---|---|---|
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C- Documentation available at the establishment level specific to the training offered (Mandatory field):

## D- Personal work and ICT spaces available at department and faculty level:

# II – Half-yearly teaching organization sheets of the specialty

**Semester 1**

| Teaching unit | Materials | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Assessment method | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **TD** | **TP** | | | **Continuous Assessment** | **Exam** |
| Fundamental EU<br>Code: UEF 1.1<br>Credits: 18<br>Coefficients: 9 | Mathematics 1 | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Physics 1 | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Structure of matter | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| Methodological EU<br>Code: UEM 1.1<br>Credits: 9<br>Coefficients: 5 | Physics 1 Practical Work | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | Chemistry 1 practical work | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | Computer Science 1 | 4 | 2 | 1h30 | | 1h30 | 45h00 | 55h00 | 40% | 60% |
| | Writing methodology | 1 | 1 | 1 hour | | | 3:00 p.m. | 10:00 a.m. | | 100% |
| EU Discovery<br>Code: UED 1.1<br>Credits: 1<br>Coefficients: 1 | Careers in Science and Technologies 1 | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| E Transversal<br>Code: UET 1.1<br>Credits: 2<br>Coefficients: 2 | Ethical and deontological dimension (the foundations) | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Foreign language 1 (French or English) | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| **Total semester 1** | | **30** | **17** | **4:00 p.m.** | **4:30 a.m.** | **4:30 a.m.** | **375 hours** | **375 hours** | | |

**Semester 2**

| Teaching unit | Materials | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Assessment method | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **TD** | **TP** | | | **Continuous Assessment** | **Exam** |
| Fundamental EU<br>Code: UEF 1.2<br>Credits: 18<br>Coefficients: 9 | Mathematics 2 | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Physics 2 | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Thermodynamics | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| Methodological EU<br>Code: UEM 1.2<br>Credits: 9<br>Coefficients: 5 | Physics 2 Practical Work | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | Chemistry 2 practical work | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | Computer Science 2 | 4 | 2 | 1h30 | | 1h30 | 45h00 | 55h00 | 40% | 60% |
| | Presentation methodology | 1 | 1 | 1 hour | | | 3:00 p.m. | 10:00 a.m. | | 100% |
| EU Discovery<br>Code: UED 1.2<br>Credits: 1<br>Coefficients: 1 | Careers in Science and Technologies 2 | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Transversal EU<br>Code: UET 1.2<br>Credits: 2<br>Coefficients: 2 | Foreign language 2<br>(French and/or English) | 2 | 2 | 3:00 a.m. | | | 45h00 | 5:00 a.m. | | 100% |
| **Total semester 2** | | **30** | **17** | **4:00 p.m.** | **4:30 a.m.** | **4:30 a.m.** | **375 hours** | **375 hours** | | |

## Semester 3

| Teaching unit | Materials | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Assessment method | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **TD** | **TP** | | | **Continuous Assessment** | **Exam** |
| Fundamental EU Code: UEF 2.1.1 Credits: 10 Coefficients: 5 | Mathematics 3 | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Waves and vibrations | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| Fundamental EU Code: UEF 2.1.2 Credits: 8 Coefficients: 4 | Fundamental Electronics 1 | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| | Fundamental Electrical Engineering 1 | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| Methodological EU Code: UEM 2.1 Credits: 9 Coefficients: 5 | Probability and statistics | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| | Computer Science 3 | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | Practical work in Electronics and Electrical Engineering | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | TP Waves and vibrations | 1 | 1 | | | 1 hour | 3:00 p.m. | 10:00 a.m. | 100% | |
| EU Discovery Code: UED 2.1 Credits: 2 Coefficients: 2 | State of the art of electrical engineering | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| | Energy and environment | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| Transversal EU Code: UET 2.1 Credits: 1 Coefficients: 1 | Technical English | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total semester 3** | | **30** | **17** | **1:30 p.m.** | **7:30 a.m.** | **4:00 a.m.** | **375 hours** | **375 hours** | | |

## Semester 4

| Teaching unit | Materials | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Assessment method | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **TD** | **TP** | | | **Continuous Assessment** | **Exam** |
| Fundamental EU<br>Code: UEF 2.2.1<br>Credits: 10<br>Coefficients: 5 | Basic telecommunications | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Combinatorial logic and sequential | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 100% |
| Fundamental EU<br>Code: UEF 2.2.2<br>Credits: 8<br>Coefficients: 4 | Numerical methods | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| | Signal theory | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| Methodological EU<br>Code: UEM 2.2<br>Credits: 9<br>Coefficients: 5 | Electrical measurements and electronics | 3 | 2 | 1h30 | | 1 hour | 37h30 | 37h30 | 40% | 60% |
| | Basic Telecommunications Practical Work | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | Practical work on combinatorial logic and sequential | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | Numerical Methods Practical Work | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| EU Discovery<br>Code: UED 2.2<br>Credits: 2<br>Coefficients: 2 | Telecommunications and applications | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| | Telecommunications Law | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| Transversal EU<br>Code: UET 2.2<br>Credits: 1<br>Coefficients: 1 | Techniques of expression, information and communication | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| **Total semester 4** | | **30** | **17** | **1:30 p.m.** | **6:00 a.m.** | **5:30 a.m.** | **375 hours** | **375 hours** | | |

## Semester 5

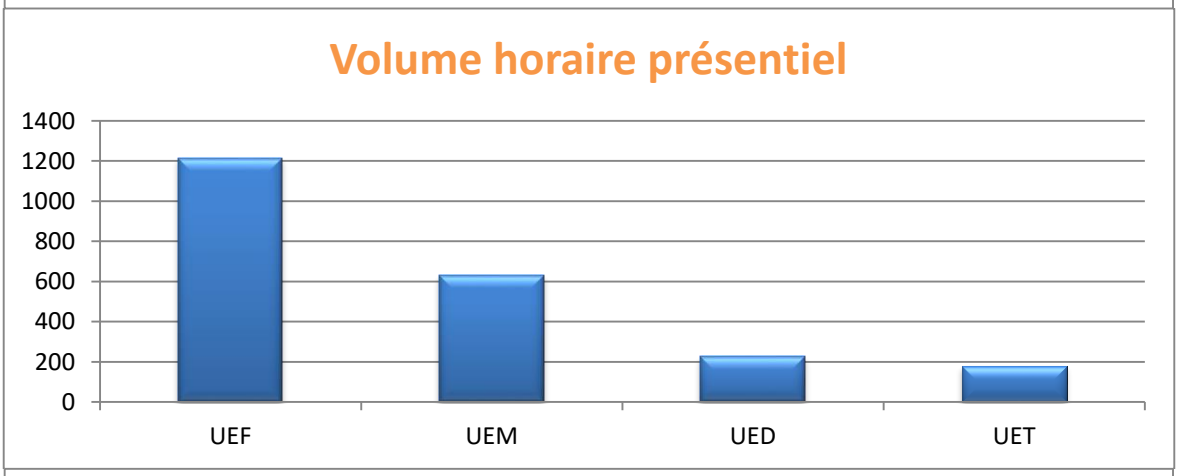
| Teaching unit | Materials | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Assessment method | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **TD** | **TP** | | | **Continuous Assessment** | **Exam** |
| Fundamental EU<br>Code: UEF 3.1.1<br>Credits: 10<br>Coefficients: 5 | Analog communications | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Signal processing | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| Fundamental EU<br>Code: UEF 3.1.2<br>Credits: 8<br>Coefficients: 4 | Waves and Propagation | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| | Telecommunications systems and networks | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| Methodological EU<br>Code: UEM 3.1<br>Credits: 9<br>Coefficients: 5 | Calculators and interfacing | 3 | 2 | 1h30 | | 1 hour | 37h30 | 37h30 | 40% | 60% |
| | Practical work on Waves and Propagation | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | TPSignal processing | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | TP Analog Communications | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| EU Discovery<br>Code: UED 3.1<br>Credits: 2<br>Coefficients: 2 | Telephony | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| | Transmission media | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| Transversal EU<br>Code: UET 3.1<br>Credits: 1<br>Coefficients: 1 | Sensors and measurements in telecommunications | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| **Total semester 5** | | **30** | **17** | **1:30 p.m.** | **6:00 a.m.** | **5:30 a.m.** | **375 hours** | **375 hours** | | |

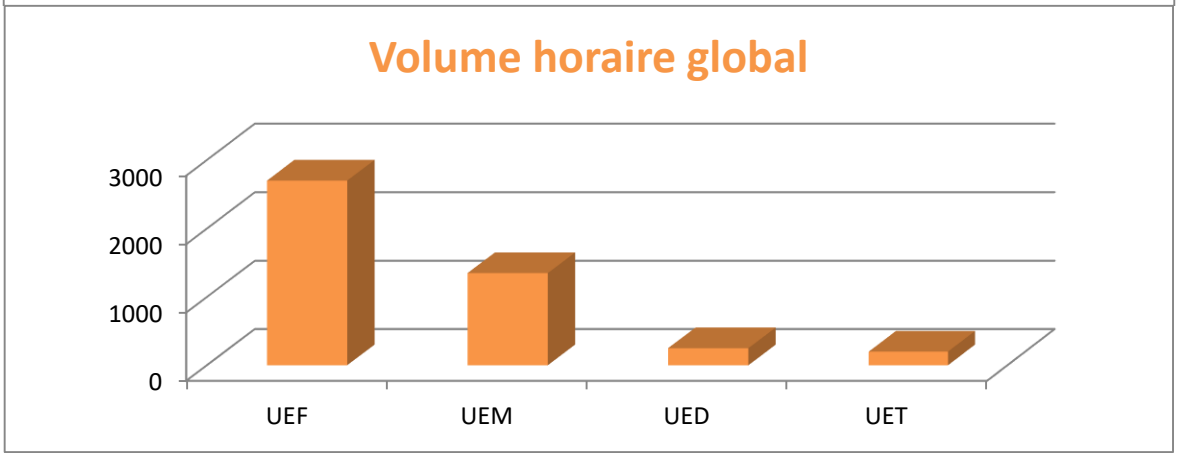
## Semester 6

| Teaching unit | Materials | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Assessment method | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **TD** | **TP** | | | **Continuous Assessment** | **Exam** |
| Fundamental EU Code: UEF 3.2.1 Credits: 10 Coefficients: 5 | Digital communications | 6 | 3 | 3:00 a.m. | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Antennas and Transmission Lines | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| Fundamental EU Code: UEF 3.2.2 Credits: 8 Coefficients: 4 | Local computer networks | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| | Coding and Information Theory | 4 | 2 | 1h30 | 1h30 | | 45h00 | 55h00 | 40% | 60% |
| Methodological EU Code: UEM 3.2 Credits: 9 Coefficients: 5 | End of Cycle Project | 4 | 2 | | | 3:00 a.m. | 45h00 | 55h00 | 100% | |
| | TPDigital communications | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | TP Antennas Lines of transmissions | 2 | 1 | | | 1h30 | 10:30 p.m. | 27:30 | 100% | |
| | Local computer networks practical work | 1 | 1 | | | 1 hour | 3:00 p.m. | 10:00 a.m. | 100% | |
| EU Discovery Code: UED 3.2 Credits: 2 Coefficients: 2 | Optoelectronics | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| | Information security | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| Transversal EU Code: UET 3.2 Credits: 1 Coefficients: 1 | Entrepreneurship and business management | 1 | 1 | 1h30 | | | 10:30 p.m. | 2:30 a.m. | | 100% |
| **Total semester 6** | | **30** | **17** | **12:00 p.m.** | **6:00 a.m.** | **7:00 a.m.** | **375 hours** | **375 hours** | | |

## Overall training summary:

| EU / VH | UEF | EMU | UED | UET | Total |
|---|---|---|---|---|---|
| Course | 720h00 | 120h00 | 225h00 | 6:00 p.m. | 1245h00 |
| TD | 495h00 | 10:30 p.m. | --- | --- | 5:17 p.m. |
| TP | --- | 487h30 | --- | --- | 487h30 |
| Personal work | 1485h00 | 720h00 | 25h00 | 8:00 p.m. | 2250h00 |
| Other (specify) | --- | --- | --- | --- | --- |
| Total | 2700h00 | 1350h00 | 250h00 | 8:00 p.m. | 4500h00 |
| Credits | 108 | 54 | 10 | 8 | 180 |
| % in credits for each EU | 60% | 30% | 10% | | 100% |

# III - Detailed program by subject

**Semester: 1**
**Teaching unit: UEF1.1**
**Subject 1: Mathematics 1**
**VHS: 67h30 (Lecture: 3h00, Tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives

This first mathematics subject is particularly dedicated to standardizing the level of students entering 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.

## Recommended prior knowledge

Basics of Mathematicsfinal year classes(sets, functions, equations, etc.).

## Content of the material:

**Chapter 1.Methods of mathematical reasoning (1 Week)**
1-1 Direct reasoning. 1-2 Reasoning by contraposition. 1-3 Reasoning by contradiction. 1-4 Reasoning by counterexample. 1-5 Reasoning by recurrence.

**Chapter 2.Sets, relations and applications (2 Weeks)**
2.1 Set theory. 2-2 Order relations, Equivalence relations. 2-3 Injective, surjective, bijective applications: definition of an application, direct image, reciprocal image, characteristic of an application.

**Chapter 3. Real functions with 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's formula. 5-2 Limited development. 5-3 Applications.

**Chapter 6. Linear algebra (4 Weeks)**
6-1 Laws and internal composition. 6-2 Vector space, basis, dimension (definitions and elementary properties). 6-3 Linear application, kernel, image, rank.

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

## Bibliographic references:

1- K. Allab, Elements of analysis, Function of a real variable, 1st & 2nd years of university, Office of University Publications.
2- J. Rivaud, Algebra: Preparatory Classes and University Volume 1, Exercises with Solutions, Vuibert.
3- N. Faddeev, I. Sominski, Collection of exercises in higher algebra, Moscow Edition
4- M. Balabne, M. Duflo, M. Frish, D. Guegan, Geometry – 2nd year of the 1st cycle preparatory classes, Vuibert University.

5- B. Calvo, J. Doyen, A. Calvo, F. Boshet, Algebra exercises, 1st scientific cycle preparation for the grandes écoles 2nd year, Armand Colin – Collection U.
6- J. Quinet, Elementary course in higher mathematics 1- Algebra, Dunod.
7- J. Quinet, Elementary course in higher mathematics 2- Usual functions, Dunod.
8- J. Quinet, Elementary course in higher mathematics 3- Integral calculus and series, Dunod.
9- J. Quinet, Elementary course in higher mathematics 4- Differential equations, Dunod.

**Semester: 1**
**Teaching unit: UEF 1.1**
**Subject 2: Physics 1**
**VHS: 67h30 (Lecture: 3h00, Tutorial: 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.

**Recommended prior knowledge**

Notions of mathematics and physics.

**Content of the material:**

**Mathematical reminders (2 Weeks)**

1- The dimensional equations

2-Vector calculus: scalar product (norm), vector product, multivariate functions, derivation. Vector analysis: gradient, rotational operators, etc.

**Chapter 1. Kinematic (5 Weeks)**

1- Position vector in coordinate systems (Cartesian, cylindrical, spherical, curvilinear) - Law of motion - Trajectory. 2- Speed and acceleration in coordinate systems. 3- Applications: Movement of the material point in different coordinate systems. 4- Relative movement.

**Chapter 2. Dynamic: (4 Weeks)**

1- General: Mass - Force - Moment of force - Absolute and Galilean reference frame. 2- Newton's laws. 3- Principle of conservation of momentum. 4- Differential equation of motion. 5- Angular momentum. 6- Applications of the fundamental law for forces (constant, time-dependent, 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 assessment: 40%; Exam: 60%.

**Bibliographic references:**

1. HAS.Gibaud,Mr. Henry;Physics course - Point mechanics - Course and corrected exercises;Dunod, 2007.
2. P. Fishbane et al. ; Physics For Scientists and Engineers with Modern Physics, 3rd Ed.; 2005.
3. PA Tipler, G. Mosca; Physics For Scientists and Engineers, 6th Ed., WH Freeman Company, 2008.

**Semester: 1**
**Teaching unit: UEF1.1**
**Subject 3: Structure of matter**
**VHS: 67h30 (Lecture: 3h00, Tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives

The teaching of this subject allows the student to acquire the 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.To make students more capable of solving chemistry problems.

## Recommended prior knowledge

Basic notions of mathematics and general chemistry.

## Content of the material:

**Chapter 1:Basic concepts (2 Weeks)**
Macroscopic states and characteristics of the states of matter, changes in states of matter, concepts of atom, molecule, mole and Avogadro's number, atomic mass unit, atomic and molecular molar mass, molar volume, Law of mass: 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 planetary model, Presentation and characteristics of the atom (Symbol, atomic number Z, mass number A, number of protons, neutrons and electrons), Isotopy and relative abundance of different isotopes, 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 (radiationalpha,βAndγ), Artificial radioactivity and nuclear reactions, Kinetics of radioactive decay, Applications of radioactivity.

**Chapter 4:Electronic structure of the atom (2 weeks)**
Wave-particle duality, Interaction between light and matter, Bohr's atomic model: hydrogen atom, The hydrogen atom in wave mechanics, Polyelectronic atoms in wave mechanics.

**Chapter 5:Periodic table of elements (3 Weeks)**
D. Mendeleev's Periodic Classification, Modern Periodic Classification, Evolution and periodicity of physicochemical properties of elements, Calculation of radii (atomic and ionic), successive ionization energies, electron affinity and electronegativity (Mulliken scale) by Slater's rules.

**Chapter 6:Chemical bonds (3 Weeks)**
Covalent bonding in Lewis theory, Polarized covalent bonding, dipole moment and partial ionic character of the bond, Geometry of molecules: Gillespie theory or VSEPR, Chemical bonding in the quantum model.

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

**Bibliographic references**

1. Ouahes, Devallez, General Chemistry, OPU.
2. SS Zumdhal & coll., General Chemistry, De Boeck University.
3. Y. Jean, Electronic structure of molecules: 1 from the atom to simple molecules, 3rd edition, Dunod, 2003.
4. F. Vassaux, Chemistry in IUT and BTS.
5. A. Casalot & A. Durupthy, Inorganic Chemistry 2nd cycle course, Hachette.
6. P. Arnaud, Course in Physical Chemistry, Ed. Dunod.
7. M. Guymont, Structure of matter, Belin Coll., 2003.
8. G. Devore, General Chemistry: T1, study of structures, Coll. Vuibert, 1980.
9. M. Karapetiantz, Constitution of Matter, Ed. Mir, 1980.

**Semester: 1**
**Teaching unit: UEM 1.1**
**Subject 1: Physics 1 Practical Work**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

**Teaching objectives**
Consolidate the theoretical knowledge provided in the course through a number of practical exercises.

**Recommended prior knowledge**
Notions of mathematics and physics.

**Content of the material:**

**5 manipulations minimum (3 hours / 15 days):**

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

**Assessment method:**
Continuous assessment: 100%.

**Semester: 1**
**Teaching unit: UEM1.1**
**Subject 2: Chemistry 1 Practical Work**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives

Consolidate the theoretical knowledge provided during the structure of matter course through a number of practical exercises.

## Recommended prior knowledge

Basic Chemistry Concepts.

