الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research

University

LOGO

# OFFER
# LMD

# ACADEMIC LICENSE

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

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

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

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اللجنة البيداغوجية الوطنية
لميدان العلوم و التكنولوجيا
National Educational Committee for the Field of Science and Technology

# عرض تكوين
# ل. م. د
# ليسانس أكاديمية

## برنامج وطني
## 2120 to 2022

| المؤسسة | الكلية/ المعهد | القسم |
|---|---|---|
| | | |

| الميدان | الفرع | التخصص |
|---|---|---|
| علوم و تكنولوجيا | اتصالات سلكية و لا سلكية | اتصالات سلكية و لا سلكية |

# Summary

# I–License identity sheet

## 1 - Location of the training:

**Faculty (or Institute):**

**Department :**

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

## 2-External partners:

**Other partner establishments:**

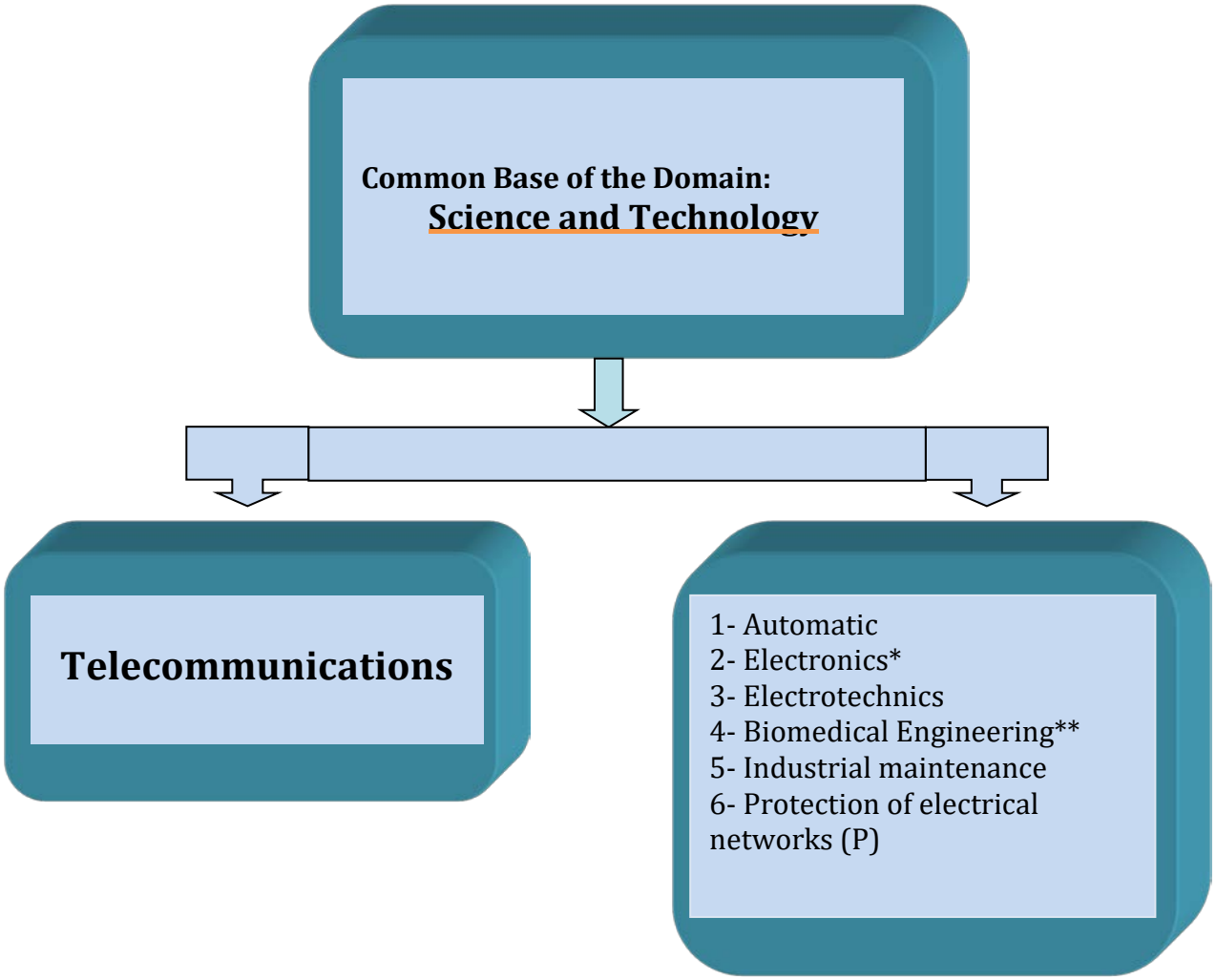
**Businesses and other socio-economic partners:**

**International partners:**

# 3–Context and objectives of the training

## A – General organization of training: project position

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



## B - Training objectives:

The need for telecommunications is becoming more and more vital for all the mechanisms that govern different social dynamics. Indeed, itServices which, until the recent past, were part of the professional context (collaborative work, Cloud Computing, etc.) are arriving in force in daily life: social networks, online games, e-commerce, video on demand, mobile access to Internet services, etc.

On another note,the field of telecommunications, with the known technological progress and the 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 the know-how to cope with this evolution.