## Content of the material:

1.Safety in the laboratory

2.Preparation of solutions

3. Notions on uncertainty calculations applied to chemistry.

4. Acid-base dosage by colorimetry and pH-metry.

5. Acid-base dosage by conductivity meter.

5. Oxidation-reduction assay

6. Determination of water hardness

7. Determination of ions in water: determination of chloride ions by the Mohr method.

## Assessment method:

Continuous assessment: 100%

**Semester: 1**
**Teaching unit: UEM1.1**
**Subject 3: Computer Science 1**
**VHS: 45h00 (Lecture: 1h30, Practical work: 1h30)**
**Credits: 4**
**Coefficient: 2**

**Objective and recommendations:**
The objective of the subject is to enable students to learn to program using a high-level language (Fortran, Pascal, or C). The choice of language is left to the discretion of each institution. The concept of algorithms must be implicitly addressed during language learning.

## Recommended prior knowledge
Basic concepts of web technology.

**Content of the material:**
**Part 1. Introduction to Computer Science (5 Weeks)**
1- Definition of computing
2- Evolution of computing 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. Concepts of algorithm and program (10Weeks)**
1- Concept of an algorithm
2- Organizational 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- Input/output operations
8- Control structures: Conditional control structures, Repetitive control structures

## Computer Science 1:
The practical exercises are intended to illustrate the concepts taught during the course. These exercises should begin with the lessons according to the following schedule:
•Initiation and f practical workfamiliarization with the computer machine from a hardware and operating system point of view (exploration of the different functionalities of the OS)
•Practical work on the use of a programming environment (Editing, Assembly, Compilation, etc.)
• TPapplication of programming techniques seen in class.

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

**Bibliographic references**
1- John Paul Mueller and Luca Massaron, Algorithms for Dummies large format, 2017.
2- Charles E. Leiserson, Clifford Stein and Thomas H. Cormen, Algorithmics: course with 957 exercises and 158 problems, 2017.

3- Thomas H. Cormen, Algorithms: Basic Notions, 2013.

**Semester: 1**
**Teaching unit: UEM1.1**
**Subject 4: Writing Methodology**
**VHS: 3:00 p.m. (Class: 1 hour)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives

To familiarize and train students with current concepts of writing methodology in force in the Science and Technology profession. Among the skills to be acquired: Knowing how to present oneself; Knowing 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.

## Recommended prior knowledge

Basic French.Basic principle of writing a document.

## Content of the material:

**Chapter 1. Concepts and generalities on writing techniques (2 Weeks)**
- Definitions, standards
-Applications: writing a summary, a letter, a request

**Chapter 2. Information research, synthesis and exploitation (3 Weeks)**
-Searching for information in the library (Paper format: Books, Magazines)
-Searching for information on the Internet (Digital: Databases; Search engines, etc.).
-Applications

**Chapter 3 Techniques and procedures of writing (3 Weeks)**
-Basic Principles of Writing - Punctuation, Syntax, Sentences
-The length of sentences
-Division into paragraphs
-Using 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 Exam: 100%.

## Bibliographic references:

1. J.-L. Lebrun, Practical guide to scientific writing, EDP Sciences, 2007.
2. M. Fayet, Successful Reporting, 3rd edition, Eyrolles, 2009.
3. M. Kalika, Master's thesis - Managing a thesis, Writing a report, Preparing a defense, Dunod, 2016.
4. M. Greuter, Succeeding in your dissertation and internship report, l'Etudiant, 2014
5. F. Cartier, Written and oral communication, Edition GEP- Groupe Eyrolles, 2012.
6. M. Fayet, Methods of written and oral communication, 3rd edition, Dunod, 2008.

7. E. Riondet, P. Lenormand, The big book of letter models, 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, The Practice of Correspondence, 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 Professional English, Springer, 2014.

**Semester: 1**
**Teaching unit: UED1.1**
**Subject 1: Careers in Science and Technology 1**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

**Objective of the subject:**
To introduce the student, in a first step, to all the sectors covered by the Science and Technology Field and in a second step to a range of careers that these sectors lead to. In the same context, this subject introduces the new challenges of sustainable development as well as the new careers that can result from it.

**Recommended prior knowledge**
None.

**Content of the subject:**
**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, develop a simple job description (job title, company, main activities, skills required (knowledge, know-how, interpersonal skills)

**2. Electronics, Telecommunications, Biomedical Engineering, Electrotechnics, Electromechanics, Optics & Precision Mechanics sectors: (2 weeks)**
- Definitions, areas of application (Home automation,embedded applications for automobiles,Video surveillance, Mobile telephony, Optical fiber, Advanced scientific instrumentation, Imagingand Instrumentationmedical, Giant mirrors, Contact lenses, Transport and distribution of electrical energy, Power generation plants, Energy efficiency,Maintenance of industrial equipment,Elevators, Wind Turbines, …
- Role of the specialist in these areas.

**3.Automation and Industrial Engineering sectors: (1 week)**
- Definitions, areas of application (Automated industrial chains, Numerical Control Machine Tools, Robotics, Inventory Management, Goods Traffic Management, Quality, - Role of the specialist in these areas.

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

**5. Sustainable development (SD): (4 weeks)**
Definitions, Global issues (climate change, demographic transitions, resource depletion (oil, gas, coal, etc.), biodiversity loss, 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, resource recovery (water, metals and minerals, etc.), sustainable production), Relevance of sustainable engineering in S&T sectors, Relationship between sustainability and engineering, Responsibility of engineers in the implementation of sustainable projects, etc.

**Student's personal work for this subject:**
The teacher in charge of this subject can let his students know that he can always assess them by asking them to prepare job sheets. Ask the students to watch a popular science film at home related to the chosen job (after giving them either the film electronically or giving them the internet link to this film) and then ask them to submit a written report or 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 whoare the only ones able to define the best way to take this personal work into account inthe overall grade 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/Decouvert-les-metiers**,www.indeed.fr,**www.pole-emploi.fr**) (1 sector / group).
Depending on the capacity 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% exam

**Bibliographic references:**
1- What jobs for tomorrow? Publisher: ONISEP, 2016, Collection: Les Dossiers.
2- J. Douënel and I. Sédès, Choosing a career according to your profile, Editions d'Organisation, Collection: Employment & career, 2010.
3- V. Bertereau and E. Ratière, What Job Are You Made For? Publisher: L'Étudiant, 6th edition, Collection: Métiers, 2015.
4- The great book of professions, Publisher: L'Étudiant, Collection: Métiers, 2017.
5- Careers in the aeronautics and space industry, Collection: Parcours, Edition: ONISEP, 2017.
6- Careers in electronics and robotics, Collection: Parcours, Edition: ONISEP, 2015.
7- Environmental and sustainable development professions, Collection: Parcours, Edition: ONISEP, 2015.
8- Construction and public works trades, Collection: Parcours, Edition: ONISEP, 2016.
9- Transport and logistics professions, Collection: Parcours, Edition: ONISEP, 2016.
10- Energy professions, Collection: Parcours, Edition: ONISEP, 2016.
11- Mechanical professions, Collection: Parcours, Edition: ONISEP, 2014.
12- Careers in chemistry, Collection: Parcours, Edition: ONISEP, 2017.
13- Web professions, Collection: Parcours, Edition: ONISEP, 2015.
14- Careers in biology, Collection: Parcours, Edition: ONISEP, 2016.

**Semester: 1**
**Teaching unit: UET 3.1**

**Subject: Ethical and deontological dimension (the foundations)**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**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 develop students' awareness of ethical principles. It introduces them to the rules that govern life at university (their rights and obligations towards the university community) and in the world of work, and raises awareness of respect for and the promotion of intellectual property andexplain to them the risks of moral evils such as corruption and how to combat them.

## Recommended prior knowledge:

None

## Content of the material:

**I. Fundamentals –The Lord of the Rings (2 weeks)**

Definitions:
1. Moral:
2. Ethics:
3. Ethics "Theory of Duty":
4. The right:

5. Distinction between the different concepts
   A. Distinction between ethics and morality
   B. Distinction between ethics and deontology

**II. The Reference Materials –Al-Qaeda (2 weeks)**

Philosophical references
The religious reference
The evolution of civilizations
The institutional reference

**III. The University Franchise –The Lord (3 weeks)**

The Concept of University Franchises
Regulatory texts
University franchise fees
University campus stakeholders

**IV. University Values –The Lord of the Rings (2 weeks)**

Social Values
Community Values
Professional Values

**V. Rights and Duties (2 weeks)**

Student Rights
Student's duties
Teachers' Rights
Obligations of the professor-researcher
Obligations of administrative and technical staff

**VI. University Relations (2 weeks)**

Definition of the concept of university relations
Student-teacher relations
Student-student relations
Student-Staff Relations
Student Relations – Association Members

**VII. Practices (2 weeks)**

Best practices for the teacher
Best practices for the student

**Bibliographic references**

1. Collection of ethics and professional conduct courses from Algerian universities.
2. BARBERI (J.-F.), 'Morality and corporate law', Les Petites Affiches, no. 68, June 7, 1995.
3. J. Russ, Contemporary Ethical Thought, Paris, puf, Que sais-je?, 1995.
4. LEGAULT, GA, Professionalism and Ethical Deliberation, Quebec, Presses of the University of Quebec, 2003.
5. SIROUX, D., 'Ethics', in M. Canto-Sperber (ed.), Dictionary of Ethics and Moral Philosophy, Paris, Quadrige, 2004.
6. Prairat, E. (2009). Teaching professions in the age of ethics. Education and Societies, 23.
7. https://elearning.univ-annaba.dz/pluginfile.php/39773/mod_resource/content/1/Cours%20Ethique%20et%20la%20d%C3%A9ontologie.pdf.

**Semester: 1**
**Teaching unit: UET1.1**
**Subject 1: French language1**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives:**
This subject aims to develop the following four skills: Oral comprehension, Written comprehension and Oral expression, Written expression through reading and studying texts.

**Recommended prior knowledge:**
Basic French.

**Content of the material:**
Below we offer a set of themes that cover fundamental sciences, technologies, economics, social issues, communication, sports, health, etc. The teacher can choose texts from this list to develop them during the course. Otherwise, they are free to address other themes of their 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 develop their linguistic skills: listening, comprehension, and oral and written expression. In addition, they must use this text to identify the grammatical structures they will develop during the same class session. Here, for illustration purposes, we recall a set of grammatical structures that can be developed as examples. Of course, it is not a question of developing them all or in the same way. Some can be recalled and others in great detail.

| Examples of themes | Grammatical structures |
|---|---|
| Climate change<br>Pollution<br>The electric car<br>The robots<br>Artificial intelligence<br>The Nobel Prize<br>The Olympic Games<br>Sports at school<br>The Sahara<br>The currency<br>Assembly line work<br>Ecology<br>Nanotechnologies<br>Optical fiber<br>The engineering profession<br>The power plant<br>Energy efficiency<br>The smart building<br>Wind energy<br>Solar energy | Punctuation. Proper nouns, Articles.<br>Grammatical functions: The noun, The verb, The pronouns, The adjective, The adverb.<br>The complement pronoun ''le, la, les, lui, leur, y, en, me, te, …''<br>The agreements.<br>The negative sentence. Don't…, Don't… yet, Don't… anymore, Don't… ever, Don't… point, …<br>The interrogative sentence. Question with "Who, What, What", Question with "When, Where, How much, Why, How, Which, Which".<br>The exclamatory sentence.<br>Reflexive verbs. Impersonal verbs.<br>The indicative tenses: Present, Future, Past Perfect, Simple Past, Imperfect.<br>… |

**Assessment method:**
Review: 100%.

**Bibliographic references**:


1. M. Badefort, Objective: International French Test, Edulang, 2006.
2. O. Bertrand, I. Schaffner, Passing the TCF, Exercises and training activities, Les éditions de l'école polytechnique, 2009.
3. M. Boulares, J.-L. Frerot, Progressive French Grammar with 400 exercises, Advanced Level, CLE International.
4. Collective, Besherelles: Grammar for all, Hatier.
5. Collective, Besherelles: Conjugation for all, Hatier.
6. Mr. Grégoire, Progressive French Grammar with 400 exercises, Beginner Level, CLE International, 1997.
7. A. Hasni et al., Training in teaching science and technology in secondary schools, Presses de l'université du Québec, 2006.
8. J.-L. Lebrun, Practical guide to scientific writing, EDP Sciences, 2007.
9. JM Robert, Difficulties of French, Hachette,
10. C. Tisset, Teaching French at school: Grammar, Spelling and Conjugation, Hachette Education, 2005.
11. J. Bossé-Andrieu, Summary of the Rules of Grammar and Spelling, Presses of the University of Quebec, 2001.
12. J.-P. Colin, French simply, Eyrolles, 2010.
13. Collective, French Assessment Test, Hachette, 2001.
14. Y. Delatour et al., Practical French grammar in 80 cards with corrected exercises, Hachette, 2000.
15. Ch. Descotes et al., The Exerciser: French Expression for Intermediate Level, Presses Universitaires de Grenoble, 1993.
16. H. Jaraush, C. Tufts, Sur le Vif, HeinleCengage Learning, 2011.
17. J. Dubois et al., The Essentials – Spelling, Larousse, 2009.

**Semester: 1**
**Teaching unit: UET1.1**
**Subject 1: English Language1**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credit: 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 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 also contain a terminology which means the translation of some words from English to French one. , 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<br>Heat Treatment of Steel.<br>Lubrication of Bearings.<br>The Lathe.<br>Welding.<br>Steam Boilers.<br>Steam Locomotives.<br>Condensation and Condensers.<br>Centrifugal Governors.<br>Impulse Turbines.<br>The Petro Engine.<br>The Carburetion System.<br>The Jet Engine.<br>The Turbo-Prop Engine.<br>Aerofoil. | Make + Noun + Adjective<br>Quantity, Contents<br>Enable, Allow, Make, etc. + Infinitive<br>Comparative, Maximum and Minimum<br>The Use of Will, Can and May<br>Prevention, Protection, etc., Classification<br>The Impersonal Passive<br>Passive Verb + By + Noun (agent)<br>Too Much or Too Little<br>Instructions (Imperative)<br>Requirements and Necessity<br>Means (by + Noun or –ing)<br>Time Statements<br>Function, Duty<br>Alternatives |

**Mode evaluation:**
Exam: 100%.

**References:**

1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office of University Publications, 1994.
2. AJ Herbert, The Structure of Technical English, Longman, 1972.
3. S. Berland-Delepine, Methodical Grammar of Modern English with Exercises, 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, English: 1000 Words and Expressions from the Press: Vocabulary and Expressions from the Economic, Social and Political World, Fernand Nathan, 2006.

**Semester: 2**
**Teaching unit: UEF1.2**
**Subject 1: Mathematics 2**
**VHS: 67h30 (Lecture: 3h00, Tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives

Students are led, step by step, towards understanding mathematics useful for their university studies. 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 using several methods.

## Recommended prior knowledge

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

## Content of the material:

**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: Systems of Linear Equations (2 Weeks)**
2-1 Generalities. 2-2 Study of the solution set. 2-3 Methods for solving a linear system. Resolution by the Cramer method. Resolution by the inverse matrix method. Resolution by the Gauss method.

**Chapter 3: Integrals (4 Weeks)**
3-1Indefinite integral, property.3-2Integration of rational functions.3-3Integration of exponential and trigonometric functions.3-4The integral of polynomials.3-5Defined 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 Second-order ordinary differential equations 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 and triple integrals.

## Assessment method:

Continuous assessment: 40%; 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, JM 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. Piskunov, 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- J. Quinet, Elementary course in higher mathematics 2- Usual functions, Dunod.
9- J. Quinet, Elementary course in higher mathematics 1- Algebra, Dunod.
10- J. Rivaud, Algebra: Preparatory Classes and University Volume 1, Exercises with Solutions, Vuibert.
11- N. Faddeev, I. Sominski, Collection of exercises in higher algebra, Moscow Edition.

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

**Teaching objectives**

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

**Recommended prior knowledge**

Mathematics 1, Physics 1.

**Content of the material:**

**Mathematical reminders:(1 Week)**

1- Elements of length, surface, volume in Cartesian, cylindrical, spherical coordinate systems. Solid angle,Operators (gradient, rotational, Nabla, Laplacian and divergence).
2- Multiple derivatives and integrals.

**Chapter I. Electrostatics:(6 Weeks)**

1- Electrostatic charges and fields.Electrostatic interaction force-Coulomb's law.
2-Electrostatic potential.3- Electric dipole.4- Electric field flow.5- Gauss's theorem.6- Conductors in equilibrium.7- Electrostatic pressure.8- Capacitance of a conductor and a capacitor.

**Chapter II. Electrokinetics: (4 Weeks)**

1- Electrical conductor.2- Ohm's law.3- Joule's law.4- Electrical 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 and Savart's law, Ampere's theorem, Calculation of magnetic fields created by permanent currents.
2- Induction phenomena: Induction phenomena (circuit in a variable magnetic field and mobile circuit in a magnetic fieldpermanent), FLorentz force,FLaplace force, Faraday's law, Lenz's law, Application to coupled circuits.

**Assessment method:**

Continuous assessment: 40%; Exam: 60%.

**Bibliographic references:**

1. J.-P. Perez, R. Carles, R. Fleckinger; Electromagnetism Foundations and Applications, Ed. Dunod, 2011.
2. H. Djelouah; Electromagnetism; Office of University Publications, 2011.
3. P. Fishbane et al. ; Physics For Scientists and Engineers with Modern Physics, 3rd ed. ; 2005.
4. PA Tipler, G. Mosca; Physics For Scientists and Engineers, 6th ed., WH Freeman Company, 2008.

**Semester: 2**
**Teaching unit: UEF1.2**
**Subject 3: Thermodynamics**
**VHS: 67h30 (Lecture: 3h00, Tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives

Provide the necessary foundations of classical thermodynamics for applications to combustion and thermal machines. Homogenize 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 prior knowledge

Basic notions of mathematics and general chemistry.

## Content of the material:

**Chapter 1: Generalities on thermodynamics (3 Weeks)**

1-Fundamental properties of state functions. 2- Definitions 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-Reminder of the laws of ideal gases.

**Chapter 2: The 1st principle of thermodynamics: (3 weeks)**

1. Work, heat, internal energy, concept of conservation of energy. 2. The first principle 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 principle of thermodynamics to thermochemistry (3 weeks)**

Heats of reaction, standard state, Lstandard enthalpy of formation, enthalpy of dissociation, Lenthalpy of change of physical state, enthalpy of a chemical reaction, Hess's law, Kirchoff's law.

**Chapter 4: The 2nd principle of thermodynamics (3 weeks)**

1- The 2nd principle for a closed system. 2. Statement of the 2nd principle: Entropy of a closed isolated system. 3. Calculation of the variation of entropy: reversible isothermal transformation, reversible isochoric transformation, reversible isobaric transformation, adiabatic transformation, during a change of state, during a chemical reaction.

**Chapter 5:The 3rd Principle 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%.

## Bibliographic references:

1. C. Coulon, S. LeBoiteux S. and P. Segonds, Thermodynamics Physics - Course and exercises with solutions, Dunod Edition.
2. HB Callen, Thermodynamics, Course, Edition John Wiley and Sons, 1960
3. R. Clerac, C. Coulon, P. Goyer, S. LeBoiteux & C. Rivenc, Thermodynamics, Course and tutorials in thermodynamics, University of Bordeaux 1, 2003

4. O. Perrot, Thermodynamics Course IUT of Saint-Omer Dunkirk, 2011
5. CL Huillier, J. Rous, Introduction to thermodynamics, Dunod Edition.

**Semester: 2**
**Teaching unit: UEM 1.2**
**Subject 1: Physics 2 Practical Work**
**VHS: 45h00 (TP: 1h30)**
**Credits: 2**
**Coefficient: 1**

**Teaching objectives**

Consolidate through practical work sessions the theoretical concepts covered in the Physics 2 course.

**Recommended prior knowledge**

Mathematics 1, Physics 1.

**Content of the material:**

**5 manipulations minimum (3h00 / 15 days)**

- Presentation of measuring instruments and tools (Voltmeter, Ammeter, Rheostat, Oscilloscopes, Generator, etc.).
-Kirchhoff's laws (mesh law, knot law).
- Thévenin's theorem.
- Association and Measurement of inductances and capacities
- Charging and discharging a capacitor
- Oscilloscope
- Practical work on magnetism

**Assessment method:**

Continuous assessment: 100%

**Semester: 2**
**Teaching unit: UEM1.2**
**Subject 2: Chemistry 2 Practical Work**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives

Consolidate the theoretical concepts covered in the Thermodynamics course through practical work sessions.

## Recommended prior knowledge

Thermodynamics.

## Content of the material:

1. Ideal gas laws.
2. Water value of the calorimeter.
3. Specific heat: specific heat of liquid and solid bodies.
4. Latent heat: Latent heat of fusion of ice
5.Heat of reaction: Determination of the energy released by a chemical reaction (HCl/NaOH)
6. Hess's Law
7. Vapor pressure of a solution.

## Assessment method:

Continuous assessment: 100%

**Semester: 2**
**Teaching unit: UEM1.2**
**Subject 3: Computer Science 2**
**VHS: 45h00 (Lecture: 1h30, Practical work: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives

Master basic programming and algorithmic techniques. Acquire fundamental computer science concepts. The skills to be acquired are: Programming with a certain degree of autonomy; Designing algorithms from the simplest to the relatively complex.

## Recommended prior knowledge

Know how to use the university website, file systems, Windows user interface, programming environment.

## Content of the material:

**Chapter 1:Indexed variables (4Weeks)**
1- One-dimensional arrays: Representation in memory, Operations on arrays
2- Two-dimensional arrays: Representation in memory, Operations on two-dimensional arrays

**Chapter 2: Functions and Procedures (6 Weeks)**
1- Functions: Types of functions, declaration of functions, function calls
2- Procedures: Concepts of global variables and local variables, simple procedure, procedure with arguments

**Chapter 3: Recordings and Files(5 Weeks)**
1- Heterogeneous data structure
2- Structure of a record (notion of fields)
3- Manipulation of record structures
4- Concept of file
5- File access modes
6- Reading and writing to a file

## Computer Science 2:

Plan a certain number of practical exercises to put into practice the programming techniques seen during the course.
- TPapplication of programming techniques seen in class.

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

## Bibliographic references:

1- Algorithms for Dummies large format Book by John Paul Mueller (Informatiker, USA) and Luca Massaron 2017
2- Algorithmics: course with 957 exercises and 158 problems Book by Charles E. Leiserson, Clifford Stein and Thomas H. Cormen 2017
3- Algorithms: Basic Notions Book by Thomas H. Cormen 2013.

**Semester: 2**
**Teaching unit: UEM1.2**
**Subject 4: Presentation Methodology**
**VHS: 3:00 p.m. (Class: 1 hour)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives

Provide the main bases for a successful oral presentation.Among the skills to acquire: Knowing how to prepare a presentation; Knowing how to present a presentation; Knowing how to capture the attention of the audience; Being aware of the pitfalls of plagiarism and knowing the regulations of intellectual property.

## Recommended prior knowledge

Expression and communication techniques and writing methodology.

## Content of the material:

**Chapter 1: The Oral Presentation (3 Weeks)**
Communication. Preparing an oral presentation. Different types of plans.

**Chapter 2: Presenting an Oral Presentation (3 Weeks)**
Structure of an oral presentation. Presentation of an oral presentation.

**Chapter 3: Plagiarism and Intellectual Property (3 Weeks)**
1- Plagiarism: Definitions of plagiarism, sanctions for plagiarism, how to borrow other authors' work, quotes, illustrations, how to be sure to avoid plagiarism?
2- Writing a bibliography: Definition, objectives, how to present a bibliography, writing the bibliography

**Chapter 4: Presenting Written Work (6 Weeks)**
- Present a written work. Applications: presentation of an oral presentation.

## Assessment method:

Review: 100%.

## Bibliographic references:

1. M. Fayet, Methods of written and oral communication, 3rd edition, Dunod, 2008.
2. M. Kalika, Master's thesis – Managing a thesis, Writing a report, Preparing a defense, Dunod, 2016.
3. M. Greuter, Succeeding in your dissertation and internship report, l'Etudiant, 2014
4. B. Grange, Making a Successful Presentation. Preparing Powerful Slides and Communicating Effectively in Public. Eyrolles, 2009.
5. H. Biju-Duval, C. Delhay, All speakers, Eyrolles, 2011.
6. C. Eberhardt, Practical work with PowerPoint. Creating and laying out slides, Dunod, 2014.
7. F. Cartier, Written and oral communication, Edition GEP- Groupe Eyrolles, 2012.
8. L. Levasseur, 50 exercises for public speaking, 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**
**Teaching unit: UED1.2**
**Subject 1: Careers in Science and Technology 2**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

**Objective of the subject:**
To introduce the student, in a first step, to all the sectors covered by the Science and Technology Field and in a second step to a range of careers that these sectors lead to. In the same context, this subject introduces the student to the new challenges of sustainable development as well as the new careers that can result from it.

**Recommended prior knowledge**
None.

**Content of the subject:**
**1.Industrial Hygiene and Safety (IHS) sectorsand Gmining industry**: (2 weeks)
- Definitions andareas of application (Safety of property and people, Environmental issues, Exploration and exploitation of mineral resources, etc.)
-Role of the specialist in these areas.

**2. Climate Engineering and Transport Engineering courses: (2 weeks)**
- Definitions, areas of application (Air conditioning, Smart buildings,Safety in transport, traffic management and road, air, naval transport, etc.)
- Role of the specialist in these areas.

**3. Civil Engineering, Hydraulics and Public Works sectors: (2 weeks)**
- Definitions and areas of application (Construction materials, Major road and rail infrastructure, Bridges, Airports, Dams, Drinking water supply and sanitation, Hydraulic flows, Water resource management, Public works and land use planning, Smart cities, etc.)
- Role of the specialist in these areas.

**4. Aeronautics, Mechanical Engineering, Maritime Engineering and Metallurgy sectors: (2 weeks)**
- Definitions and areas of application (Aeronautics, Avionics, Automotive Industry, Ports, Seawalls,Production of industrial equipment,Steel industry,Metal processing,…)
- Role of the specialist in these areas.

**5. Approaches to sustainable production: (2 weeks)**
Industrial ecology, remanufacturing, ecodesign.

**6. Measure the sustainability of a process/product/service: (2 weeks)**
Environmental analysis, Life cycle analysis (LCA), Carbon footprint, case studies/applications.

**7. Sustainable Development and Business: (3 weeks)**
Definition of the company as an economic entity (notions of profit, costs, performance) and social entity (notion of corporate social responsibility), Impact of economic activities on the environment (examples), Challenges/benefits of sustainable development for the company, Means of engagement in a sustainable development approach (e.g. ISO 14001 certification, labeling (e.g. energy labeling, Ecolabel, Organic/AB Label, FSC Label, etc.), strategic sustainable development plan, Global Reporting Initiative (GRI)…), World rankings of the most sustainable companies (Dow Jones Sustainable Index,

Global 100, etc.), Company case studieshigh-performance/eco-responsible in the ST sectors (e.g. SIEMENS, Cisco, Henkel AG& Co, TOTAL, Peugeot, Eni SPA, etc.).

**Student's personal work for this subject:**

- Work in groups/pairs: Reading articles on sustainable development and/or reports from successful and sustainable companies and preparing summaries of the main actions undertaken in the field of sustainable development.

Examples of documents for reading and summarizing:

- Case of ONA and ENIEM: Kadri, Mouloud, 2009, Sustainable development, business and ISO 14001 certification, Market and organizations vol. 1 (No. 8), p. 201-215 (free online access:http://www.cairn.info/revue-marche-et-organisations-2009-1-page-201.htm)
- Mireille Chiroleu-Assouline. Sustainable development strategies for businesses. Ideas, The Review of Economic and Social Sciences, CNDP, 2006, pp. 32-39 (free online access:http://halshs.archives-ouvertes.fr/hal-00306217/document)
- Web page on environmental and societal commitments ofTOTAL:https://www.total.com/fr/engagement
- Innovationssustainable mobilityfrom the PSA group:http://www.rapportannuel.groupe-psa.com/rapport-2015/engagements/dessolutions-innovantes-pour-des-transports-durables/

**Assessment method:**

100% exam

**Bibliographic references:**

1- V. Maymo and G. Murat, The Sustainable Development and CSR Toolbox - 53 tools and methods, Edition: Dunod, 2017.
2- P. Jacquemot and V. Bedin, The encyclopedic dictionary of sustainable development, Edition: Sciences Humaines, 2017.
3- Y. Veyret, J. Jalta and M. Hagnerelle, Sustainable development: All the issues in 12 lessons, Edition: Autrement, 2010.
4- L. Grisel and Ph. Osset, Life Cycle Analysis of a Product or Service: Applications and Practical Implementation, 2nd Edition: AFNOR, 2008.
5- Sh. Shaked, N. Jolliet-Gavin, P. Crettaz, M. Saadé-Sbeih and O. Jolliet, Life Cycle Analysis: Understanding and Carrying Out an Eco-Assessment, 3rd Edition: PPUR, 2017.
6- G. Pitron and H. Védrine, The rare metal war: The hidden face of the energy and digital transition, Edition: Liens qui libèrent, 2018.
7- Environmental and sustainable development professions, Collection: Parcours, Edition: ONISEP, 2015.

**Semester: 2**
**Teaching unit: UET1.2**
**Subject 1: French language 2**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives:**
This subject aims to develop the following four skills: Oral comprehension, Written comprehension, Oral expression, Written expression through reading and studying texts.

**Recommended prior knowledge:**
Basic French.

**Content of the material:**
Below we offer a set of themes that cover fundamental sciences, technologies, economics, social issues, communication, sports, health, etc. The teacher can choose texts from this list to develop them during the course. Otherwise, they are free to address other themes of their 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 develop their linguistic skills: listening, comprehension, and oral and written expression. In addition, they must use this text to identify the grammatical structures they will develop during the same class session. Here, for illustration purposes, we recall a set of grammatical structures that can be developed as examples. Of course, it is not a question of developing them all or in the same way. Some can be recalled and others in great detail.

| Examples of themes | Grammatical structures |
|---|---|
| The pharmaceutical industry<br>The food industry<br>The National Employment Agency ANEM<br>Sustainable development<br>Renewable energies<br>Biotechnology<br>Stem cells<br>Road safety<br>The dams<br>Water – Water resources<br>Avionics<br>Automotive electronics<br>Electronic newspapers<br>Carbon 14 dating<br>Violence in stadiums<br>Drugs: a social scourge<br>Smoking<br>School failure<br>The Algerian War<br>Social networks<br>China, an economic power<br>Superconductivity<br>Cryptocurrency<br>Advertising | The subjunctive. The conditional. The imperative.<br>The past participle. The passive form.<br>Possessive adjectives, possessive pronouns.<br>Demonstratives, Demonstrative pronouns.<br>The expression of quantity (several, a few, enough, many, more, less, as much, etc.).<br>Numbers and measurements.<br>The pronouns "who, that, where, whose".<br>Subordinate preposition of time.<br>The cause, The consequence.<br>The goal, the opposition, the condition.<br>Comparatives, superlatives.<br>… |

| | |
|---|---|
| Autism | |

**Assessment method:**
Review: 100%.

**Bibliographic references**:


1. M. Badefort, Objective: International French Test, Edulang, 2006.
2. O. Bertrand, I. Schaffner, Passing the TCF, Exercises and training activities, Les éditions de l'école polytechnique, 2009.
3. M. Boulares, J.-L. Frerot, Progressive French Grammar with 400 exercises, Advanced Level, CLE International.
4. Collective, Besherelles: Grammar for all, Hatier.
5. Collective, Besherelles: Conjugation for all, Hatier.
6. Mr. Grégoire, Progressive French Grammar with 400 exercises, Beginner Level, CLE International, 1997.
7. A. Hasni et al., Training in teaching science and technology in secondary schools, Presses de l'université du Québec, 2006.
8. J.-L. Lebrun, Practical guide to scientific writing, EDP Sciences, 2007.
9. JM Robert, Difficulties of French, Hachette,
10. C. Tisset, Teaching French at school: Grammar, Spelling and Conjugation, Hachette Education, 2005.
11. J. Bossé-Andrieu, Summary of the Rules of Grammar and Spelling, Presses of the University of Quebec, 2001.
12. J.-P. Colin, French simply, Eyrolles, 2010.
13. Collective, French Assessment Test, Hachette, 2001.
14. Y. Delatour et al., Practical French Grammar in 80 cards with corrected exercises, Hachette, 2000.
15. Ch. Descotes et al., The Exerciser: French Expression for Intermediate Level, Presses Universitaires de Grenoble, 1993.
16. H. Jaraush, C. Tufts, Sur le Vif, HeinleCengage Learning, 2011.
17. J. Dubois et al., The Essentials – Spelling, Larousse, 2009.

**Semester: 2**
**Teaching unit: UET1.2**
**Subject 1: English Language 2**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**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 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 also contain a terminology which means the translation of some words from English to French one. , 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.<br>Chain Reaction.<br>Reactor Cooling System.<br>Conductor and Conductivity.<br>Induction Motors.<br>Electrolysis.<br>Liquid Flow and Metering.<br>Liquid Pumps.<br>Petroleum.<br>Road Foundations.<br>Rigid Pavements.<br>Piles for Foundations.<br>Suspension Bridges. | Explanation of Cause<br>Result<br>Conditions (if), Conditions (Restrictive)<br>Eventuality<br>Manner<br>When, Once, If, etc. + Past Participle<br>It is + Adjective + to<br>Ace<br>It is + Adjective or Verb + that…<br>Similarity, Difference<br>In Spite of, Although<br>Formation of Adjectives<br>Phrasal Verbs |

**Mode evaluation:**
Exam: 100%.

**References:**

1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office of University Publications, 1994.
2. AJ Herbert, The Structure of Technical English, Longman, 1972.
3. S. Berland-Delepine, Methodical Grammar of Modern English with Exercises, 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, English: 1000 Words and Expressions from the Press: Vocabulary and Expressions from the Economic, Social and Political World, Fernand Nathan, 2006.

**Semester: 3**
**Teaching unit: UEF 2.1.1**
**Subject 1:Mathematics 3**
**VHS: 67h30 (Lecture: 3h00, Tutorial: 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 conditions of convergence as well as the different types of convergence.

## Recommended prior knowledge

Mathematics 1 and Mathematics 2

## Content of the subject:

**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, etc.

**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 Review of ordinary differential equations. 3.2 Partial differential equations. 3.3 Special functions.

**Chapter 4: Series** **3 weeks**

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

**Chapter 5: Fourier Transform** **3 weeks**

5.1 Definition and properties. 5.2 Application to the resolution of differential equations.

**Chapter 6: Laplace Transform** **2 weeks**

6.1 Definition and properties. 6.2 Application to the resolution of differential equations.

## Assessment method:

Continuous assessment: 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, JM 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. Piskunov, 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- MR Spiegel, Laplace Transforms, Course and Problems, 450 Corrected Exercises, McGraw-Hill.

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

## Teaching objectives

Introduce the student to the phenomena of mechanical vibrations restricted to low amplitude oscillations for 1 or 2 degrees of freedom as well as to the study of the propagation of mechanical waves.

## Recommended prior knowledge

Mathematics 2, Physics 1 and Physics 2

## Content of the material:

***Preamble**: This subject is divided into two parts, the Waves part and the Vibrations part, which can be approached independently of each other. In this regard and due to 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 (Group A) streams. While for students in Groups B and C (Civil Engineering, Mechanical Engineering and Process Engineering), it is advisable to start with Vibrations. In any case, the teacher is called upon to do his best to cover both parts. We remind you that this subject is intended for engineering professions in the Science and Technology field. Also, the teacher is requested to skim over all parts of the course that require demonstrations or theoretical developments and to focus only on the applied aspects. Moreover, demonstrations can be the subject of an auxiliary work to be requested from students as activities within the framework of the student's personal work. For this purpose, consult paragraph "G-Student Assessment through Continuous Assessment and Personal Work" present in this training offer.*

**Part A: Vibrations**

**Chapter 1: Introduction to Lagrange's equations** **2 weeks**

1.1 Lagrange equations for a particle
1.1.1 Lagrange equations
1.1.2 Case of conservative systems
1.1.3 Case of velocity-dependent friction forces
1.1.4 Case of a time-dependent external force
1.2 Multi-degree-of-freedom system.

**Chapter 2: Free Oscillations of One-Degree-of-Freedom Systems** **2 weeks**

2.1 Undamped Oscillations
2.2 Free oscillations of damped systems

**Chapter 3: Forced Oscillations of One-Degree-of-Freedom Systems 1 week**

3.1 Differential equation
3.2 Mass-spring-damper system
3.3 Solution of the differential equation
3.3.1 Harmonic excitation
3.3.2 Periodic excitation
3.4 Mechanical impedance

**Chapter 4: Free oscillations of two-degree-of-freedom systems 1 week**

4.1 Introduction
4.2 Two-degree-of-freedom systems

**Chapter 5: Forced Oscillations of Two-Degree-of-Freedom Systems** **2 weeks**
5.1 Lagrange equations
5.2 Mass-spring-shock absorber system
5.3 Impedance
5.4 Applications
5.5 Generalization to systems with n degrees of freedom

**Part B: Waves**
**Chapter 1: One-dimensional propagation phenomena** **2 weeks**
1.1 Generalities and basic definitions
1.2 Propagation equation
1.3 Solution of the propagation equation
1.4 Progressive sinusoidal wave
1.5 Superposition of two progressive sinusoidal waves

**Chapter 2: Vibrating Strings** **2 weeks**
2.1 Wave equation
2.2 Harmonic Progressive 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 Progressive sinusoidal wave
3.4 Reflection-Transmission

**Chapter 4: Electromagnetic Waves** **2 weeks**
4.1 Wave equation
4.2 Reflection-Transmission
4.3 Different types of electromagnetic waves

## Assessment method:
Continuous assessment: 40%; Final exam: 60%.

## Bibliographic references:

1. H. Djelouah; Vibrations and Mechanical 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; Hermès 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.
7. H. Djelouah; Electromagnetism; Office of University Publications, 2011.

**Semester: 3**
**Teaching unit: UEF 2.1.2**
**Subject 1:Fundamental Electronics 1**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

Explain the calculation, analysis, and interpretation of electronic circuits. Understand the properties, electrical models, and characteristics of electronic components: diodes, bipolar transistors, and operational amplifiers.

## Recommended prior knowledge

Concepts of materials physics and fundamental electricity.

## Content of the subject:

*The number of weeks displayed is for informational purposes only. It is clear that the course leader is not required to strictly adhere to this dimension or the arrangement of the chapters.*

**Chapter 1. Continuous Regime and Fundamental Theorems 3 weeks**

Definitions (dipole, branch, node, mesh), voltage and current generators (ideal, real), voltage-current relationships (R, L, C), voltage divider, current divider. Fundamental theorems: superposition, Thévenin, Norton, Millmann, Kennelly, Equivalence between Thévenin and Norton, Maximum power transfer theorem.