It therefore becomes essential to invest in this area through knowledge, scientific research and technological applications since their impacts on socio-economic balances are becoming more and more decisive...Mastering information means mastering 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 offered.

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

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

The lessons of the third semester (common to the entire Electrical Engineering family) are reserved forthe acquisition of the basic subjects of 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 and(local 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 field of initiative, to evolve and adapt to changes in their profession through the End of Cycle Project and the Personal Project of the student.

## C – Targeted profiles and skills:

This training aims to raise the student to a level of knowledge and skills capable of enabling them tocontinuewith easea Masters intelecommunications. On another side,the practical and professional knowledge acquired during trainingwill constitute a springboard for himguarantor of immediate integration into the professional environment.

At the end of the training, young qualified executives must be able to:

- ✓ Know the fundamentals of telecommunications law;
- ✓ Understand Telecommunications systems and services;
- ✓ Dialogue 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 evolve and extend a network from an existing infrastructure;
- ✓ Master standards and norms in terms of protocols, topologies, security and administration platforms;
- ✓ Deal with both electronics and IT 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 international standards in force in developed countries, means that job opportunities for students leaving this training are enormous.

Young executives can apply formany functionsin this vast sector of activity as assistants to telecommunications engineers, managers of the technical-sales service, managers of the telecommunications infrastructure maintenance service, 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 the promotion of new uses.

The professional opportunities offered by this license are numerous and concern all sectors of activity:

Ministry of Post and Information and Communication Technologies(MPTIC):

Algeria Telecom, Mobilis, Ooredoo, Djezzy, Algerian Space Agency, Directions of Wilaya MPTIC, Third-party Telecommunications Operators.

Ministry of Communication:

Algerian Television Broadcasting Networks and Technical Structures (TDA).

Ministry of National Defence :

Transmission, Telecoms Infrastructure

Ministry of the Interior:

Transmission, Telecoms Infrastructure.

Ministry of Industry:

Telecoms Infrastructure

Ministry of Energy:

Sonatrach (Transmission, Telecoms Infrastructure), Sonalgaz (Transmission, Telecoms Infrastructure), Third-party operators deploying 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:

| Common semesters 1 and 2 | |
|---|---|
| **Sector** | **Specialties** |
| Aeronautics | Aeronautics |
| Civil engineering | Civil engineering |
| Climate engineering | Climate engineering |
| Maritime genius | Naval Propulsion and Hydrodynamics |
| | Naval construction and architecture |
| Mechanical Engineering | Energy |
| | Mechanical construction |
| | Materials Engineering |
| Hydraulic | Hydraulic |
| Transportation Engineering | Transportation Engineering |
| Metallurgy | Metallurgy |
| Precision optics and mechanics | Optics and photonics |
| | Precision engineering |
| Public works | Public works |
| Automatic | Automatic |
| Electromechanics | Electromechanics |
| | Industrial maintenance |
| Electronic | Electronic |
| Electrical engineering | Electrical engineering |
| Biomedical genius | Biomedical genius |
| 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

| Group of sectors A Common semester 3 | |
|---|---|
| **Sector** | **Specialties** |
| Automatic | Automatic |
| Electromechanics | Electromechanics |
| | Industrial maintenance |
| Electronic | Electronic |
| Electrical engineering | Electrical engineering |
| Biomedical genius | Biomedical genius |
| Industrial Engineering | Industrial Engineering |
| Telecommunication | Telecommunication |

| Group of sectors B Common semester 3 | |
|---|---|
| **Sector** | **Specialties** |
| Aeronautics | Aeronautics |
| Civil engineering | Civil engineering |
| Climate engineering | Climate engineering |
| Maritime genius | Naval Propulsion and Hydrodynamics |
| | Naval construction and architecture |
| Mechanical Engineering | Energy |
| | Mechanical construction |
| | Materials Engineering |
| Hydraulic | Hydraulic |
| Transportation Engineering | Transportation Engineering |
| Metallurgy | Metallurgy |
| Precision optics and mechanics | Optics and photonics |
| | Precision engineering |
| Public works | Public works |

| Group of sectors C Semester 3 common | |
|---|---|
| **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 sectors which present basic lessons common to each other (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 Engineering Processes and Mining Engineering (Group C).

This degree offers multidisciplinary and transversal teaching programs:

Multidisciplinary, in the sense that the lessons 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 lessons of semester 3 for all the specialties in the same group of sectors are also 100% identical.

| Semester | Sector group | 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 way, this License offers the student the choice of joining, if they express the desire and depending on the educational places available:

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

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

- All specialties from another group of sectors tothe end of semester 3
(Subject to equivalence and advice from the training team).

- All specialties from the same group of sectors tothe end of semester 4
(Subject to equivalence and advice from the training team).

## F – Performance indicators expected from the training:

All training must meet the quality requirements of today and tomorrow. As such,pto better appreciate theexpected training performanceproposedon the one hand anden exploiting the flexibility and flexibility of the LMD system on the other hand,it is proposed, for information only, for this license a certain number of mechanisms to evaluate and monitor the progress of teaching, training programs, student/teacher and student/administration relationships, the future of graduates of this license 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.

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 distributed.