**Chapter 2. Passive Quadrupoles 3 weeks**

Representation of a passive network by a quadrupole. Quantities characterizing the behavior of a quadrupole in an assembly (input and output impedance, voltage and current gain), application to adaptation. Passive filters (low-pass, high-pass, etc.), Gain curve, Phase curve, Cutoff frequency, Bandwidth.

**Chapter 3. Diodes 3 weeks**

Basic reminders on semiconductor physics: Definition of a semiconductor, Crystalline Si, Doping concepts, N and P semiconductors, PN junction, Construction and operation of a diode, direct and reverse polarizations, Current-voltage characteristic, static and variable regime, Equivalent diagram. Applications of diodes: Single and double alternation rectification. Voltage stabilization by Zener diode. Clipping, Other types of diodes: Varicap, LED, Photodiode.

**Chapter 4. Bipolar Transistors 3 weeks**

Bipolar transistors: Transistor effect, operating modes (blocking, saturation, etc.), Static characteristics network, Polarizations, Load line, Quiescent point, etc. Study of the three fundamental assemblies: EC, BC, CC, Equivalent diagram, Voltage gain, Decibel gain, Bandwidth, Current gain, Input and output impedances. Study of multi-stage BF amplifiers in static and dynamic regimes, link capacitors, decoupling capacitors. Other uses of the transistor: Darlington assembly, switching transistor, etc.

**Chapter 5- Operational amplifiers: 3 weeks**

Principle, Equivalent diagram, Ideal op-amp, Feedback, Op-amp characteristics,Basic Operational Amplifier Assemblies: Inverting, Non-Inverting, Adder, Subtractor, Comparator, Follower, Differentiator, Integrator, Logarithmic, Exponential, etc.

## Assessment method:

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

**Bibliographic references:**


1. A. Malvino, Principle of Electronics, 6th Edition Dunod, 2002.
2. T. Floyd, Electronic Components and Application Systems, 5th Edition, Dunod, 2000.
3. F. Milsant, Electronics Course (and Problems), Volumes 1 to 5, Eyrolles.
4. M. Kaufman, Electronics: Components, Volume 1, McGraw-Hill, 1982.
5. P. Horowitz, Treatise on Analog and Digital Electronics, Volumes 1 and 2, Publitronic-Elektor, 1996.
6. M. Ouhrouche, Electrical Circuits, International Polytechnic Press, 2009.
7. Neffati, General Electricity, Dunod, 2004
8. D. Dixneuf, Principles of electrical circuits, Dunod, 2007
9. Y. Hamada, Electronic Circuits, OPU, 1993.
10. I. Jelinski, All Electronics in Exercises, Vuibert, 2000.

**Semester: 3**
**Teaching unit: UEF 2.1.2**
**Subject 2:Fundamental Electrical Engineering 1**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

Know the basic principles of electrical engineering. Understand the operating principle of transformers and electrical machines.

## Recommended prior knowledge:

Basic concepts of electricity.

## Content of the material:

**Chapter 1. Mathematical reminders on complex numbers (CN) (1Week)**
Cartesian form, conjugate NCs, Module, Arithmetic operations on NCs (addition, etc.), Geometric representation, Trigonometric form, Moivre formula, root of NCs, Representation by an exponential of an NC, Trigonometric application of Euler's formulas, Application to electricity of NCs.

**Chapter 2. Reminders on the fundamental laws of electricity (2 weeks)**
Continuous regime: electric dipole, association of R, C, L dipoles.
Harmonic regime: representation of sinusoidal quantities, average and effective values, Fresnel representation, complex notation, impedances, powers in sinusoidal regime (instantaneous, active, apparent, reactive), Boucherot's Theorem.
Transient regime: RL circuit, RC circuit, RLC circuit, charging and discharging of a capacitor.

**Chapter 3. Electrical Circuits and Powers (3 weeks)**
Single-phase circuits and electrical power. Three-phase systems: Balanced and unbalanced (symmetrical components) and electrical power.

**Chapter 4. Magnetic Circuits (3 weeks)**
Magnetic circuits in sinusoidal alternating current. Self and mutual inductance. Electrical-magnetic analogy.

**Chapter 5. Transformers (3 weeks)**
Ideal single-phase transformer. Real single-phase transformer. Other transformers (isolation, pulse, autotransformer, three-phase transformers).

**Chapter 6. Introduction to Electrical Machines (3 weeks)**
General information on electrical machines. Operating principle of the generator and the motor. Power balance and efficiency.

## Assessment method:

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

## Bibliographic references:

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

1. JP Perez, Electromagnetism Foundations and Applications, 3rd Edition, 1997.
2. A. Searched,Electrical Engineering for Engineers, 10th edition, Dunod, 1980.
3. C. François, Electrical Engineering, Ellipses, 2004
4. L. Lasne, Electrotechnics, Dunod, 2008

5. J. Edminister, Theory and Applications of Electric Circuits, McGraw Hill, 1972
6. D. Hong, Electrical Circuits and Measurements, Dunod, 2009
7. M. Kostenko, Electrical Machines - Volume 1, Volume 2, MIR Editions, Moscow, 1979.
8. M. Jufer, Electromechanics, Polytechnic and University Presses of Romandie - Lausanne, 2004.
9. A. Fitzgerald, Electric Machinery, McGraw-Hill Higher Education, 2003.
10. J. Lesenne, Introduction to Advanced Electrical Engineering. Technique and Documentation, 1981.
11. P. Maye, Industrial electric motors, Dunod, 2005.
12. S. Nassar, Electrical Circuits, Maxi Schaum.

**Semester: 3**
**Teaching unit: UEM2.1**
**Subject 1:Probability and statistics**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Subject objectives

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

## Recommended prior knowledge

Mathematics 1 and Mathematics 2

## Content of the material:

**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: Single-variable statistical series** **(3 weeks)**

A.2.1 Number, Frequency, Percentage.
A.2.2 Cumulative workforce, Cumulative frequency.
A.2.3 Graphical representations: bar chart, pie chart, stick chart. Polygon of frequencies (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: Two-variable statistical series** **(3 weeks)**

A.3.1 Data tables (contingency table). Scatter plot.
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.1.1Arrangements
B.1.2Combinations
B.1.3Permutations.

**Chapter 2: Introduction to Probability** **(2 weeks)**

B.2.1Algebra of events
B.2.2Definitions
B.2.3Probability spaces
B.2.4General probability theorems

**Chapter 3: Conditioning and Independence** **(1 week)**

B.3.1Packaging,
B.3.2Independence,
B.3.3Bayes' formula.

**Chapter 4: Random Variables** **(1 Week)**
B.4.1Definitions and properties,
B.4.2Distribution function,
B.4.3Mathematical expectation,
B.4.4Covariance and moments.

**Chapter 5: Common Discrete and Continuous Probability Laws** **(3Weeks)**
Bernoulli, binomial, Poisson, ...; Uniform, normal, exponential, ...

## Assessment method:
Continuous assessment: 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 probability calculus and statistics. ENSTA handout, 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. Course in mathematical statistics. Economica, 1988.
7. A. Montfort. Introduction to Statistics. Ecole Polytechnique, 1991

**Semester: 3**
**Teaching unit: UEM2.1**
**Subject 2:Computer Science 3**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Subject objectives:

Teach the student programming using easy-to-access software (mainly: Matlab, Scilab, Mapple, etc.). This subject will be a tool for carrying out practical work on numerical methods in S4.

## Recommended prior knowledge:

The basics of programming acquired in computer science 1 and 2.

## Content of the material:

**TP 1: Presentation of a scientific programming environment (1 Week)**

**(Matlab, Scilab, etc.)**

**TP 2: Script files and Data and variable types (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 switch instructions)(2 Weeks)**

**TP 6: Function files (2 Weeks)**

**TP 7: Graphics (Management of graphics windows, plot) (2 Weeks)**

**TP 8: Using toolbox (2 Weeks)**

## Assessment method:

Continuous assessment: 100%.

## Bibliographic references:


1. Jean-Pierre Grenier,Getting started in algorithms with MATLAB and SCILAB,Eellipses,2007.
2. Laurent Berger, Scilab from theory to practice, 2014.
3. Bégyn Arnaud, Gras Hervé, Grenier Jean-Pierre, Programming and simulation in Scilab, 2014.
4. Thierry Audibert,Amar Oussalah,Maurice Nivat, Computer science: Programming and scientific calculation in Python and Scilab, 1st and 2nd year scientific preparatory classes, Ellipses, 2010.

**Semester: 3**
**Teaching unit: UEM 2.1**
**Subject 3:Electronics and Electrical Engineering Practical Work**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

Consolidation of knowledge acquired in fundamental electronics and electrical engineering subjects to better understand and assimilate the fundamental laws of electronics and electrical engineering.

## Recommended prior knowledge

Fundamental electronics. Fundamental electrical engineering.

## Content of the subject:

The practical work teacher is required to complete at least 3 practical work in Electronics and 3 practical work in Electrical Engineering from the list of practical work proposed below:

**Electronics 1 Practical Work**
**TP 1:**Fundamental theorems
**TP 2:**Characteristics of passive filters
**TP 3:**Diode / Rectifier Characteristics
**TP 4:**Stabilized power supply with Zener diode
**TP 5:**Characteristics of a transistor and operating point
**TP 6:**Operational amplifiers.

**Electrical Engineering Practical Work 1**
**TP 1:**Single-phase voltage and current measurement
**TP 2:**Measurement of three-phase voltages and currents
**TP 3:**Three-phase active and reactive power measurement
**TP 4:**Magnetic circuits (hysteresis loop)
**TP 5:**Transformer Tests
**TP 6:**Electrical machines (demonstration).

## Assessment method:

Continuous assessment: 100%

## Bibliographic references:

**Semester: 3**
**Teaching unit: UEM 2.1**
**Subject 4:TP Waves and vibrations**
**VHS: 3:00 p.m. (TP: 1:00)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives**

The objectives assigned by this program focus on introducing students to putting 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.

**Recommended prior knowledge**

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

**Content of the material:**

**TP1:**Mass – spring
**TP2:**Simple pendulum
**TP3:**Torsion pendulum
**TP4:**Oscillating electric circuit in free and forced mode
**TP5:**Coupled pendulums
**TP6:**Transverse oscillations in vibrating strings
**TP7:**Grooved pulley according to Hoffmann
**TP8:**Electromechanical systems (The electrodynamic loudspeaker)
**TP9:**Pohl's pendulum
**TP10:**Propagation of longitudinal waves in a fluid.

**Noticed**: It is recommended to choose at least 5 TP from the 10 offered.

**Assessment method:**

Continuous assessment: 100%.

**Bibliographic references:**

**Semester: 3**
**Teaching unit: UED 2.1**
**Subject 1:State of the art of electrical engineering**
**VHS: 10:30 p.m. (Course: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives**
To give the student a general overview of the different existing fields in Electrical Engineering while highlighting the impact of electricity in improving human daily life.

**Recommended prior knowledge**
None

**Content of the material:**

**1- The Electrical Engineering family**: Electronics, Electrotechnics, Automation, Telecommunications, etc.

**2- Impact of Electrical Engineering on the development of society**: Advances in Microelectronics, Automation and Supervision, Robotics, Development of Telecommunications, Instrumentation in Health Development, etc.

**Assessment method:**Final exam: 100%.

**Bibliographic references:**
(Depending on the availability of documentation at the establishment level, websites, etc.)

**Semester: 3**
**Teaching unit: UED 2.1**
**Subject 2:Energy and environment**
**VHS: 10:30 p.m. (Course: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

To introduce the student to the different existing energies, their sources and the impact of their uses on the environment.

## Recommended prior knowledge:

Concepts of energy and environment.

## Content of the material:

**Chapter 1:**The different energy resources

**Chapter 2:**Energy storage

**Chapter 3:**Consumption, reserves and developmentsresourcesof energy

**Chapter 4:**The different types of pollution

**Chapter 5:**Detection and treatmentof thepollutants and waste

**Chapter 6:**Impact of pollution on health and the environment.

## Assessment method:

Final exam: 100%.

## Bibliographic references:

1. Jenkins et al., Electrotechnics of renewable energies and cogeneration, Dunod, 2008
2. Pinard, Renewable energies for electricity production, Dunod, 2009
3. Crastan, Power plants and alternative electricity production, Lavoisier, 2009
4. Labouret and Villoz, Photovoltaic solar energy, 4th ed., Dunod, 2009-10.

**Semester: 3**
**Teaching unit: UET 2.1**
**Subject 1:Technical English**
**VHS: 10:30 p.m. (Course: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

This course should enable the student to acquire a sufficiently significant level of language to enable him to use a scientific document and speak about his specialty and his field in English, at least, with a certain ease and clarity.

## Recommended prior knowledge:

English 1 and English 2

## Content of the subject:

- Oral comprehension and oral expression, vocabulary acquisition, grammar, etc.

-Nouns and adjectives, comparatives, following and giving instructions, identifying things.

-Use of numbers, symbols, equations.

- Measurements: Length, surface, volume, power, etc.

- Describe scientific experiments.

- Ccharacteristics of scientific texts.

## Assessment method:

Final exam: 100%.

## Bibliographic references:


1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office of University Publications, 1994.
2. AJ Herbert, The Structure of Technical English, Longman, 1972.
3. Test of English as a Foreign Language – Preparation Guide, Cliffs, 1991.
4. Cambridge – First Certificate in English, Cambridge books, 2008.
5. K. Wilson, Th. Healy, First Choice, Oxford, 2007.
6. M. Mann, S. Tayore-Knowles, Destination: Grammar & Vocabulary with Answer Key, MacMillan, 2006.
7. P. Charles Brown, Norma D. Mullen, English for Computer Science, Oxford University Press, 1989.
8. Graeme Kennedy, Structure and Meaning in English: A Guide for Teachers, Pearson, 2004.
9. Anne M. Hanson, Brain-Friendly Strategies for Developing Student Writing Skills, 2nd Edition, Corwin Press, 2008.
10. Ann Bridges, How to Pass Higher English, Hodder Gibson-Hachette, 2009.

**Semester: 4**
**Teaching unit:UEF 2.2.1**
**Matter:Fundamental Telecommunications**
**VHS: 67h30 (Lecture: 3h00, Tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives:

The course aims to provide a global overview of the basic principles of analog and digital telecommunications systems and to deduce the minimum characteristics.

## Recommended prior knowledge:

Mathematics 3,Waves and vibrations, Fundamental electronics 1

## Content of the material:

**Chapter 1. General Information on Telecommunications (3 Weeks)**
History and evolution of telecommunications, Services offered by telecommunications, Telecommunications norms and standards

**Chapter 2. Communication Systems (4 Weeks)**
Telecommunications Sources and Signals, Basic Diagram and Principles of a Communication System, Transmission Media (Transmission Lines: Two-Wire Line, Coaxial Cable, Printed Line, Waveguides, Optical Fibers, Free Space)

**Chapter 3. Analog Transmission Techniques** (4 Weeks)
Mathematical reminders: Signal classes, Examples of elementary signals, Principle of analog transmission, Filtering, Amplification, Modulation, Mixing.

**Chapter 4. Digital Transmission Techniques (4 Weeks)**
Principle of digital transmission, Sampling, Quantization, Coding, Transmission channel.

## Assessment method:

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

## Bibliographic references:

1. D. Battu, Introduction to Telecoms: Technologies and Applications, Dunod, Paris, 2002.
2. P. Clerc, P. Xavier, Fundamental Principles of Telecommunications, Ellipses, Paris, 1998.
3. G. Barué, Telecommunications and Infrastructure, Ellipses, 2002.
4. E. Altman, A. Ferreira and J. Galtier, Satellite Telecommunications Networks: Technology and Services, Dunod, Paris, 1999.
5. PG Fontolliet, Telecommunications Systems, Treatise on Electricity, Vol. XVIII, PPUR, Lausanne, 1999 (Chapters 12 & 13).
6. C. Servin, Networks & Telecoms, 2nd ed., Dunod, Paris, 2006.
7. G. Baudoin, Digital Radiocommunications T1: Principles, Modeling and Simulation, Dunod, Paris, 2007

**Semester: 4**
**Teaching unit: UEF 2.2.1**
**Subject 2:Combinatorial and sequential logic**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

Understand common combinational circuits. Understand how to design some applications of combinational circuits using standard tools such as truth tables and Karnaugh tables. Understand sequential circuits through flip-flop circuits, counters, and registers.

## Recommended prior knowledge

None.

## Content of the subject:

*The number of weeks displayed is for informational purposes only. It is clear that the course leader is not required to strictly adhere to this dimension or the arrangement of the chapters.*

**Chapter 1: Boolean Algebra and Simplification of Logical Functions 2 weeks**
Logical variables and functions (OR, AND, NOR, NAND, XOR). Laws of Boolean algebra. De Morgan's theorem. Complete and incomplete logical functions. Representation of logical functions: truth tables, Karnaugh tables. Simplification of logical functions: Algebraic method, Karnaugh method.

**Chapter 2: Number Systems and Information Coding 2 weeks**
Representation of a number by codes (binary, hexadecimal, DCB, signed and unsigned binary, etc.), base change or conversion, unweighted codes (Gray code, error detection and correction codes, ASCII code, etc.), arithmetic operations in binary code.

**Chapter 3: Combinational Transcoder Circuits 2 weeks**
Definitions, Decoders, Priority Encoders, Transcoders, Cascading, Applications, Analysis of a Decoder IC Datasheet, List of Decoder ICs.

**Chapter 4: Combinational Switch Circuits 2 weeks**
Definitions, multiplexers, demultiplexers, Cascading, Applications, Analysis of the technical data sheet of a switching integrated circuit, List of integrated circuits.

**Chapter 5: Combinational Comparison Circuits 2 weeks**
Definitions, 1-bit, 2-bit and 4-bit comparator circuit, Cascading, Applications, Datasheet analysis of a comparator IC, List of integrated circuits.

**Chapter 6: The Seesaws 2 weeks**
Introduction to sequential circuits. The RS flip-flop, the RST flip-flop, the D flip-flop, the master-slave flip-flop, the T flip-flop, the JK flip-flop. Examples of flip-flop applications: Frequency divider by n, Pulse train generator, etc.
It is advisable to present for each flip-flop the truth table, examples of timing diagrams as well as the limits and imperfections.

**Chapter 7: Counters 2 weeks**
Definition, Classification of counters (synchronous, regular, irregular, asynchronous, complete and incomplete cycles). Realization of complete and incomplete synchronous binary counters, Excitation tables of JK, D and RS flip-flops, Realization of asynchronous binary counters modulo (n): complete, incomplete, regular and irregular. Programmable counters (start from any state).

**Chapter 8. The Registers** **1 Week**

Introduction, classic registers, shift registers, loading and retrieving data in a register (PIPO, PISO, SIPO, SISO), shifting data in a register, a general-purpose register, the 74LS194A, available integrated circuits, Applications: classic registers, special counters, queues.

## Assessment method:

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

## Bibliographic references:

1- J. Letocha, Introduction to Logic Circuits, McGraw Hill Edition.
2- JC Lafont, Course and problems in digital electronics, 124 exercises with solutions, Ellipses.
3- R. Delsol, Digital Electronics, Volumes 1 and 2, Edition Berti
4- P. Cabanis, Digital Electronics, Dunod Edition.
5- M. Gindre, Combinatorial Logic, Edition Ediscience.
6- H. Curry, Combinatory Logic II. North Holland, 1972
7- R. Katz, Contemporary Logic Design, 2nd ed. Prentice Hall, 2005.
8- M. Gindre, Digital Electronics: Combinational Logic and Technology, McGraw Hill, 1987
9- C. Brie, Combinatorial and Sequential Logic, Ellipses, 2002.
10-JP. Ginisti, Combinatorial Logic, Paris, PUF (coll. “What do I know?” n°3205), 1997.
11- JL. Krivine, Lambda-calculus, types and models, Masson, 1990, chap. Combinatorial logic, English translation available on the author's website.

**Semester: 4**
**Teaching unit: UEF 2.2.2**
**Subject 1:Numerical methods**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

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

## Recommended prior knowledge:

Mathematics 1, Mathematics 2, Computer Science 1 and Computer Science 2.

## Content of the material:

**Chapter 1.Solving nonlinear equations f(x)=0** (3 Weeks)
1. Introduction to calculation errors and approximations, 2. Introduction to methods for solving nonlinear equations, 3. Bisection method, 4. Method of successive approximations (fixed point), 5. Newton-Raphson method.

**Chapter 2.Polynomial interpolation** **(2 weeks)**
1. General introduction, 2. Lagrange polynomial, 3. Newton polynomials.

**Chapter 3.Function approximation:** **(2 Weeks)**
1. Approximation method and quadratic mean. 2. Orthogonal or pseudo-Orthogonal systems. Approximation by orthogonal polynomials, 3. Trigonometric approximation.

**Chapter 4.Digital integration** (2 Weeks)
1. General introduction, 2. Trapezoid method, 3. Simpson's method, 4. Quadrature formulas.

**Chapter 5.Solving ordinary differential equations**
**(Initial condition or Cauchy problem)** (2 Weeks)
1. General introduction, 2. Euler's method, 3. Improved Euler's method, 4. Runge-Kutta method.

**Chapter 6.Direct method of solving systems of linear equations (2 weeks)**
1. Introduction and definitions, 2. Gauss method and pivoting, 3. LU factorization method, 4. ChoeleskiMMt factorization method, 5. Thomas algorithm (TDMA) for diagonal sorting systems.

**Chapter 7.Method for approximate solution of systems of linear equations**
(2 Weeks)
1. Introduction and definitions, 2. Jacobi method, 3. Gauss-Seidel method, 4. Use of relaxation.

## Assessment method:

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

## Bibliographic references:

1. C. Brezinski, Introduction to the practice of numerical calculation, Dunod, Paris 1988.
2. G. Allaire and SM Kaber, Numerical Linear Algebra, Ellipses, 2002.
3. G. Allaire and SM 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, SP Norsett and G. Wanner, Solving Ordinary Differential Equations, Springer, 1993.
9. PG Ciarlet, Introduction to matrix numerical analysis and optimization,
Masson, Paris, 1982.

**Semester: 4**
**Teaching unit: UEF 2.2.2**
**Subject 2:Signal theory**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

Acquire basic notions of the mathematical tools used in signal processing.

## Recommended prior knowledge:

Basic math course.

## Content of the material:

**Chapter 1. General information on signals (3 Weeks)**

Objectives of signal processing. Areas of application. Classification of signals (morphological, spectral, etc.). Deterministic signals (periodic and non-periodic) and random signals (stationary and non-stationary). Causality. Concepts of power and energy. Basic functions in signal processing (measurement, filtering, smoothing, modulation, detection, etc.). Examples of basic signals (rectangular pulse, triangular pulse, ramp, step, sign, Dirac, etc.)

**Chapter 2. Fourier Analysis (4 Weeks)**

Introduction, Mathematical reminders (scalar product, Euclidean distance, linear combination, orthogonal basis, etc.). Approximation of signals by a linear combination of orthogonal functions. Fourier series, Fourier transform, Properties. Parseval's theorem. Fourier spectrum of periodic (discrete spectrum) and non-periodic (continuous spectrum) signals.

**Chapter 3. Laplace Transform (3 Weeks)**

Definition. Properties of the Laplace Transform. Signal/system relationship. Application to linear and translation-invariant systems or SLIT (Time and Frequency Analysis).

**Chapter 4. Convolution Product (2 weeks)**

Formulation of the convolution product, Properties of the convolution product, Convolution product and Dirac momentum.

**Chapter 5. Signal Correlation** (3 weeks)

Finite total energy signals. Finite total average power signals. Cross-correlation between signals, Autocorrelation, Properties of the correlation function. Energy spectral density and power spectral density. Wiener-Khintchine theorem. Case of periodic signals.

## Assessment method:

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

## Bibliographic references:

1. S. Haykin, “Signals and systems”, John Wiley & Sons, 2nd ed., 2003.
2. AV Oppenheim, “Signals and systems”, Prentice-Hall, 2004.
3. F. de Coulon, “Theory and processing of signals”, PPUR Edition.
4. F. Cottet, “Signal processing and data acquisition, Course and solved exercises”, Dunod.
5. B. Picinbono, “Signal and Systems Theory with Solved Problems”, Bordas Edition.
6. Mr. Benidir,“Theory and Signal Processing, Volume 1: Representation of Signals and Systems - Course and Corrected Exercises'', Dunod, 2004.
7. Mr. Benidir,“Theory and Signal Processing, Volume 2: Basic Methods for Signal Analysis and Processing - Course and Corrected Exercises'', Dunod, 2004.
8. J. Max, Signal Processing

**Semester: 4**
**Teaching unit: UEM 2.2**
**Subject 1:Electrical and electronic measurements**
**VHS: 37h30 (Course: 1h30, Practical work: 1h00)**
**Credits: 3**
**Coefficient: 2**

## Teaching objectives:

Introduce the student to the techniques of measuring electrical and electronic quantities. Familiarize them with the use of analog and digital measuring devices.

## Recommended prior knowledge

General Electricity, Fundamental Laws of Physics.

## Content of the subject:

*The number of weeks displayed is for informational purposes only. It is clear that the course leader is not required to strictly adhere to this dimension or the arrangement of the chapters.*

**Chapter 1. Measurements, quantities and uncertainties 5 weeks**

Introduction, Quantity, Standard, Unit systems, Table of multiples and submultiples, Dimensional equations, Useful formulas, Measurement accuracy, Measurement error, Classification of errors, Uncertainties in indirect measurements, Qualities of measuring devices, Calibration of measuring devices, Graphic symbols of measuring devices, General measurement methods (Deviation, zero, resonance methods), Application exercises.

**Chapter 2. Measurement Methods 6 weeks**

**1. Voltage measurements:**Direct methods of voltage measurements, AC voltage measurements, Indirect method of voltage measurements by the opposition method.
**2. Current measurement:**Direct method of measuring currents, Using the simple Shunt.
**3. Resistance measurements:**Classification of resistances, Voltammetric method, Zero method: The Wheatstone Bridge, Measurement of very large resistances by the charge loss method.
**4. Impedance measurements:**Capacitance measurements, Inductance measurements, AC bridges.
**5. Continuous Power Measurements: Fundamental Relationship, Ammeter and Voltmeter Method, Continuous Electrodynamic Wattmeter.**
**6. AC Power Measurements: Instantaneous and average power, Complex power, apparent power, active power and reactive power, Electrodynamic AC Wattmeter, 3 voltmeter method for active power, Direct reactive power measurement method, Indirect reactive power measurement method**
**7. Phase shift measurements: Direct measurement of phase shifts using an oscilloscope, Measurement of phase shifts using Lissajous figures.**
**8. Frequency and period measurements: Direct frequency measurement with an oscilloscope, Frequency measurement with Lissajous figures, Frequency measurement using the frequency meter method, Frequency measurement using the period meter method, Application exercises.**

**Chapter 3. Measuring Devices 4 weeks**

Introduction
**Analog measuring devices**: Classification of deflection devices, The moving coil galvanometer, Structure of the magnetoelectric ammeter, Structure of the magnetoelectric voltmeter, Operation of the electrodynamic wattmeter in alternating current
**Digital measuring devices:**Analog to digital converters (ADCs), How a digital measuring device works, Examples of digital measuring devices (The multimeter, the oscilloscope, etc.).
**Electrical and electronic measurements:**

**TP No. 1: Resistance measurement:**

Measure resistance using the following 5 methods: voltammetric, ohmmeter, Wheatstone bridge, comparison and substitution.
Compare these methods with each other and establish an error calculation.

**TP No. 2: Inductance measurement:**

Carry out the measurement of inductances using the following 3 methods: voltammetric, Maxwell bridge, resonance.
Compare these methods with each other and establish an error calculation.

**TP No. 3: Capacity measurement:**

Carry out the measurement of capacities using the following 3 methods: voltammetric, Sauty bridge, resonance.
Compare these methods with each other and establish an error calculation.

**TP No. 4: Phase shift measurement:**

Carry out resistance measurements using the following 2 methods: Phase meter and oscilloscope.

**TP No. 5: Single-phase power measurement:**

Measure the resistance using the following 5 methods: wattmeter, Cosϕmeter, three voltmeters, three ammeters, power sensor.
Compare these methods with each other and establish an error calculation.

**TP No. 6: Three-phase power measurement:**

Carry out resistance measurements using the following methods: Star system and delta system, balanced and unbalanced.

## Assessment method:

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

## Bibliographic references:

1- M. Cerr, Industrial Instrumentation: T.1, Tec and Doc Edition.
2- M. Cerr, Industrial Instrumentation: T.2, Tec and Doc Edition.
3- P. Oguic, Measurements and PC, ETSF Edition.
4- D. Hong, Electrical Circuits and Measurements, Dunod, 2009.
5- W. Bolton, Electrical and Electronic Measurement and Testing, 1992.
6- A. Fabre, Electrical and electronic measurements, OPU, 1996.
7- G. Asch, Sensors in industrial instrumentation, Dunod edition, 2010.
8- L. Thompson, Electrical Measurements and Calibration: Fundamentals and Applications, Instrument Society of America, 1994.
9- JP Bentley, Principles of Measurement Systems, Pearson Education, 2005.
10- J. Niard, Electrical measurements, Nathan, 1981.
11- P. Beauvilain, Electrical and Electronic Measurements.
12-M. Abati, Applied electronic measurements, Delagrave Techniques and Standardization Collection.
13- P. Jacobs, Electrical Measurements, Dunod Edition.
14-A. Leconte, Measurements in electrotechnics (Document D 1 501), Engineering techniques.

**SourcesInternet:**

- http://sitelec.free.fr/cours2htm
- http://perso.orange.fr/xcotton/electron/coursetdocs.ht
- http://eunomie.u-bourgogne.fr/elearning/physique.html
- http://www.technique-ingenieur.fr/dossier/appareilsdemesure

**Semester: 4**
**Teaching unit: UEM 2.2**
**Subject 2:TPFundamental Telecommunications**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

**Teaching objectives**:
Consolidate the knowledge acquired during the subjects of fundamental electronics 1 and fundamental telecommunications through practical work sessions, to better understand and assimilate thedifferent types of Modulation, Demodulation and converters.

**Recommended prior knowledge:**
Fundamental telecommunications

**Content of the material:**

**TP No. 1:**Study of basic circuits for rectification and filtering

**TP No. 2:**Principles of AM Amplitude Modulation and Demodulation

**TP No. 3:**Principles of FM Frequency Modulation and Demodulation

**TP No. 4:**Principles of PM Phase Demodulation Modulation

**TP No. 5:**Analog-to-digital and digital-to-analog converters

**Assessment method:**
Continuous assessment: 100%.

**Bibliographic references:**
1. D. Battu, Introduction to Telecoms: Technologies and Applications, Dunod, Paris, 2002.
2. P. Clerc, P. Xavier, Fundamental Principles of Telecommunications, Ellipses, Paris, 1998.
3. G. Barué, Telecommunications and Infrastructure, Ellipses, 2002.
4. E. Altman, A. Ferreira and J. Galtier, Satellite Telecommunications Networks:
5. Technology and Services, Dunod, Paris, 1999.
6. PG Fontolliet, Telecommunications Systems, Treatise on Electricity, Vol. XVIII,
7. PPUR, Lausanne, 1999 (Chapters 12 & 13).
8. C. Servin, Networks & Telecoms, 2nd ed., Dunod, Paris, 2006.
9. G. Baudoin, Digital Radiocommunications T1: Principles, Modeling and Simulation, Dunod, Paris, 2007

**Semester: 4**
**Teaching unit: UEM 2.2**
**Subject 3:Practical work on combinatorial and sequential logic**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

Consolidate the knowledge acquired during the subject course.Combinatorial and Sequential Logic" through practical work to better understand and assimilate the content of this subject.

## Recommended prior knowledge

Combinatorial and Sequential Logic.

## Content of the subject:

*The teacher chooses from this list of practical work between 4 and 6 practical work to carry out and covering the two types of logic circuits (combinatory and sequential).*

**TP1: TTL and CMOS integrated circuit technology.**
Understand and test the different logic gates

**TP2: Simplification of logical equations through practice**
Discover the rules for simplifying equations in Boolean algebra through practice

**TP3: Study and implementation of common combinatorial logic functions**
Example: switching circuits (MUX, DMUX), coding and decoding circuits, etc.

**TP4: Study and creation of an arithmetic combinational circuit**
Creation of an adder and/or subtractor circuit for 2 4-bit binary numbers.

**TP5: Study and creation of a combinational logic circuit**
Implementing a logic function using logic gates. For example, a 7-segment display and/or a 2's complement generator for a 4-bit number and/or a 4-bit Gray code generator, etc.

**TP6: Study and creation of a combinational logic circuit**
Complete study (Truth table, Simplification, Logic diagram, Practical assembly and Tests) of a combinational circuit based on specifications.

**TP7: Study and creation of meter circuits**
Incomplete asynchronous counter circuits using flip-flops, Irregular cycle synchronous counter circuits using flip-flops

**TP8: Study and creation of registers**

## Assessment method:

Continuous assessment: 100%

## Bibliographic references:

1. J. Letocha, Introduction to Logic Circuits, Mc-Graw Hill Edition.
2. JC Lafont, Course and problems in digital electronics, 124 exercises with solutions, Edition Ellipses.

**Semester: 4**
**Teaching unit: UEM 2.2**

**Subject 4:Numerical Methods Practical Work**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

Programming of different numerical methods with a view to their applications in the field of mathematical calculations using a scientific programming language (Matlab, Scilab, etc.).

## Recommended prior knowledge

Numerical Method, Computer Science 2 and Computer Science 3.

## Content of the subject:

**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 interpolation, 2. Chebyshev approximation

**Chapter 3:Digital integrations** **3 weeks**

1. Rectangle Method, 2. Trapezoid Method, 3. Simpson Method

**Chapter 4:Differential equations** **2 weeks**

1. Euler's 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 assessment: 100%.

## Bibliographic references:


1. Jose Ouin, Algorithms and numerical calculation: Solved practical work and programming with Scilab and Python software,Ellipses, 2013.
2. Bouchaib Radi,Abdelkhalak El Hami, Mathematics with Scilab: guide to calculation, programming, graphic representations; conforms to the new MPSI program, Ellipses, 2015.
3. Jean-Philippe Grivet, Applied numerical methods: for scientists and engineers,EDP sciences, 2009.

**Semester: 4**
**Teaching unit: UED 2.2**
**Subject: Telecommunications and Applications**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives**:
This courseaims to paint a picture of themain concepts and applications encountered in telecommunications

**Recommended prior knowledge: (***brief description of the knowledge required to follow this course – Maximum 2 lines).*

**Content of the subject:**

**Chapter 1: Introduction to Telecommunications Applications (3Weeks)**
Electromagnetic spectrum and telecommunications, Classification of telecommunications systems,The telecommunications market: current status and future trends.

**Chapter 2: Introduction to Telephony (4 Weeks)**
Basics of telephony, Introduction to the public switched telephone network (PSTN), Introduction to the mobile (cellular) telephone network.

**Chapter 3: Introduction to Radio and Television Broadcasting (4 Weeks)**
Broadcasting, Terrestrial and Cable Television Networks, Satellite Television.

**Chapter 4: Other applications of telecommunications (4 Weeks)**
Principle of radar, Wireless communication networks, Computer networks.

**Assessment method:**
Final exam: 100%.

**Bibliographic references:**

1. D. Battu, Introduction to Telecoms: Technologies and Applications, Dunod, Paris, 2002.
2. P. Clerc, P. Xavier, Fundamental Principles of Telecommunications, Ellipses, Paris, 1998.
3. G. Barué, Telecommunications and Infrastructure, Ellipses, 2002.

**Semester: 4**
**Teaching unit: UED 3.1**
**Subject 2:Telecommunications Law**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives**:
Telecommunications law thus constitutes one of the basic elements of the legal regime governing information technology. This course presents the foundations and essential aspects of the regulation of telecommunications networks and services. It examines, in particular, the rules that aim to ensure the proper functioning of the telecommunications market.

**Recommended prior knowledge:**
None

**Content of the subject:**

1. Introduction: Evolution of information and communication technologies and the law relating thereto.
2. International Telecommunications Organizations.
   - International Telecommunication Union (ITU)
3. International Telecommunications Regulations and Standards.
4. Legal framework for telecommunications in Algeria.
   - Historical
   - Main areas of telecommunications supervision.

Study of Algerian laws governing telecommunications by the supervisory ministry (MPTIC). Official Journal of the People's Democratic Republic of Algeria, No. 48.

**Assessment method:**
Final exam: 100%.

**Bibliographic references:**
1. MPTIC
2. ARPT
3. ITU

**Teaching unit: UET2.2**
**Matter :Techniques of expression, information and communication**
**VHS: 10:30 p.m. (Course: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

This course aims to develop the student's skills, both personal and professional, in the field of communication and expression techniques. It also allows the student to learn the techniques, tools, and methods used to facilitate communication.

## Recommended prior knowledge:

Languages (Arabic; French; English)

## Content of the material:

**Chapter 1:Research, analyze and organize information (2 weeks)**
Identify and use locations, tools and documentary resources, Understand and analyze documents, Create and update documentation.

**Chapter 2:Improve the ability to express oneself (2 weeks)**
Take into account the communication situation, Produce a written message, Communicate orally, Produce a visual and audiovisual message, Improve group communication skills.

**Chapter 3:Develop autonomy, organizational and communication skills within the framework of a project approach (2 weeks)**
Position yourself in a project and communication approach, Anticipate action, Implement a project:Presentation of a report on a practical work (Homework).

**Chapter 4: ICT -Definition and Evolution (2 weeks)**
Definition, Activities using ICT, Mastery of ICT skills, Evolution of ICT,Information and Communication Services

**Chapter 5: Searching, Using, and Retrieving Information. (2weeks)**
Search directories (YAHOO, GOOGLE), Search engines, Query and search language, Retrieving and printing an HTML page, Retrieving an image, Downloading a file or software, Playing an HTML file locally, Playing a multimedia file saved on the Web.

**Chapter 6:ICT Rights (2 weeks)**
Computer crime, Media law, Electronic communications law, Electronic commerce law, Internet governance, etc.

**Chapter 7: Securing Sensitive Information, Protecting Confidential Data and Preventing Nuisances. (3 weeks)**
Backup of important data, "Informatique et Libertés" law, Dangers of the Internet, Computer hacking, Machine protection, Protection against viruses, Protection against cyber threats or online threats (Phishing, spam emails, spyware, malware, ransomware, viruses and trojan horses, man-in-the-middle attacks, etc.), Prevent data loss, Spam, Hoaxes, Cryptology, Electronic signature….

## Assessment method:

Final exam: 100%.

**Bibliographic references:**

(Books and handouts, websites, etc.)