**1. Evaluation of the course of the training:**

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

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

**Before the training:**

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

**During training:**

- ✓ Regularity of meetings of educational committees.
- ✓ 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 lessons and teaching methods.

**After the training:**

- ✓ Student success rate per semester in this Degree.
- ✓ Ratewastage (failure and abandonment) of students.
- ✓ Identification of the causes of student failure.
- ✓ Reorientation alternatives are offered to students in a situation of failure.
- ✓ Ratestudents who graduate on time.
- ✓ Ratestudentswho continue their studies after the license.

## 2. Evaluation of the course of lessons:

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

As a result, a system for evaluating programs and teaching methods can be put in place based on the following indicators:

- ✓ Equipping teaching rooms and laboratories with materials and supports necessary for educational improvement (projection systems (data shows), wifi connection, etc.).
- ✓ Existence of a communication and teaching platform in which courses, tutorials and practical work are accessible to students and their questions resolved.
- ✓ Equipping educational laboratories with materials and equipment in line with the teaching content.
- ✓ Number of effective teaching weeks provided during a semester.
- ✓ Completion rate of teaching programs.

- ✓ Digitization and conservation of end of studies and/or end of cycle dissertations.
- ✓ Number of TPs carried out as well as the multiplication of the type of TPs per subject (diversity of TPs).
- ✓ Quality of the establishment's documentary collection in relation to the specialty and its accessibility.
- ✓ Support from the socio-economic sector for training (company visit, company internship, seminar courses provided by professionals, etc.).

**3. Integration of graduates:**

A coordination committee is created, made up of those responsible for training and members of the Administration, which is mainly responsible for monitoring the integration of graduates from the sector into professional life, and for establishing a graduate monitoring file. of the sector, to identify and/or update the existing economic and industrial potential at the regional and national level, to anticipate and encourage new professions in relation to the sector in association with the chamber of commerce, the various support agencies employment, public and private operators, etc., to participate in any action concerning the professional integration of graduates (organization of events with socio-economic operators).
To carry out these missions, this committee has complete freedom to carry out or commission any study or survey on the employment and post-employment of graduates. Below is a list ofindicators and modalities 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 outlets.
- ✓ Establishment of an association of former graduates of the sector.
- ✓ Creation of small businesses by graduates of the specialty.
- ✓ Level of employer satisfaction.

## G- Evaluation of the student through continuous assessment and personal work:

**G1- Evaluation by continuous monitoring:**

The importance of continuous assessment methods on the training of students in terms of educational achievements no longer needs to be demonstrated. In this regard,Articles 20, 21 and 22 of Order 712 of November 3, 2011, define and specify the terms and organization of the continuous evaluation of students according to the training course. The calculation of the averages for continuous assessment (tutorials and practical work) is made from a weighting of all the elements which constitute this evaluation. These articles specify that this weighting is left to the discretion of the teaching team.

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

The analysis of the different proposals coming from these establishments showed that, indeed, articles 21 and 22 of decree 712 of November 3, 2011 are not explicit enough and

deserve more clarification. These articles could be enriched by taking into account the following points which represent a synthesis of the proposals collected.

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

### 1.1. Preparing the series of exercises:

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 in a tutorial session.
These exercises must be prepared by the student before coming to tutorial. This preparation can be evaluated. The evaluation method is left to the discretion of the teacher responsible for the tutorial.
The exercises not solved in tutorial can be the subject of personal work to be carried out by groups of 3 to 4 students and to be submitted for evaluation (deadline: 1 week).

### 1.2. Written questions:

Each end of a series of exercises (ie each end of a chapter) will be followed by a short written quiz. This questioning must be organized in collaboration with the subject manager in order to ensure a fair evaluation for all students (essentially when several teachers are involved in the tutorials).

### 1.3. Student participation in tutorials:

This participation must be evaluated. The evaluation method is left to the discretion of the teacher responsible for the tutorial.

### 1.4. Student Attendance:

Student attendance is mandatory in TD and TP. In class, it is difficult to control it for undergraduate students where the numbers are very large (lectures in an amphitheater). For masters where numbers are small, attendance must be compulsory in classes and tutorials.

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

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

## 3. About cross-curricular subjects and discoveries that do not have a TD or TP:

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

However, the teacher in charge of this subject can, if he wishes, let the students know that he can possibly evaluate them (ongoing) by offering them to prepare presentations, to make reports, to look for additional information. of the course, use free software, ask 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 indicated to them the internet link to this film) and ask them to then 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 capable of defining the best way to take this personal work into account inthe overall score of the final exam.

In the same vein, 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 person responsible for the subject may consider continuous evaluations of the student like 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 Teaching Council.

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

## 4. Harmonization of continuous monitoring:

The use of a common grid for evaluation would promote the harmonization of these practices from one teacher to another, from one department to another and from one establishment to another. It would also constitute a structuring and reassuring benchmark for students. To do this, we propose below an evaluation grid for information purposes which presents the various continuous controls making it possible to evaluate the degree of acquisition of students' skills, whether in terms of knowledge or analytical skills. and synthesis skills.
Please note that these assessments are not intended to “trap” students by imposing very difficult continuous assessments on them. On the contrary, it is a question of 'honestly' evaluating the degree of assimilation of the different skills and knowledge taught to the student in complete objectivity. In the same spirit, we would benefit from promoting the contractualization of learning evaluation by specifying, for example, the success criteria and good practices which would result in correct and precise answers to the questions. Thus, the evaluation would mainly focus on the acquired knowledge which was the subject of training by giving exercises linked to what was prepared in tutorial without forgetting, however, to evaluate the students' ability to mobilize their skills in more complex situations.