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. 3- Matthieu Dubost, Improving your written and oral expression: all the keys, Edition Ellipses 2014.
4. Allegrezza Serge and Dubrocard Anne (edited by). Internet Econometrics. Palgrave Macmillan Ltd, 2011. ISBN-10: 0230362923; ISBN-13: 9780230362925
5. Anduiza Eva, Jensen J. Michael and Jorba Laja (edited by). Digital Media and Political Engagement Worldwide. Cambridge UniversityPress - MUA, 2012. ISBN-10: 1107668492; ISBN-13: 9781107668492
6. Baron GL, and Bruillard E. Computing and its users in education. Paris, PUF, 1996. ISBN-10: 2130474926; ISBN-13: 978-2130474920
7. OnlineChantepie P. and Le Diberder A. Digital revolution and cultural industries. Benchmarks. Paris, La Découverte, 2010. ISBN-10: 2707165050; ISBN-13: 978-2707165053
8. Dawn Medlin B. Integrations of Technology Utilization and Social Dynamics in Organizations. Information Science Reference (Isr), 2012. ISBN-10: 1-4666-1948-1; ISBN-13: 978-1-4666-1948-7
9. Devauchelle B. How digital technology is transforming places of knowledge. FYP Editions, 2012. ISBN-10: 2916571612; ISBN-13: 978-2916571614
10. GreenfieldDavid. "The Addictive Properties of Internet Usage." In Internet Addiction, 133?153. John Wiley & Sons, Inc., 2007. ISBN: 9780470551165.http://dx.doi.org/10.1002/9781118013991.ch8.
11. Kurihara Yutaka and [Al.]. Information technology and economic development. Information Science Reference (Isr), 2007. ISBN 10: 1599045818; ISBN 13: 9781599045818
12. Paquelin D. The appropriation of digital training devices. From prescription to use. Paris, L'Harmattan, 2009. ISBN-10: 2296085563; ISBN-13: 978-2296085565
13. Tansey Stephen D. Business, information technology and society. Routledge Ltd, 2002. ISBN-10: 0415192137; ISBN-13: 978-0415192132

**Teaching unit: UEF 3.1.1**
**Matter:Analog communications**
**VHS: 67h30 (Lecture: 3h00, Tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives:

Analog communication and the main functions of electronics are the basis of instrumentation and telecommunications systems, hence the objectives of this subject. Through this subject, the student will master the concepts of analog communication and telecommunications systems. He will then be able to understand the limitations as well as the advantages of such systems.

## Recommended prior knowledge:

Fundamental electronics 1, fundamental telecommunications, signal theory.

## Content of the material:

**Chapter 1. Radio Frequency Basics (1 Week)**
Analog transmission chains, Frequency bands, bandwidth, wavelength and power, The decibel scale.

**Chapter 2. Components of a transmission chain (3 Weeks)**
RLC, quartz, VCO and PLL oscillators; Superheterodyne receivers, amplifiers, filters, mixers.

**Chapter 3. Amplitude modulation and demodulation (2Weeks)**
General (Transmission Chain and Transmission Channel), Definition and necessity of modulation, Principle, Appearance of the modulated signal. Parameters (modulation index), Over-modulation, Different types of amplitude modulation (carrierless, single-sideband), Spectra and bandwidth, Power, Modulation rate, Demodulation by envelope detection, Synchronous or coherent demodulation, Demodulation and noise.

**Chapter 4. Angular modulations and demodulations and frequency and phase demodulation (2 Weeks)**
Principle and parameters of frequency modulation, Appearance of the FM modulated signal, Spectrum and Bessel functions, Bandwidth, FM demodulation (derivation and envelope detection), Analogy with phase or PM modulation, Relationship between frequency and phase modulation, Comparisons between angular modulations (FM and PM) and AM modulation (Bandwidth, Power and sensitivity to noise).

**Chapter 5. Performance of different modulations in the presence of noise (2 Weeks)**
Introduction, Additive Noise (AWGN) and Signal-to-Noise Ratio (SNR), Signal-to-Noise Ratio on Baseband Links, Signal-to-Noise Ratio in Amplitude Modulation, Signal-to-Noise Ratio in Frequency Modulation, Signal-to-Noise Ratio in Phase Modulation, Effects of Intermodulation (IM), Order of IM, Types and Measurement of Intermodulation, Reduction of Intermodulation.

**Chapter 6. Superheterodyne Receivers (3Weeks)**
Structure of a classic AM receiver, Mixer, superheterodyne, Intermediate frequency (IF) filters, Image frequency problem and solution with the input RF (Radio Frequency) amplifier, Automatic frequency control (AFC), Automatic gain control of the RF amplifier.

**Chapter 7. Phase-Locked Loop (PLL) (2Weeks)**
Operating principle, Loop gain, tracking range, Locking range, Dynamic operation of a 1st order and 2nd order loop, Applications: synchronization, Application to frequency modulation and demodulation, frequency synthesizers.

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

## Bibliographic references:


1. AP Malvino, “Principles of Electronics”, 6th edition, Sciences-Sup, Dunod.
2. P. Rochette, “Fundamentals of Electronics”, Technosup, Ellipses.
3. J. Millman, “Microelectronics”, Ediscience.
4. J. Encinas, “Phase-locked path (PLL): realizations and applications”.
5. P. Brémaud, “Signal and communications: Modulation, coding and information theory”, Ellipses.
6. HH Ouslimani, A. Ouslimani, “Main functions of electronics”, Casteilla, 2010.
7. JM Poitevin, “Electronics: Main Functions”, Dunod, 2003.
8. G. Baudoin, “Radiocommunication”, Dunod, 2007.
9. Y. Mori, “Electronics for Signal Processing”, vol. 4, Lavoisier, 2006.
10. F. Milsant, “Electronics Course”, volume 4, Eyrolles, 1994.
11. F. Biquard, “Amplitude modulation”, Technosup, Ellipses, 1998.
12. L. Vandendorpe, “Analog modulations”, Catholic University of Louvain, Belgium.
13. BP Lathi, “Modern Digital and Analog Communication Systems”, Oxford University Press, 1998.
14. LW Couch, “Digital and Analog Communication Systems”, Prentice-Hall, New Jersey, 2007
15. THE Frenzel,“Principles of Electronic Communication Systems“, Fourth Edition; McGraw-Hill Education 2016.
16. F. de Dieuleveult, O. Romain,“Electronics applied to high frequencies, Principles and applications“, 2nd edition, Dunod, 2008.
17. LW Couch,“Digital and Analog communication systems“, Eighth Edition, Pearson Education, Inc. 2013.
18. JG Proakis, M. Salehi,“Communication systems engineering“, 2nd Ed., Prentice-Hall, Inc 2002.

**Semester: 5**
**Teaching unit: UEF 3.1.1**
**Matter:Signal processing**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

To familiarize the student with digital signal processing techniques such as spectral analysis and digital filtering.

## Recommended prior knowledge

Signal theory, Mathematics 3, Fundamental electronics 1, Probability and statistics.

## Content of the subject:

*The number of weeks displayed is for informational purposes only. It is clear that the course leader is not required to strictly adhere to this dimension or the arrangement of the chapters.*

**Chapter 1. Reminders of the main results of Signal Theory (1 Week)**
Signals. Fourier series. Fourier transform and existence conditions. Parseval's theorem.Plancherel's theorem. Convolution and correlation.

**Chapter 2.Random processes (4Weeks)**
Concepts on random variables (discrete and continuous, probability density, mathematical expectation, variance, standard deviation, etc.), Characteristics of random processes: mean, autocorrelation functions, inter-correlation, stationarity in the broad and strict sense, ergodism, power spectral density. Specific processes (Gaussian process, Poisson process, telegraph signal, pseudo-random sequences). Noise (thermal noise, shot noise, etc.)

**Chapter 3. Analysis and synthesis of analog filters (3Weeks)**
Reminders on the Laplace transform. Time and frequency analysis of analog filters. Poles, zeros, p-plane and stability of analog filters. Passive and active filters, First and second order low-pass filters, First and second order high-pass filters, Band-pass filters.Other analog filters (Butterworth, Chebyshev I and II, Elliptical, etc.)

**Chapter 4.Signal sampling (3Weeks)**
Sampling: Principles and definition (theoretical, averaging, blocking, etc.). Anti-aliasing filter. Shannon condition. Analog signal restitution and interpolator filter. Quantizations, quantization noise. Examples of Analog-to-Digital Conversion and Digital-to-Analog Conversion.

**Chapter5.Discrete Transforms (4 Weeks)**
Definition of TFTD (Discrete Time Fourier Transform), TFD (Discrete Fourier Transform), Inverse TFD, Relationship between Fourier Transform and TFD, Weighting Windows, Properties of TFD and Circular Convolution, Fast TFD Algorithms (FFT). Z Transform and Introduction to Digital Filtering (Interest, Equationstemporal,transfer function, classification, implementation structures, etc.).

## Assessment method:

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

## Bibliographic references:

1. S. Haykin, “Signals and systems”, John Wiley & Sons, 2nd ed., 2003.
2. AV Oppenheim, “Signals and systems”, Prentice-Hall, 2004.

3. F. de Coulon, “Theory and processing of signals”, Edition Presses Polytechniques Universités Romandes.
4. F. Cottet, “Signal processing and data acquisition, Course and solved exercises”, Dunod.
5. B. Picinbono, “Signal and Systems Theory with Solved Problems”, Bordas Edition.
6. Mr. Benidir,“Theory and Signal Processing, Volume 1: Representation of Signals and Systems - Course and Corrected Exercises'', Dunod, 2004.
7. Mr. Benidir,“Theory and Signal Processing, Volume 2: Basic Methods for Signal Analysis and Processing - Course and Corrected Exercises'', Dunod, 2004.

**Semester: 5**
**Teaching unit: UEF 3.1.2**
**Matter:Waves and Propagation**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

Any long-distance transmission chain using radio waves uses electromagnetic waves. These waves tend to be affected by the propagation media. It is therefore necessary to know how to study these electromagnetic waves, to be able to model them, to characterize them, while taking into account the specificities of the media in which they propagate.

## Recommended prior knowledge:

Physics 2, Waves and Vibrations, Fundamental Telecommunications.

## Content of the material:

**Chapter 1. Maxwell's Equations** **(3 weeks)**

- Reminders on scalar and vector operators.
-Maxwell's equations.
- Electromagnetic wave. Electromagnetic power (Poynting vector).

**Chapter 2. Propagation of electromagnetic waves in dielectric media** **(3 weeks)**

-Wave equationin a perfect dielectric medium. Case of vacuum.Plane, progressive, monochromatic wave. Polarization of the wave.
- Reflection/transmission between two LHI media (normal and oblique incidence).

**Chapter 3. Propagation of electromagnetic waves in conductive mediaand the dissipative media** **(2 weeks)**

- Maxwell's equations and propagation equation in a conductor.
- Skin effect.
-Reflection on a perfect conducting surface and standing waves.
-Maxwell's equations and propagation equation in adissipative medium.
- Propagation parameters in adissipative medium. Electrical characteristics of the soil.

**Chapter 4.Reflection and refraction of plane waves** **(4 Weeks)**

- Behavior of the electromagnetic field when passing from one medium to another.
- TEM wave incident on the separation surface of two dielectrics. Wave polarized in the plane of incidence. Wave polarized normally to the plane of incidence.
-Snell-Descartes law.

**Chapter 5.Propagation of Hertzian waves** **(3 weeks)**

- Atmospheric layers (Troposphere- Stratosphere- Ionosphere).
- Different modes of atmospheric propagation. Atmospheric refraction.
- Reflection on the ground.
- Propagation modes by frequency band.

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

## Bibliographic references:


1. F. Gardiol, “Electromagnetism: Treatise on Electricity”, Lausanne Edition.
2. P. Rosnet, “Elements of electromagnetic propagation: Fundamental physics”, 2002.
3. G.Dubost, “Free and guided propagation of electromagnetic waves”, Masson, 1995.
4. M. Nekab, “Waves and propagation phenomena”, OPU, 2004.
5. M. Jouquet, “Electromagnetic waves 1: free propagation”, Dunod, 1973.
6. Garing, “Electromagnetic waves in dielectric media: Exercises and corrected problems”, 1998.
7. Garing, “Electromagnetic waves in vacuum and conducting media: Exercises and corrected problems”, 1998.
8. From Josef A. Edminister, "Electromagnetism", Dunod, 2004.
9. T. Kahan, "Hertzian Waves",Publisher. Paris: PUF, 1974.
10. H. Gié and JP Sarmant "Electromagnetism", Vol 2, Edt.TEC & DOC (Lavoisier), 1982.
11. RE Collin, "Foundations for microwave engineering",
12. A. Jean Berteaud, "Hyperfrequencies",
13. PF Combes-"Transmission in free space and in lines",Dunod, 1988.

**Semester: 5**
**Teaching unit: UEF 3.1.2**
**Matter: Telecommunications systems and networks**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

The objective of this module is to familiarize the student with the basic concepts of telecommunications networks. The student will understand the concepts of norms and standards. The characteristics and evaluation criteria of digital transmissions. How to protect these digital transmissions against errors due mainly to the types of channels used. Finally, examples of wired, wireless, and also mobile telecommunications networks will be presented.

## Recommended prior knowledge:

Fundamental telecommunications, Telecommunications and Applications,Telecommunications law.

## Content of the material:

**Chapter 1. Digital Transmission Systems (4 Weeks)**

Introduction, Standardization bodies, Support and transmission channels, Principle of a data link General structure of a transmission chain (Digitization of information, information source, source coding, channel coding, modulation, demodulation, channel decoding, source decoding).

**Chapter 2. Data Transmission (4 Weeks)**

Operating modes, Link mode (point-to-point and multipoint), Transmission mode (parallel and serial, synchronous, asynchronous, isochronous), Multiplexing (time, statistical time, frequency, wavelength), Bandwidth, Modulation speed, Bit rate.

**Chapter 3. Modems and Interfaces (2 Weeks)**

Characteristics and standards, Nomenclatures, links between two systems, dial-up modem, ADSL.

**Chapter 4. Error Protection (2 Weeks)**

Introduction, error rates, error detection, self-correcting code.

**Chapter 5.Telecommunications networks (3 Weeks)**

Fixed, wireless, mobile networks, Examples.

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

## Bibliographic references:

1. Tanenbaum, “Networks,” 4th edition, Prentice Hall, 2003.
2. R. Parfait, “Telecommunications networks”, Hermes science publications, 2002.
3. E. Hollocou, “Telecommunications techniques and networks”, Armand Colin, 1991.
4. C. Servin, “Networks and telecoms”, Dunod, Paris, 2006.
5. D. Dromard and D. Seret, “Network Architectures”,Pearsont Editions, 2009.
6. P. Polin, “Networks: fundamental principles”, Edition Hermès.
7. D. Comer, “TCP/IP, architectures, protocols and applications”, Editions Interéditions.
8. D. Présent, S. Lohier, “Transmissions and Networks, course and corrected exercises”, Dunod.
9. P. Clerc, P.Xavier, “Fundamental Principles of Telecommunications”, Ellipses, Paris, 1998.
10. D. Battu, “Introduction to Telecoms: Technologies and Applications”, Dunod, Paris, 2002.

11. P. Rolin, G. Martineau, L. Toutain, A. Leroy,"Networks, fundamental principles",EditionHermes, 1997.
12. G. Pujolle, "Networks and telecoms course: With corrected exercises", 3rd edition, Eyrolles, 2008.
13. V. Breton, P. Boniface,"Telecommunications and networks", Memotech, Eyrolles, 2014.
14. RL Freeman, "Telecommunication System Engineering", John Wiley & Sons, 2004.
15. M. Rahoual and P. Siarry, "Computer networks design and optimization", Editions Technic, 2006

**Semester: 5**
**Teaching unit: UEM 3.1**
**Matter:Calculators and interfacing**
**VHS: 37h30 (Lecture: 1h30, Practical work: 1h00)**
**Credits: 3**
**Coefficient: 2**

## Teaching objectives:

Digital signal processing today requires real-time hardware implementation. Programmable circuits are readily available. However, their use requires expert mastery. Students must therefore begin by mastering the basic foundations of microprocessor systems, followed by a detailed study of the operation of 16-bit microprocessor cards.

## Recommended prior knowledge:

Combinatorial and sequential logic.

## Content of the material:

**Chapter 1. Approach to programmable circuits (1Week)**
Basic architecture, Von Neumann model, CPU, main memory, input/output interfaces, buses, address decoding

**Chapter 2. Architecture of a 16-bit microprocessor (5 Weeks)**
Internal architecture, Pinouts, Special registers, Addressing modes, Instruction sets, Different architectures: RISC, CISC, Harvard

**Chapter 3. General study of input-output interfaces (3 Weeks)**
General descriptions of PIO, USART, Timer circuits (pinout, internal architecture, simplified operating modes).

**Chapter 4. Data exchanges (2Weeks)**
General information, Data exchange protocols (by testing the peripheral status bit (polling), by interrupt, by direct memory access).

**Chapter 5. Memoirs (2 Weeks)**
Organization of a memory, characteristics of a memory, different types of RAM and ROM memory, criteria for choosing a memory, concept of memory hierarchy, cache memories.

**Chapter 6. Principles of implementing a synchronous logic system by a programmable circuit (2 Weeks)**
Configuration of a programmable circuit, Description, RTOS: real-time system for industrial applications.

## TP Calculators and interfacing:

**TP1:**Introduction to the Microprocessor Kit and Programming,
**TP2:**Arithmetic and logical operations,
**TP3:**Loops and control structures,
**TP4:**The subroutines,
**TP5:**I/O management (Serial, parallel interfacing).

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

## Bibliographic references:

1. JC Buisson, “Designing your microprocessor, structure of logical systems”, Ellipses, 2006.
2. A. Tanenbaum, “Computer Architecture,” Dunod.
3. P. Zanella, Y. Ligier, E. Lazard, “Computer Architecture and Technology”, Dunod, 2013.
4. JM Trio, “Microprocessors 8086-8088: Architecture and programming”, 8087 computing coprocessor, Eyrolles.
5. H. Lilen, ““Fundamental course on microprocessors”, Dunod, 1993.
6. JC Buisson, “Designing your microprocessor: Structure of logical systems”, Ellipses, 2006.
7. M. Aumiaux, “The use of microprocessors”, Masson, Paris, 1982.
8. M. Aumiaux, “Microprocessor systems”, Masson, Paris, 1982.
9. RL Tokheim, “Microprocessors”, Volumes 1 and 2, Schaum Series, Mc Graw Hill.
10. G. Blanchet and B. Dupouy,“Computer architecture“, DUNOD, 2013
11. PA Pin, “Computer and Network TechnologyCourses and corrected exercises“, Sciences Sup, Dunod 2010 - 9th edition - 544 pages
12. G. Asch,P. Renard,P. Desgoutte,Z. Mammeriet al,“Data acquisitionFrom sensor to computer“,Technology and Engineering, Dunod/The New Factory2011 - 3rd edition - 544 pages.
13. E. Mesnard, “Industrial computing; from binary to processor; digital circuit design methods“,Publisher: ELLIPSES, 2004, 316 pages.
14. O.Cauet,“Assembler language; master the code of X86 family processors“,Publisher: Eniservices2011 424 pages.

**Semester: 5**
**Teaching unit: UEM 3.1**
**Matter:Practical work on Waves and Propagation**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

The objective of this module, in the form of practical work, is to consolidate the theoretical knowledge of the subject.Waves and Propagation.

## Recommended prior knowledge:

Physics 2, Waves and Vibrations, Fundamental Telecommunications.

## Content of the material:

**TP1: Electromagnetic waves**

Introduction to wave transmission, Electromagnetic spectra.
- Demonstration of the existence of electromagnetic waves in our environment through a simple experiment (for example: by connecting a wire antenna or a simple 1m wire to the input of the oscilloscope).
- Transmission and reception of waves (for example: transmission and reception by two parallel and very close 1m wires. The first must be connected to the GBF input and the second to the oscilloscope input).

**TP2:wave propagation in a coaxial line**

Measurement of propagation parameters in the cable (propagation time phase velocity, primary cable parameters). Measurement of attenuation as a function of frequency. Measurement of cable dispersion as a function of frequency. Propagation in impulse mode, propagation in harmonic mode, direct and reflected wave, characteristic impedance, reflection coefficient, advantages and disadvantages of a coaxial line.

**TP3:Propagation of electromagnetic waves in a waveguide**

Decimetric waves and microwaves, propagation effects in a metallic waveguide, guided propagation devices, measurement of important parameters such as the standing wave ratio (SWR) and the guide wavelength.

**TP4: Waves, reflection and adaptation**

Measurement of the reflection coefficient in module and in phase of any load. Measurement of the characteristic impedance. Measurement of the attenuation constant of a two-wire line, Adaptation of a load. Study of a line in impulse mode.

## Assessment method:

Continuous assessment: 100%

**Semester: 5**
**Teaching unit: UEM 3.1**
**Subject: Practical work Signal processing**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

To familiarize the student with digital signal processing techniques such as spectral analysis and digital filtering.

## Recommended prior knowledge:

Signal theory, Mathematics 3, Fundamental electronics 1, Probability and statistics.

## Content of the material:

**TP1:** Getting Started with Matlab: Reminders on common commands:

- Help (MATLAB help), Variables, Basic operations, String, Display, Input/output,Files (script/function), …
- Upgradefor the exploitation of Matlab toolboxes [Toolbox /Matlab, signal and Simulink].

**TP2:**Signal generation and display

- Sine, pulse, step, gate, rectangular, square, triangular, sawtooth,cardinal sine signal;Sampling study.

**TP3:**Random variables. Generation of random variables. Probability density. Distribution function. Generation of a random signal. Calculation of the correlation function and the PSD.

**TP4:**Fourier series.Transformed fromDirect Discrete Fourier (DFT) and Inverse (DFT-1). Transformed fromDirect and inverse Fast Fourier (FFT, IFFT). Comparisons of computation times between DFT and FFT with respect to the number of samples N.

**TP5:**Analysis and synthesis of analog filters (Butterworth, Chebyshev, Elliptic, etc.). Transfer functions in p. Frequency responses, Poles and zeros in the p plane.

## Assessment method:

Continuous assessment: 100%

**Semester: 5**
**Teaching unit: UEM 3.1**
**Subject: Practical workAnalog communications**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

This subject allows the student to put into practice the knowledge acquired during the analog communication course through circuit analysis, understanding the operating principle and measurement.

## Recommended prior knowledge:

Fundamental electronics 1, fundamental telecommunications, signal theory.

## Content of the material:

**TP1:Amplitude modulation demodulation**

Implement, study, analyze and understand amplitude modulation/demodulation techniques. Measure relevant parameters.

**TP2:Frequency modulation demodulation**

Implement, study, analyze and understand frequency modulation/demodulation techniques. Measure relevant parameters. Compare with analog modulation.

**TP3:Frequency Transposition: Mixers**

Study of the Frequency Transposition function (Mixer). Applications (frequency doubler, superheterodyne, modulation/demodulation, superheterodyne receiver, etc.).

**TP4: PLL phase-locked loops**

Study of a phase-locked loop (PLL),Characterize the phase comparator used, Applications.

## Assessment method:

Continuous assessment: 100%

**Semester: 5**
**Teaching unit: UED 3.1**
**Matter:Telephony**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

Communications networks encompass a wide range of applications. Telephony, in particular, is one of the most widely used communication networks in today's society. Its operation, evolution, characteristics, and future are of crucial importance to students specializing in digital telecommunications.

## Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and applications.

## Content of the material:

**Chapter 1. Analog switched telephony (3 Weeks)**
History, evolution, principle and architecture

**Chapter 2. Telephony transmission media (2 Weeks)**
Evaluation criteria, Electrical conductors, Wireless, Optical fiber

**Chapter 3. GSM Digital Cellular Telephony (4 Weeks)**
Networks, Protocols, Architecture and equipment, Principle diagrams, Measurements.

**Chapter 4. New generations of digital telephony (4 Weeks)**
3G and UMTS, 3.5G, 4G, …

**Chapter 5. Telephone interconnection equipment (2 Weeks)**
Switches, routers, interfaces, gateways

## Assessment method:

Exam: 100%

## Bibliographic references:


1. C. Servin, “Networks and Telecoms”, Dunod, 2006.
2. G. Pujolle, “Networks and telecoms course: With corrected exercises”, 3rd edition, Eyrolles, 2008.
3. RL Freeman, “Telecommunication System Engineering”, John Wiley & Sons, 2004.
4. D. Smith, J. Dunlop, “Telecommunications Engineering“, CRC Press 3rd Edition 1994.
5. J.C. Bellamy, “Digital Telephony”, John WileY & Sons, INC, 2000.
6. K. Doll, ““Mobile Telephony”, Collection What do I know? PUF, 2003.
7. L. Ouakil, G. Pujolle, “Telephony over IP”, 2nd edition, 2008.
8. H. Holma, A. Toskala, “UMTS: Third Generation Mobile Networks”, 2nd edition, 2001.
9. L. Merdrignac, “Telephone Terminals”, Engineering Techniques, 1990.
10. J. Pons, “Voice over IP: Internet, fixed and mobile - Main standards”, Techniques de l’ingénieur, 2009.
11. J. Cellmer, “Cellular Networks, From the GSM System to the GPRS System”, Engineering Techniques, 2004.
12. A. Oumnad,“Public Switched Telephone Network“, Course, http://www.oumnad.123.fr/RTCP /RTCP.pdf.

13. D. Seret et al,"NETWORKS and TELECOMMUNICATIONS", Bachelor's degree course in mathematics and computer science, René Descartes University – Paris 5, 2005-2006.
14. J. M Philippe,"The GSM network and Mobile", V07/2002.

**Semester: 5**
**Teaching unit: UED 3.1**
**Matter:Transmission media**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

Transmission channels and media form the core of telecommunications systems. They often affect transmitted signals through various types of interference and degradation, mainly due to their characteristics. Understanding these transmission media is an absolute necessity for telecommunications students.

## Recommended prior knowledge:

Fundamental telecommunications, Telecommunications and applications.

## Content of the subject:

**Chapter 1. Characteristics of transmission media (3Weeks)**

Bandwidth, attenuation, noise sensitivity, characteristic impedance, reflection coefficients, transmission coefficients and standing wave ratio (SWR).

**Chapter 2. Electrical Conductors (2 Weeks)**

Coaxial, twisted pairs, standards and categories.

**Chapter 3. Optical fibers (4 Weeks)**

Characteristics, types of optical fibers, advantages,areas of application of optical fiber (telecommunications, medicine, sensors (temperature, pressure, etc.), lighting).

**Chapter 4. Radio Beams (4 Weeks)**

General information, main frequencies and bands or channels, satellite links.

**Chapter 5.Light beams (infrared and visible) in free space (2 Weeks)**

Specters. Scopes.Advantages and limitations. Infrared sources. Visible light sources (Examples: LED and Laser). Applications.

## Assessment method:

Exam: 100%

## Bibliographic references:

1. T. KAHAN, "Hertzian waves",Publisher. Paris: PUF, 1974.
2. PF Combes-"Transmission in free space and in lines",: Dunod, 1988.
3. PF Combes, “Microwaves, passive circuits, propagation, antennas, Courses and exercises”, Dunod, 1997.
4. G. DUBOST,“Free and guided propagation of electromagnetic waves / Radiation - Exercises with solutions and course reminders“.
5. J. Quinet,“Theory and practice of electronic circuits and amplifiers, Propagation of HF current along lines; Smith chart - Antenna. Maxwell's equations and applications“.

6. JM Mur, “Optical fibers: Fundamental concepts (cables, connectors, components, protocols, networks)”, ENI Epsilon, 2012.
7. Z. Toffano, “Optoelectronics: Photonic components and optical fibers”, Ellipses, 2001.
8. DA Dealoue, ““Fiber optic telecommunications”, Sciences Technology.
9. P. Lecoy, ““Fiber Optic Communications”, Hermès, Lavoisier, 2014.
10. G. Barué, “Telecommunications and Infrastructure”, Ellipses, 2002.
11. D. Présent, S. Lohier, “Transmissions and Networks, Course and corrected exercises”, Dunod Edition, 2005.
12. D. Smith, J. Dunlop, “Telecommunications Engineering“, CRC Press 3rd Edition 1994.
13. LE Frenzel, “Electronic Communication Systems”, McGraw-Hill, New York, 1998.
14. W. Sinnema and R. McPherson, “Electronic Communications”, Prentice-Hall, Scarborough.
15. C. W Davidson, M. Millan, “Transmission lines for Communication with CAD programs”.
16. G. Maral,Mr. Bousquet,Z. Sun,“Satellite Communications Systems: Systems, Techniques and Technology“. 5th Edition. 2009
17. ITU Handbook on Satellite Communications, 3rd ed., 2002, 1210 p.
18. Aerospace Law: Telecommunications Satellites, Montreal, McGill University, 1982, 354 p.

**Semester: 5**
**Teaching unit: UET 3.1**
**Matter:Sensors and measurements in telecommunications**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

In this module, students will learn the basics of measurement systems, especially those used in telecommunications. They should also be familiar with the various sensors used and their characteristics.

## Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and applications.

## Content of the subject:

**Chapter 1. Characteristics of a measuring system (3 Weeks)**
Precision, resolution, response time, measurement range, linearity, physical quantity, sensor, etc.

**Chapter 2. Classification of sensors in telecommunications (3 Weeks)**
Definition, liabilities, assets, software.

**Chapter 3. Examples of sensors (3 Sweeks)**
Microphone, CCD sensors, RF field sensors, digital software sensors…

**Chapter 4. Static and dynamic measurements in telecommunications (4 Weeks)**
Multimeters, spectrum analyzers, reflectometers, fiber optic testers. Link testers, data analyzers, etc.

**Chapter 5. Case Study (2 Sweeks)**
Examples of measurements for mobile telephony or for telephony via IP networks.

## Assessment method:

Exam: 100%

## Bibliographic references:

1. M. Grout and P. Saloun, “Industrial Instrumentation”, Dunod edition, 2010.
2. G. Asch et al, “Data Acquisition: From Sensor to Computer”, Dunod Editions.
3. K. Hoffmann, “An Introduction to Measurements using Strain Gages”, 1987.
4. J. Fraden, “Handbook of modern sensors: physics, designs and applications”, Springer
5. Mr.Ferretti, “Fiber optic sensors”, Engineering Techniques.
6. W. Nawrocki, "Measurement Systems and Sensors", Artech House, 2005.
7. F. Gardiol, “Hyperfrequencies”, Presses Polytechniques Romandes, 1996.

**Semester: 6**
**Teaching unit: UEF 3.2.1**
**Matter:Digital communications**
**VHS: 67h30 (Lecture: 3h00, Tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives:

Telecommunications systems are essentially composed of three parts: the transmitter, the channel, and the receiver. Several digital processing steps are performed at the transmitter and receiver levels of digital telecommunications systems. The objective of this subject is to provide students with the basic foundations of these digital operations.

## Recommended prior knowledge:

Fundamental Telecommunications, Signal theory, Signal processing, Analog communication.

## Content of the material:

**Chapter 1. Digital Baseband Transmission (3 Weeks)**

Elements of a digital transmission chain, baseband modulation. Line codes (Bit/symbol conversion and shaping), Bipolar NRZ code, Unipolar NRZ code, Unipolar RZ code, Biphase/Manchester code, HDB3 code (High Density Bipolar of order 3), M-ary line codes (M-ary NRZ codes), Power spectral density of line codes, Criteria for choosing a line code. Concept of complex envelope.

**Chapter 2. Optimal Receiver (3 Weeks)**

Structure of a receiver with M signals, vector representation of signals and noise, optimal detection (MAP detector for maximum a posteriori and ML detector for maximum likelihood), Structure of the optimal receiver (autocorrelation or adapted filtering on each of the channels then decision).

**Chapter 3. Interference-free Transmission (3 Weeks)**

Channel Effect on Line Code Waveform, Characteristics of Intersymbol Interference, Eye Diagram, No Intersymbol Interference Condition, Nyquist Criterion, Raised Cosine Filter, Error Probability Performance of an M-ary System with Nyquist Filtering, Filtering Distribution between Transmit and Receive.

**Chapter 4. Performance for Baseband Transmission (3 Weeks)**

Binary signal detection and hypothesis testing, maximum likelihood criterion, likelihood ratio, optimal binary receiver with two correlators, single correlator and matched filter. Error probability for the case of white Gaussian noise with low-pass filter and matched filter.

**Chapter 5. Narrowband Digital Modulations (3 Weeks)**

Principle, Amplitude shift keying (ASK), OOK modulation, Symmetrical M-ASK modulations, Physical realization and performance, Phase shift keying (PSK), Constellations, M-PSK modulations, Physical realization and performance, Quadratic dual-carrier modulation (QAM), Physical realization and performance, Frequency shift keying (FSK), MSK modulation, Physical realization and performance of a binary FSK

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

## Bibliographic references:

1. G. Baudouin, “Digital Radiocommunications”, Dunod, 2002.
2. JM Brossier, “Signal and digital communication: equalization and synchronization”, Hermès Science, 1997.

3. P. Comon, “Digital Communications - Courses and exercises for engineering students”, Harmattan editions, 2010.
4. A. Glavieux, M. Joindot, “Digital Communications”,Mason,1996.
5. A. Glavieux, M. Joindot “Introduction to digital communications”, Collection: Sciences Sup, Dunod, 2007.
6. HP Hsu, “Analog and Digital Communications: Courses and Issues”, McGraw-Hill, 1994.
7. G. Mahé, ““Digital Communications Systems”, Ellipses.
8. LW Couch, “Digital and Analog Communication Systems”, Prentice-Hall, New Jersey, 2007.
9. S. Haykin, “Communication Systems”, John Wiley and Sons, Hoboken, New Jersey, 2001.
10. J. Proakis, M. Salehi, “Communication Systems Engineering”, 2nd edition, Prentice-Hall, New Jersey, 2002.
11. Proakis, “Digital Communications”, Ed. Mac Graw Hill, 1995.
12. B.Sklar, “Digital Communications, Fundamentals and applications”, Prentice Hall, 2001.
13. BP Lathi,“Modern Digital and Analog Communication Systems“,Oxford University Press,1998.
14. HP Hsu,“Analog and Digital Communications”, (Schaum's Outlines) 2nd Edition, McGraw Hill. 2003.
15. B. Sklar, “Digital Communications, Fundamentals and applications”, Prentice Hall, 2001.

**Semester: 6**
**Teaching unit: UEF 3.2.1**
**Matter:Antennas and Transmission Lines**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

To introduce students to the technologies related to radio frequency wave transmission, the different types of antennas used, and transmission lines in general. Furthermore, this subject aims to provide some information regarding the basic foundations of microwaves.

## Recommended prior knowledge:

Fundamental Electronics 1,Fundamental telecommunications, waves and propagation, Transmission media.

## Content of the material:

**Chapter 1. Propagation and Transmission Lines (4 Weeks)**

- Reminders: Incident wave, reflected wave and standing wave (Reflection coefficient, transmission coefficient and standing wave ratio).
- Model of a transmission line with two parallel planes, (Equations of a line, Equivalent electrical diagram of a section of line with and without losses).
- Solution of the Telegraphists' equations. Calculation of powers (incident and reflected power. Power at the load) based on three media (Generator, Line and Load).
-The Smith chart and its use for impedance matching.

**Chapter 2. Types of Transmission Lines and Their Applications (1Sweek)**

- Example: Coaxial line, two-wire andtwisted, etc.
-Calculation of primary parameters of two-wire lines and coaxial cable.

**Chapter 3. Basic characteristics of antennas (3 Weeks)**

- Radiation characteristics: Characteristic surface, Radiation diagram,Surface power density, Radiated power, Radiation intensity, Directivity, Efficiency, Gain, EIRP.
- Electrical characteristics:Electrical model and frequency behavior, Adaptation and adaptation condition, Bandwidth,Polarization of an antenna.

**Chapter 4. Radiation of elementary antennas (3 Weeks)**

- Calculation of the electromagnetic field at a long distance from the electric doublet (Characteristic surface, and radiation diagram, radiated power, equivalent height, radiation resistance).
- Calculation of the electromagnetic field at long distance of a dipole antenna isolated in space (Characteristic surface and radiation pattern, radiated power, equivalent height, radiation resistance).

**Chapter 5. Types of Antennas and Their Applications (4 Weeks)**

Folded antenna, Loop antenna of different shapes (square, triangle, diamond, etc.), vertical or horizontal, Wire doublet antenna for decametric waves, Yagi-Uda antenna with parasitic elements, very directional and with high gain, Omnidirectional vertical quarter-wave antenna for very high frequencies (THF or VHF), Magnetic loop antenna of reduced dimensions, Helix antenna for decimetric waves with circular polarization,Parabolic antenna for centimeter waves (microwaves).

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

## Bibliographic references:

1. F. Gardiol, “Electromagnetism: Treatise on Electricity”, Lausanne Edition.
2. P. Combes, “Microwaves, passive circuits, propagation, antennas, Courses and exercises”, Dunod, 1997.
3. R.-C. Houzé, “Antennas, Fundamentals”, Dunod, 2006.
4. A. Ducros, “Antennas: Theory and Practice”, Transmission and Reception, Elektor, 2008.
5. WL Stutzman, GA Thiele, “Antenna Theory and Design”, John Wiley.
6. C. Balanis, “Antenna Theory: Analysis and Design”, 3rd Edition, John Wiley & Sons Inc, 2005.
7. R. Aksas, “Telecommunications: Antennas Theory and Applications”, Ellipses Marketing, 2013.
8. RC. Houzé, “Antennas, Fundamentals”, Dunod, 2006.
9. O. Picon et al, “Antennas: Theory, Design and Applications”, Dunod, 2009.

**Semester: 6**
**Teaching unit: UEF 3.2.2**
**Matter:Local computer networks**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

Introduce students to the world of telecommunications by teaching them the basic concepts of traditional and emerging local area networks. Master the specific constraints of local area networks. Choose a local area network and associated equipment. Size, install, configure, and diagnose a local area network.

## Recommended prior knowledge

Combinatorial and sequential logic.

## Content of the subject:

*The number of weeks displayed is for informational purposes only. It is clear that the course leader is not required to strictly adhere to this dimension or the arrangement of the chapters.*

**CChapter 1. Concepts on data transmission (2 Weeks)**

Digital transmission systems (Introduction, standardization bodies, transmission medium and channels, principle of a data link), data transmission (Operating modes, bandwidth, modulation speed, bit rate, etc.), serial transmission and parallel transmission, synchronous and asynchronous transmission, transmission techniques, transmission media and means.

**Chapter 2. Local Area Networks (3 Weeks)**

The main bodies, IEEE model, network classification, the OSI model, the main components of a network, the different physical topologies.

**Chapter 3. Ethernet Network (3 Weeks)**

Presentation (Addressing and Ethernet Framing), access method: CSMA/CD, rules and laws for the Ethernet network, Ethernet frame formats, topologies, cables and connectors. Interconnection, repeaters, hubs, bridge, switches. Notions on the evolution of Ethernet networks (Fast Ethernet and Gigabit Ethernet, etc.)