## 4-1 Directed work:

| | | |
|---|---|---|
| Preparation of series of exercises and personal work (homework, presentations, etc.) | 30% | 06 points |
| Written questions (minimum 02 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 returned 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 spirit of the LMD. A very substantial amount of weekly time has been reserved for him: approximately 50% of the total hourly volume of the training (see the table ''Overall training summary'' present in this training offer).
A survey carried out by the CPND-ST among training teams across all university establishments indicated that the time relating to the student's personal work could be judiciously exploited, under good supervision of the teacher, in a manner rational and in different forms. The tasks that would then be accomplished by the 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 free will 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 work at home 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, resolve a difficult exercise, go over the proof of a theorem in detail, search for the complement of a course, use free software or a CAD-CAD tool to make applications and simulations linked to the course, etc. These activities can be evaluated, noted and registered as a bonus for the students who carry them out.

**2. Mini course project:**

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

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 for 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 monitoring score.

**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 likely to enable them to better understand the reality of the world of work and subsequently help them achieve better professional integration.
Administrative managers as well as 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. We can offer students templates to help them present their internship report properly.

**4. Participation in scientific events:**

In order to imbue students with a scientific spirit (mainly for higher level students), they must be guided and encouraged to participate in round tables, laboratory seminars and conferences organized within their faculty and/or establishment. It is even advisable to encourage these students to attend conferences, related to their specialty, outside their university during exhibitions, fairs and others. 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:**

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

**Conclusion :**

The autonomy of the student, considered as a lever for success, rests largely on the personal work that they are required to do, by appropriating the resources and tools made available to them. All this must, of course, be supervised and formalized within the framework of educational monitoring and support which must be provided jointly by the university teacher and the administrative manager throughout the training course.
This autonomy will allow them to build their professional identity according to their aspirations, their abilities and their acquired knowledge or to build their academic career in the pursuit of higher studies.

## 4 - Human resources available:

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

Number of students:

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

| First and last name | Graduation diploma | Specialty diploma (Magister, doctorate) | Grade | Subjects to teach | Registration |
|---|---|---|---|---|---|
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**Department 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 | Home establishment | Graduation diploma | Specialty diploma (Magister, doctorate) | Grade | Subjects to teach | Registration |
|---|---|---|---|---|---|---|
| | | | | | | |
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**Department visa**

**Faculty or institute visa**

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

| Grade | Internal Workforce | External Workforce | Total |
|---|---|---|---|
| Teachers | | | |
| Lecturers (A) | | | |
| Lecturers (B) | | | |
| Assistant Master (A) | | | |
| Assistant Master (B) | | | |
| Other (*) | | | |
| Total | | | |

(*) Technical and support staff

## 5 - Material resources specific to the specialty

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

**Laboratory title:**

**Student capacity:**

| No. | Equipment designation | Number | Comments |
|---|---|---|---|
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B- Internship sites and in-company training:(see agreements/conventions section)

| Training place | Number of students | Training period |
|---|---|---|
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C- Documentation available at the establishment level specific to the proposed training (mandatory field):

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

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

**Semester 1**

| Teaching unit | Modules | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Evaluation mode | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **T.D.** | **TP** | | | **Continuous monitoring** | **Exam** |
| Fundamental EU<br>Code: UEF 1.1<br>Credits: 18<br>Coefficients: 9 | Mathematics 1 | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Physics 1 | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Structure of matter | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| Methodological EU<br>Code: UEM 1.1<br>Credits: 9<br>Coefficients: 5 | TP Physics 1 | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | TP Chemistry 1 | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | Computer science 1 | 4 | 2 | 1h30 | | 1h30 | 45:00 | 55:00 | 40% | 60% |
| | Writing methodology | 1 | 1 | 1h00 | | | 3:00 | 10:00 | | 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 | 02:30 | | 100% |
| E Transverse<br>Code: UET 1.1<br>Credits: 2<br>Coefficients: 2 | Ethical and deontological dimension (the foundations) | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| | Foreign language 1 (French or English) | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| | | **30** | **17** | | | | **375h00** | **375h00** | | |

| Total semester 1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

## Semester 2

| Teaching unit | Modules | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Evaluation mode | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **T.D.** | **TP** | | | **Continuous monitoring** | **Exam** |
| Fundamental EU<br>Code: UEF 1.2<br>Credits: 18<br>Coefficients: 9 | Mathematics 2 | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Physics 2 | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Thermodynamics | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| Methodological EU<br>Code: UEM 1.2<br>Credits: 9<br>Coefficients: 5 | TP Physics 2 | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | TP Chemistry 2 | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | Computer science 2 | 4 | 2 | 1h30 | | 1h30 | 45:00 | 55:00 | 40% | 60% |
| | Presentation methodology | 1 | 1 | 1h00 | | | 3:00 | 10:00 | | 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 | 02:30 | | 100% |
| Transversal EU<br>Code: UET 1.2<br>Credits: 2<br>Coefficients: 2 | Foreign language 2 (French and/or English) | 2 | 2 | 3:00 | | | 45:00 | 05:00 | | 100% |
| **Total semester 2** | | **30** | **17** | **4:00** | **4:30** | **4:30** | **375h00** | **375h00** | | |