**Chapter 4. The TCP/IP Protocol (5 Weeks)**

Presentation of the TCP/IP model and comparison with OSI. Internet layer: ARP/RARP, IP and ICMP. IPv4 addressing: nomenclature, address classes,subnet mask, subnets and supernets, UDP, TCP.Classful Address, Classless Address, Network Segmentation, Connectivity Testing (ping, tracert and pathping commands, etc.). IPv6 Address, Migration from IPv4 to IPv6

**Chapter 5. Wireless Local Area Networks (Wi-Fi) (2 Weeks)**

Introduction to WLAN (Wireless Local Area Network), presentation of WiFi or 802.11, MAC layer features. Access methods. Different topologies with and without infrastructure (or access point).

## Assessment method:

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

## Bibliographic references:

1. G. Pujolle; Networks, 3rd edition; Eyrolles, 2002.
2. Tanenbaum; Networks, 4th edition; Prentice Hall, 2003.

3. R. Parfait; Telecommunications networks; Hermes science publications, 2002.
4. E. Hollocou; Telecommunications techniques and networks; Armand Colin, 1991.
5. C. Servin; Networks and telecoms; Dunod, Paris, 2003.
6. D. Dromard and D. Seret; Network Architectures; Pearsont Editions, 2009.
7. P. Polin; Networks: fundamental principles; Hermès Edition.
8. D. Comer; TCP/IP, architectures, protocols and applications; Editions Interéditions.
9. D. Present, S. Lohier; Transmissions and Networks, courses and corrected exercises; Dunod.
10. P. Clerc, P. Xavier; Fundamental Principles of Telecommunications; Ellipses, Paris, 1998.
11. D. Battu; Introduction to Telecommunications: Technologies and Applications; Dunod, Paris, 2002.

**Semester: 6**
**Teaching unit: UEF 3.2.2**
**Matter:Coding and Information Theory**
**VHS: 45h00 (Lecture: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

Digital communication techniques and technologies have evolved significantly in recent years. Several constraints and challenges still remain, mainly related to transmission channels. Thus, to increase transmission rates and ensure quality signals, we must use coding and compression methods. From this module, the student will have to learn the basic foundations for evaluating the characteristics of transmission channels and the different coding methods used.

## Recommended prior knowledge:

Probability and statistics,Fundamental telecommunications,Signal theory and processing,Telecommunications systems and networks.

## Content of the subject:

**Chapter 1. Information and Coding (4 Sweeks)**
Principles of a digital transmission chain. Reminders on probabilities and random variables. Concept of quantity of information, measurement of information, mutual information, entropy and applications.

**Chapter 2. Source Coding (4 Sweeks)**
Generalities, Shannon-Fanno coding, Huffman algorithms, arithmetic algorithm, Lempel-Zip algorithm, coding of a discrete source.

**Chapter 3. Transmission Channel (3 Sweeks)**
Definition of a transmission channel, models, discrete memoryless channel, causal channel, symmetric discrete channel, erasure channel. Transition matrix, channel capacity, capacity calculation examples.

**Chapter 4. General Principles of Error-Correcting Codes (4 Sweeks)**
Introduction to channel coding, Review of linear algebra. Shannon's channel coding theorems. Concepts of block coding and trellis coding. Parameters of a linear code. Hamming distance, Concept of a minimum distance of a code. Generating matrices. Examples of linear codes.

## Assessment method:

Continuous assessment: 40%; Exam: 60%.

## Bibliographic references:


1. F. Bavaud**,JC Chappelier, J. Kohlas,**"Introduction to Information Theory and its Applications", University of Fribourg.
2. O.Rioul, "Theory of information and coding",Lavoisier, 2007.
3. Y.Mori, "Information and coding theory: analog signal, digital signal and applications in telecommunications", Hermès Science, 2006.
4. T.Mr.Cover and JA Thomas, "Elements of information theory", 2nd edition, Wiley Series in telecommunications and signal Processing, 2006.
5. Alain Glavieux, Michel Joindot Digital Communications. Ed Masson
6. Pierre Csillag, Introduction to Correcting Codes. Ed Ellipses
7. Bernard Sklarm Digital Communications: fundamentals and applications. Ed Prentice Hall
8. JC Bic, DD Duponteil, JC .Imbeaux, Elements of digital communications. Ed Dunod

9. Hervé Benoit Digital Television MPEG1, MPEG2 and the principles of the European DVB system. Ed. Dunod.
10. Glavieux and all, Channel coding in communication networks: from theory to turbocodes, Volume 3 of Digital Signal Image Processing Series, John Wiley Sons, 2007.
11. Claude Berrou and all, Codes and Turbo Codes, Collection IRIS Series, IRIS International, Springer, 2010.
12. WE Ryan, Shu Lin, Channel codes: classical and modern, Cambridge University Press, 2009.
13. Shu Lin, Daniel J. Costello, Error control coding: fundamentals and applications, Edition 2, Pearson-PrenticeHall, 2004.
14. T. Richardson, R. Urbanke, Modern coding theory, Cambridge University Press, 2008.
15. TM Cover, JA Thomas, "Elements of Information Theory", Wiley & Sons, 2nd edition, 2006.
16. Gérard Battail, "Information Theory: Application to Communication Techniques", Telecommunications Educational Collection, MASSON, 1997
17. Louis Wehenkel, Information and Coding Theory, lecture at the University of Liège, 2003, http://www.montefiore.ulg.ac.be/~lwh/Info/
18. E. Roubine, "Introduction to Communication Theory. Volume III: Information Theory", MASSON et Cie collection, 1970
19. A. Spataru, "Foundations of the theory of information transmission", presses polytechniques romandes, supplement to the treatise on electricity, 1987
20. David JC MacKay "Information Theory, Inference, and Learning Algorithm", Cambridge Univ. Press, 2003 http://www.cs.toronto.edu/~mackay/itprnn/ps/
21. François Auger, "Introduction to signal and information theory, course and exercises", Science and Technology collection, Technip editions, 1999
22. RG Gallager, "Information Theory and reliable communication", Wiley, 1968
23. Geneviève Jourdain, "Information Theory", DEA SIPT course handout (INPG), 1992
24. Jean Brini, "Information Theory course", handout of 2nd year ENSERG course 2001/2002.

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

## Teaching objectives:

Assimilate knowledge from different subjects in a comprehensive and complementary manner. Put into practice the concepts taught during training. Encourage students' sense of autonomy and initiative. Teach them to work in a collaborative environment by stimulating their intellectual curiosity.

## Recommended prior knowledge:

The entire Bachelor's program.

## Content of the material:

The theme of the End of Cycle Project must come from a joint choice between the tutor and a student (or a group of students: pairs or even trios). The substance of the subject must necessarily fit with the objectives of the training and the real skills of the student (Bachelor's level). It is also preferable that this theme takes into account the social and economic environment of the establishment. When the nature of the project requires it, it can be subdivided into several parts.

## Noticed:

During the weeks when students are familiarizing themselves with the purpose of their project and its feasibility (bibliographic research, search for software or hardware necessary to carry out the project, revision and consolidation of teaching directly linked to the subject, etc.), the subject manager must use this face-to-face time to remind students of the essential content of the two subjects.Writing Methodology''And ''Presentation Methodology''covered during the first two semesters of the common core.

At the end of this study, the student must submit a written report in which he must set out as explicitly as possible:

- The detailed presentation of the study theme, emphasizing its relevance in its socio-economic environment.
- The means implemented: methodological tools, bibliographic references, contacts with professionals, etc.
- Analysis of the results obtained and their comparison with the initial objectives.
- Criticism of the observed deviations and possible presentation of other additional details.
- Identification of the difficulties encountered by highlighting the limits of the work carried out and the follow-up to be given to the work carried out.

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

## Assessment method:

Controlcontinuous: 100%

**Semester: 6**
**Teaching unit: UEM 3.2**
**Matter:TPDigital communications**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

To give the student the basic foundations of these numerical operations.

## Recommended prior knowledge:

Fundamental Telecommunications, Signal theory, Signal processing, Analog communication.

## Content of the material:

**TP1:Baseband modulation/demodulation**
Online coding (different codes such as NRZ, Biphase, Miller, Bipolar, etc.), Baseband demodulation.

**TP2:Baseband transmission in the presence of white Gaussian noise**
Bit/symbol conversion, shaping filter, AWGN channel, receiving filter, sampling, decision and decoding.

**TP3:Digital modulation/demodulation of PAM (ASK), FSK, PSK, and QAM type on infinite band channel.**
Implement, study, analyze and understand digital modulation/demodulation techniques of the typePAM (ASK), FSK, PSK, and QAM. Measure relevant parameters like BER.

**TP4:Digital modulation/demodulation of BPSK, QPSK and MPSK type on limited band channel.**
Implement, study, analyze and understand digital modulation/demodulation techniques like BPSK, QPSK, M-PSK and M-QAM. Measure relevant parameters like BER, Eye Diagram and Constellation.

## Assessment method:

Continuous assessment: 100%

**Semester: 6**
**Teaching unit: UEM 3.2**
**Subject: TP Antennas Transmission lines**
**VHS: 10:30 p.m. (TP: 1:30 p.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

This teaching allows the student to understand through experience the basic principles of propagation on transmission lines as well as the radiation mechanisms of antennas.

## Recommended prior knowledge:

Fundamental Electronics 1,Fundamental telecommunications, waves and propagation, Transmission media.

## Content of the material:

**TP1**:TOS measurements and adaptation of a transmission line. Measurement of frequency, power, wavelength, coupling.Measurement of the reflection coefficient in module and in phase of any load, Measurement of the characteristic impedance.

**TP2**:Far field measurement as a function of antenna distance.Measurement of basic parameters of an antenna (gain, directivity, opening angle at -3db, etc.). Verification of the reciprocity of an antenna.

**TP3**:Antenna adaptation and reflection coefficient measurement.

**TP4**:Antenna polarization and polarization losses.

**TP5**: Diagram measurementradiation of different types of antennas.

## Assessment method:

Continuous assessment: 100%

**Semester: 6**
**Teaching unit: UEM 3.2**
**Matter:Local computer networks practical work**
**VHS: 3:00 p.m. (TP: 1:00 p.m.)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

Consolidate the knowledge learned in the courseLocal computer networks.

## Recommended prior knowledge:

Fundamental Telecommunications,Telecommunications and Applications,Telecommunications Systems and Networks, Telecommunications Law.

## Content of the material:

**TP1:**Production and testing of RJ45 or twisted pair cables (crossed, straight)

**TP2:**Implementation of a peer-to-peer network between two PCs (IP addressing, file sharing).

**TP3:**Configuration and implementation of a multi-station network with switches (IP addressing, tests with ipconfig, ping, arp, tracert, etc.).

**TP4:**Creation of a WiFi network and configuration of an access point (static and dynamic IP addressing by DHCP, securing the access point, etc.)

**TP5:**Operation of TCP/IP protocols (Encapsulation Process) by analyzing data frames (Using Wireshark).

NB: Practical work can be carried out on a real local computer network and/or using a simulator.

## Assessment method:

Continuous assessment: 100%

**Semester: 6**
**Teaching unit: UED 3.2**
**Matter:Optoelectronics**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

Nowadays, the transmission medium is the most important element in a transmission system, especially digital. Optical fiber is part of this trend and brings considerable improvements in terms of broadband. Mastering optical transmission is the essential objective of this field.

## Recommended prior knowledge:

Fundamental Electronics 1,Fundamental telecommunications, Transmission media.

## Content of the subject:

**Chapter 1. Optical fibers (3 Weeks)**
Concepts of guidance and geometric optics, Multi-mode and single-mode optical fibers, Attenuation and dispersion in optical fibers, Transmission windows, Manufacturing of optical fibers.

**Chapter 2. Optical cables and their applications (2 Weeks)**
Different types of optical cables, Submarine cables, Connection of optical fibers, Connection faults in optical fibers.

**Chapter 3. Light Emitters and Receivers (3 Weeks)**
The LED, the Laser, the PIN photodiode and the APD.

**Chapter 4. Optical fiber transmission chain (4 Weeks)**
Structure of a fiber optic transmission system, The transmission and reception block, The EDFA optical amplifiers, The link budget.

**Chapter 5. Optical Link Measurement Methods (3 Weeks)**
OTDR Reflectometer, Error Rate Measurement and Eye Diagram.

## Assessment method:

Exam: 100%

## Bibliographic references:

1. JM Mur, “Optical fibers: Fundamental concepts (cables, connectors, components, protocols, networks)”, ENI Epsilon, 2012.
2. Z. Toffano, “Optoelectronics: Photonic components and optical fibers”, Ellipses, 2001.
3. R. Maciejko, “Optoelectronics”, International Polytechnic Press, 2002.
4. RC Houze, “Lasers, principle and operation”.
5. DA Dealoue, ““Fiber optic telecommunications”, Sciences Technology.
6. P. Lecoy, ““Fiber Optic Communications”, Hermès, Lavoisier, 2014.
7. E. Rosencher, B. Vinter, “Optoelectronics”, 2nd edition, Sciences Sup Collection, Dunod, 2002.

**Semester: 6**
**Teaching unit: UED 3.2**
**Matter:Information security**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

In the field of telecommunications and computer networks, information security has become a major issue. The objective of this subject is to help students understand the basics of computer security and its criteria. Understanding the fundamentals of the techniques and technologies used in communication network security is also the goal of this subject.

## Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and Applications,Telecommunications systems and networks.

## Content of the material:

**Chapter 1. Introduction to Information Security (2 Weeks)**
What is security?, Threats and Attacks, The objectives of information security: Confidentiality, Integrity, Availability, Security measures.

**Chapter 2. Concepts of Cryptography and Cryptanalysis (5 Weeks)**
Principles of cryptography, Symmetric cryptography, Asymmetric cryptography, Conventional cryptography, Encryption and decryption (block, stream, Integrity and authenticity).

**Chapter 3. Firewall Security (2 Weeks)**
Basic definitions of a firewall, Security policies, Tools in firewalls.

**Chapter 4. Switching Security (2 Weeks)**
Concepts on VLANs, Data link layer attacks and responses.

**Chapter 5. Virtual Private Networks (VPNs) (2 Weeks)**
How a VPN works, The different types of VPNs, The protocols used.

**Chapter 6. Wireless Network Security (2 Weeks)**
WEP: Wired Equivalent Privacy, WEP problems, WPA: Wi-Fi Access Protocol, … etc.

## Assessment method:

Exam: 100%

## Bibliographic references:

1. O. Paul, ""Prevention of Denial of Service in Public Networks",Information Systems Security, 2003.
2. F. Raynal, "Hidden Channels",Information Systems Security, 2003.
3. T. Noel, "IP Mobile",Information Systems Security, 2002.
4. D.Trezentos, "Standard for wireless networks: IEEE 802.11",Information Systems Security, 2002.
5. C.Chiaramonti, "Electronic Data Interchange",Information Systems Security, 2001.

**Semester: 6**
**Teaching unit: UET 3.2**
**Subject: Entrepreneurship and business management**
**VHS: 10:30 p.m. (Class: 1.5 hours)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives:**

- Prepare for professional integration at the end of studies;
- Developing entrepreneurial skills among students;
- To raise awareness and familiarize students with the opportunities, challenges, procedures, characteristics, attitudes and skills required by entrepreneurship;
- To prepare students so that they can, one day or another, create their own business or, at least, better understand their work in an SME.

**Recommended prior knowledge:**

No specific knowledge, except mastery of the language of instruction.

**Targeted skills:**

Ability to analyze, synthesize, work in a team, communicate well orally and in writing, be autonomous, plan and meet deadlines, be responsive and proactive. Be aware of entrepreneurship by presenting an overview of management knowledge useful for business creation.

**Content of the material:**

Chapter 1 – Operational preparation for employment: **(2 Weeks)**

Writing a cover letter and preparing a CV, Job interview, etc., Documentary research on careers in the sector, Conducting interviews with professionals in the field and Simulation of job interviews.

Chapter 2 - Entrepreneurship and Entrepreneurial Spirit: **(2 Weeks)**

Entrepreneurship, Companies around you, Entrepreneurial motivation, Knowing how to set goals, Knowing how to take risks

Chapter 3 - The profile of an entrepreneur and the profession of Entrepreneur: **(3 Weeks)**

The qualities of an entrepreneur, Knowing how to negotiate, Knowing how to listen, The place of SMEs and VSEs in Algeria, The main factors for success when creating a VSE/SME

Chapter 4 - Finding a Good Business Idea: **(2 Weeks)**

Creativity and innovation, Recognizing and evaluating business opportunities

Chapter 5–Starting and Running a Business: **(3 Weeks)**

Choosing an appropriate market, Choosing a location for your business, Legal forms of business, Finding help and financing to start a business, Recruiting staff, Choosing suppliers

Chapter 6 - Development of the business project: **(3 Weeks)**

The Business Model and the Business Plan, Carry out your business project with the Business Model Canvas

**Assessment method:**Exam: 100%

**References:**

- FayolleAlain, 2017. Entrepreneurship theories and practices, applications for learning to undertake. Dunod, 3rd ed.

- LégerJarniou, Catherine, 2013, The Entrepreneur's Big Book. Dunod, 2013.

- PlaneJean-Michel, 2016, Management of organizations: theories, concepts, performances. Dunod, 4th ed.

- LégerJarniou, Catherine, 2017, Building Your Business Plan. The Entrepreneur's Big Book. Dunod,.

- Sion Michel, 2016, Succeeding in your business Methods, tools and tips plan.Dunod, 4th ed.

- Patrick Koenblit, Carole Nicolas, Hélène Lehongre, Building your professional project, ESF, Publisher 2011.

- Lucie Beauchesne, Anne Riberolles, Building your professional project, L'Etudiant 2002.

- ALBAGLI Claude and HENAULT Georges (1996), Business creation in Africa, ed EDICEF/AUPELF, 208 p.

# IV- Agreements / Conventions

# STANDARD LETTER OF INTENT

## (In case of a license co-sponsored by another university establishment)

### (Official paper on the letterhead of the university establishment concerned)

Subject: Approval of co-sponsorship of the license entitled:

The university (or university center) hereby declares to co-sponsor the above-mentioned license for the entire period of authorization of the license.

To this end, the university (or university center) will assist this project by:

- Giving his point of view in the development and updating of teaching programs,
- Participant in seminars organized for this purpose,
- By participating in the defense juries,
- By working to pool human and material resources.

SIGNATURE of the legally authorized person:

FUNCTION :

Date :

# STANDARD LETTER OF INTENT

## (In case of license in collaboration with a company in the user sector)

### (Official company letterhead)

**OBJECT :**Approval of the project to launch a Bachelor's degree course entitled:

Provided to:

The company hereby declares its willingness to show its support for this training as a potential user of the product.

To this end, we confirm our support for this project and our role will consist of:

- Give our point of view in the development and updating of teaching programs,
- Participate in seminars organized for this purpose,
- Participate in defense juries,
- Facilitate as much as possible the reception of interns either in the context of final year dissertations or in the context of supervised projects.

The means necessary to carry out the tasks incumbent upon us to achieve these objectives will be implemented on a material and human level.

Mr (or Mrs)*……..is designated as external coordinator of this project.

**SIGNATURE**of the legally authorized person:

**FUNCTION :**

**Date :**

**OFFICIAL STAMP or COMPANY SEAL**

# V - Opinions and Visas of the Administrative and Consultative Bodies

**License Title: Telecommunications**

| **Department Head + Domain Team Leader** |
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| Date and visa:Date and visa: |
| **Dean of the Faculty (or Director of the Institute)** |
| Date and visa: |
| **Head of university establishment** |
| Date and visa: |

## VI – Notice and Visa of the Regional Conference

## VII – Opinion and Visa of the National Educational Committee of the Domain