## Semester 3

| Teaching unit | Modules | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Evaluation mode | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **T.D.** | **TP** | | | **Continuous monitoring** | **Exam** |
| Fundamental EU Code: UEF 2.1.1 Credits: 10 Coefficients: 5 | Mathematics 3 | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Waves and vibrations | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| Fundamental EU Code: UEF 2.1.2 Credits: 8 Coefficients: 4 | Fundamental Electronics 1 | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| | Fundamental electrical engineering 1 | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| Methodological EU Code: UEM 2.1 Credits: 9 Coefficients: 5 | Probability and statistics | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| | Computer science 3 | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | Electronics and electrical engineering TP | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | TP Waves and vibrations | 1 | 1 | | | 1h00 | 3:00 | 10:00 | 100% | |
| EU Discovery Code: UED 2.1 Credits: 2 Coefficients: 2 | State of the art of electrical engineering | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| | Energy and environment | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| Transversal EU Code: UET 2.1 Credits: 1 Coefficients: 1 | Technical English | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| **Total semester 3** | | **30** | **17** | **1:30** | **7:30** | **4:00** | **375h00** | **375h00** | | |

## Semester 4

| Teaching unit | Modules | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Evaluation mode | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **T.D.** | **TP** | | | **Continuous monitoring** | **Exam** |
| Fundamental EU<br>Code: UEF 2.2.1<br>Credits: 10<br>Coefficients: 5 | Fundamental Telecommunications | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Combinatorial logic and sequential | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 100% |
| Fundamental EU<br>Code: UEF 2.2.2<br>Credits: 8<br>Coefficients: 4 | Numerical methods | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| | Signal theory | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| Methodological EU<br>Code: UEM 2.2<br>Credits: 9<br>Coefficients: 5 | Electrical measurements and electronic | 3 | 2 | 1h30 | | 1h00 | 37:30 | 37:30 | 40% | 60% |
| | Basic Telecommunications TP | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | Combinatorial logic TP and sequential | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | TP Numerical methods | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| EU Discovery<br>Code: UED 2.2<br>Credits: 2<br>Coefficients: 2 | Telecommunications and applications | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| | Telecommunications Law | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| Transversal EU<br>Code: UET 2.2<br>Credits: 1<br>Coefficients: 1 | Expression, information and communication techniques | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| **Total semester 4** | | **30** | **17** | **1:30** | **6:00** | **5:30** | **375h00** | **375h00** | | |

## Semester 5

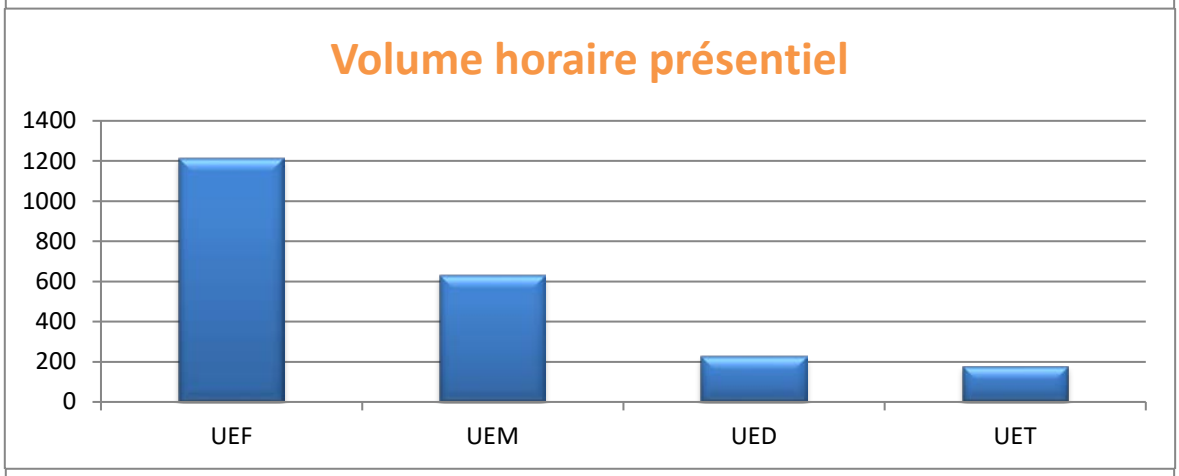
| Teaching unit | Materials | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Evaluation mode | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **T.D.** | **TP** | | | **Continuous monitoring** | **Exam** |
| Fundamental EU<br>Code: UEF 3.1.1<br>Credits: 10<br>Coefficients: 5 | Analog communications | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Signal processing | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| Fundamental EU<br>Code: UEF 3.1.2<br>Credits: 8<br>Coefficients: 4 | Waves and Propagation | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| | Telecommunications systems and networks | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| Methodological EU<br>Code: UEM 3.1<br>Credits: 9<br>Coefficients: 5 | Calculators and interfacing | 3 | 2 | 1h30 | | 1h00 | 37:30 | 37:30 | 40% | 60% |
| | TP Waves and Propagation | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | TPSignal processing | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | Analog communications TP | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| EU Discovery<br>Code: UED 3.1<br>Credits: 2<br>Coefficients: 2 | Telephony | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| | Transmission media | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| Transversal EU<br>Code: UET 3.1<br>Credits: 1<br>Coefficients: 1 | Telecommunications sensors and measurements | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| **Total semester 5** | | **30** | **17** | **1:30** | **6:00** | **5:30** | **375h00** | **375h00** | | |

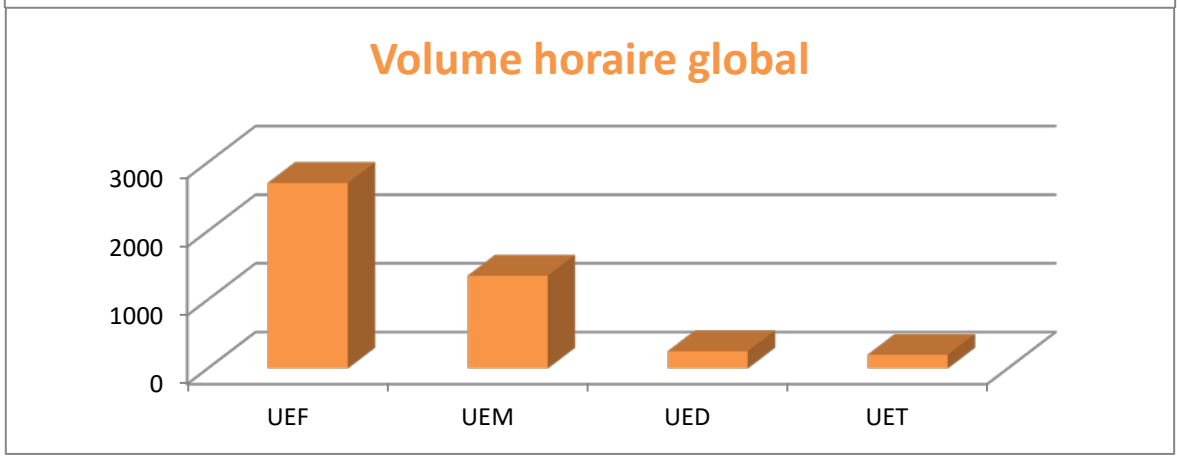
## Semester 6

| Teaching unit | Modules | Credits | Coefficient | Weekly hourly volume | | | Half-yearly Hourly Volume (15 weeks) | Additional Work in Consultation (15 weeks) | Evaluation mode | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Titled | | | **Course** | **T.D.** | **TP** | | | **Continuous monitoring** | **Exam** |
| Fundamental EU<br>Code: UEF 3.2.1<br>Credits: 10<br>Coefficients: 5 | Digital communications | 6 | 3 | 3:00 | 1h30 | | 67h30 | 82h30 | 40% | 60% |
| | Antennas and Transmission Lines | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| Fundamental EU<br>Code: UEF 3.2.2<br>Credits: 8<br>Coefficients: 4 | Local computer networks | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| | Coding and Information Theory | 4 | 2 | 1h30 | 1h30 | | 45:00 | 55:00 | 40% | 60% |
| Methodological EU<br>Code: UEM 3.2<br>Credits: 9<br>Coefficients: 5 | End of Cycle Project | 4 | 2 | | | 3:00 | 45:00 | 55:00 | 100% | |
| | TPDigital communications | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | TP Antennas Lines transmissions | 2 | 1 | | | 1h30 | 10:30 | 27:30 | 100% | |
| | TP Local computer networks | 1 | 1 | | | 1h00 | 3:00 | 10:00 | 100% | |
| EU Discovery<br>Code: UED 3.2<br>Credits: 2<br>Coefficients: 2 | Optoelectronics | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| | Information security | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| Transversal EU<br>Code: UET 3.2<br>Credits: 1<br>Coefficients: 1 | Entrepreneurship and business management | 1 | 1 | 1h30 | | | 10:30 | 02:30 | | 100% |
| **Total semester 6** | | **30** | **17** | **12:00** | **6:00** | **7:00** | **375h00** | **375h00** | | |

## Overall summary of the training:

| EU / V.H. | UEF | EMU | UED | UET | Total |
|---|---|---|---|---|---|
| Course | 720h00 | 120h00 | 225h00 | 180h00 | 1245h00 |
| T.D. | 495h00 | 10:30 p.m. | --- | --- | 517h30 |
| TP | --- | 487h30 | --- | --- | 487h30 |
| Personal work | 1485h00 | 720h00 | 25:00 | 8:00 p.m. | 2250h00 |
| other (explain, list,) | --- | --- | --- | --- | --- |
| Total | 2700h00 | 1350h00 | 250h00 | 200h00 | 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 (Class: 3h00, tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives

This first mathematics subject is notably devoted to the homogenization of the level of students upon 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

Mathematics basicsterminal classes(sets, functions, equations, etc.).

## Material content:

**Chapter 1.Methods of mathematical reasoning (1 week)**
1-1 Direct reasoning. 1-2 Reasoning by contraposition. 1-3 Reasoning through the absurd. 1-4 Reasoning by counter example. 1-5 Reasoning by induction.

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

**Chapter 3. Real functions with a 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 Reverse function

**Chapter 5. Limited development (2 weeks)**
5-1 Taylor formula. 5-2 Limited development. 5-3 Applications.

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

## Evaluation method:

Continuous monitoring: 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 of higher mathematics 1- Algebra, Dunod.
7- J. Quinet, Elementary course of higher mathematics 2- Usual functions, Dunod.
8- J. Quinet, Elementary course of higher mathematics 3- Integral calculation and series, Dunod.
9- J. Quinet, Elementary course of higher mathematics 4- Differential equations, Dunod.

**Semester: 1**
**Teaching unit: UEF 1.1**
**Subject 2: Physics1**
**VHS: 67h30 (Class: 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**

Concepts of mathematics and physics.

**Material content:**

**Math reminders (2 weeks)**

1- Equations with dimensions
2-Vector calculation: scalar product (norm), vector product, functions with several variables, derivation. Vector analysis: gradient, rotational operators, etc.

**Chapter 1. Cinematic (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. Dynamics: (4 weeks)**

1- Generality: Mass - Force - Moment of force – Absolute and Galilean Reference. 2- Newton's laws. 3- Principle of conservation of momentum. 4- Differential equation of motion. 5- Kinetic 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.

**Evaluation method:**

Continuous monitoring: 40%; Exam: 60%.

**Bibliographic references:**

1. HAS.Gibaud,Mr. Henry;Physics course - Mechanics of the point - Courses 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 (Class: 3h00, tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives

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

## Recommended prior knowledge

Basic notions of mathematics and general chemistry.

## Material content:

**Chapter 1 :Fundamentals (2 weeks)**
States and macroscopic characteristics of the states of matter, changes in states of matter, notions of atom, molecule, mole and Avogadro's number, atomic mass unit, atomic and molecular molar mass, molar volume, Weight law: 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), Isotopia and relative abundance of the 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 (radiationα,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, Poly electronic atoms in wave mechanics.

**Chapter 5:Periodic classification of elements (3 weeks)**
Periodic classification of D. Mendeleiev, Modern periodic classification, Evolution and periodicity of the physicochemical properties of the 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)**
The covalent bond in Lewis' theory, The polarized covalent bond, dipole moment and partial ionic character of the bond, Geometry of molecules: Gillespie theory or VSEPR, The chemical bond in the quantum model.

## Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

**Bibliographic references**

1. Ouahes, Devallez, General Chemistry, OPU.
2. SS Zumdhal et al., 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 TP1**
**VHS: 10:30 p.m. (TP: 1:30 a.m.)**
**Credits: 2**
**Coefficient: 1**

**Teaching objectives**

Consolidate the theoretical knowledge brought to the course through a certain number of practical manipulations.

**Recommended prior knowledge**

Concepts of mathematics and physics.

**Material content:**

**5 manipulations at least (3 hours / 15 days):**

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

**Evaluation method:**

Continuous control: 100%.

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

## Teaching objectives

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

## Recommended prior knowledge

Basic concepts of Chemistry.

## Material content:

1.Safety in the laboratory

2.Preparing 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: dosage of chloride ions using the Mohr method.

## Evaluation method:

Continuous control: 100%

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

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

## Recommended prior knowledge
Basic notions of web technology.

**Material content:**
**Part 1. Introduction to Computer Science (5 weeks)**
1- Definition of IT
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. Algorithm and program concepts (10Weeks)**
1- Concept of an algorithm
2- Organization chart representation
3- Structure of a program
4- The approach and analysis of a problem
5- Data structure: Constants and variables, Data types
6- Operators: assignment operator, Relational operators, Logical operators, Arithmetic operations, Priorities in operations
7- Input/output operations
8- Control structures: Conditional control structures, Repetitive control structures

## Computer science lab 1:
The objective of the practical exercises is to illustrate the concepts taught during the course. These must begin with lessons according to the following schedule:
•TP of initiation and ffamiliarization with the computing machine from a hardware and operating systems point of view (exploration of the different functionalities of the OS)
•Introductory practical work on using a programming environment (Editing, Assembly, Compilation, etc.)
• TPapplication of programming techniques seen in class.

## Evaluation method:
Continuous monitoring: 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: 1:00)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives

Familiarize and train students in current concepts of writing methodology in force in the Science and Technology profession. Among the skills to acquire: Knowing how to present yourself; Know how to write a CV and a cover letter; Know how to position yourself in writing or orally in relation to an opinion or an idea; Master syntax and spelling in writing.

## Recommended prior knowledge

Basic French.Basic principle of writing a document.

## Material content:

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

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

**Chapter 3 Writing techniques and procedures (3 weeks)**
-Basic Principle of Writing- Punctuation, Syntax, Sentences
-Sentence length
-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 practical work

## Evaluation method:

Control Review: 100%.

## Bibliographic references:

1. J.-L. Lebrun, Practical guide to scientific writing, EDP Sciences, 2007.
2. M. Fayet, Succeeding in your reports, 3rd edition, Eyrolles, 2009.
3. M. Kalika, Master's thesis - Managing a thesis, Writing a report, Preparing a defense, Dunod, 2016.
4. M. Greuter, 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: 1h30)**
**Credits: 1**
**Coefficient: 1**

**Objective of the subject:**
Introduce the student, in a first step, to all the sectors covered by the Field of Sciences and Technologies and in a second step a range of professions leading to these sectors. In the same context, this subject introduces the new challenges of sustainable development as well as the new professions that can result from them.

**Recommended prior knowledge**
None.

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

**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, Electricity production 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,Energy sector (oil, gas), …
- Role of the specialist in these areas.

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

**6. Sustainable engineering: (4 weeks)**
Definition, Principles of sustainable engineering (definitions of: sustainable energy/energy efficiency, sustainable mobility/ecomobility, valorization of resources (water, metals and minerals, etc.), sustainable production), Relevance of sustainable engineering in ST sectors , Relationship between sustainability and engineering, Responsibility of engineers in carrying out sustainable projects, …

**Student's personal work for this subject:**
The teacher responsible for this subject can let his students know that he can always evaluate them by offering to prepare job descriptions. Ask students to watch at home a popular science film related to the chosen profession (after having given them either the film on electronic media or having indicated to them the internet link to this film) and ask them to then 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 capable of defining the best way to take this personal work into account inthe overall score of the final exam.

**Work in group:**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 capacities of the establishments, recommend calling on doctoral students and former graduates of the establishment in a tutoring/mentoring system where each group can call on its tutor/mentor to develop the job description/discover the different ST professions .

**Evaluation mode:**
100% review

**Bibliographic references:**
1- What jobs for tomorrow? Publisher: ONISEP, 2016, Collection: Les Dossiers.
2- J. Douënel and I. Sédès, Choosing a profession according to your profile, Editions d'Organization, 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- Jobs in the aeronautics and space industry, Collection: Course, Edition: ONISEP, 2017.
6- Electronics and robotics professions, Collection: Course, Edition: ONISEP, 2015.
7- The environment and sustainable development professions, Collection: Course, Edition: ONISEP, 2015.
8- Building and public works professions, Collection: Course, Edition: ONISEP, 2016.
9- Transport and logistics professions, Collection: Course, Edition: ONISEP, 2016.
10- Energy professions, Collection: Course, Edition: ONISEP, 2016.
11- Mechanical professions, Collection: Course, Edition: ONISEP, 2014.
12- Chemistry professions, Collection: Course, Edition: ONISEP, 2017.
13- Web professions, Collection: Course, Edition: ONISEP, 2015.
14- Biology professions, Collection: Course, Edition: ONISEP, 2016.

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

**Subject: Ethical and deontological dimension (the foundations)**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

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

## Recommended prior knowledge:

None

## Material content:

**I. Fundamentals –مفاهم أساسية (2 weeks)**

Definitions:

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

5. Distinction between the different notions
   - A. Distinction between ethics and morality
   - B. Distinction between ethics and professional conduct

**II. The Repositories –المرجعيات (2 weeks)**

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

**III. The University Franchise –الحرم الجامعي (3 weeks)**

The Concept of University Franchises
Regulatory texts
University Franchise Royalties
University campus actors

**IV. University Values –القيم الجامعية (2 weeks)**

Social Values
Community Values
Professional Values

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

Student Rights
Student homework
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 relationships
Student – student relations
Student – Staff Relations
Student Relations – Association Members

**VII. Practices (2 weeks)**

Good practices For the teacher
Good 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 Boîtes, n° 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 de l'Université du Québec, 2003.
5. SIROUX, D., 'Deontology', in M. Canto-Sperber (dir.), 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: 1h30)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives:**
The aim is to develop the following four skills in this subject: Oral comprehension, Written comprehension and Oral expression, Written expression through reading and studying texts.

**Recommended prior knowledge:**
Basic French.

**Material content:**
We offer below a set of themes that deal with fundamental sciences, technologies, economics, social facts, communication, sport, health, etc. The teacher can choose from this list of texts to develop them during the course. Otherwise, he is free to address other themes of his choice. The texts can be borrowed from various communication media: daily newspapers, sports or entertainment magazines, specialized or popular magazines, books, websites, audio and video recordings, etc.
For each text, the teacher helps the student develop their linguistic skills: listening, comprehension, oral and written expression. In addition, he must use this text to identify the grammatical structures that he will develop during the same class session. We recall here, by way of illustration, a set of grammatical structures which 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 can be detailed.

| Examples of themes | Grammatical structures |
|---|---|
| Climate change<br>Pollution<br>The electric car<br>The robots<br>Artificial intelligence<br>Nobel prize<br>Olympic Games<br>Sports at school<br>The Sahara<br>The currency<br>The line work<br>Ecology<br>Nanotechnologies<br>The optical fiber<br>The profession of engineer<br>The power plant<br>Energetic efficiency<br>The smart building<br>Wind energy<br>Solar energy | The punctuation. Proper nouns, Articles.<br>Grammatical functions: The noun, The verb, The pronouns, The adjective, The adverb.<br>The complement pronoun ''the, the, the, him, their, y, en, me, te,...''<br>Agreements.<br>The negative sentence. Don't... don't, Don't... yet, Don't... again, Don't... ever, Don't... not,...<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 tenses of the indicative, Present, Future, past perfect, simple past, Imperfect.<br>… |

**Evaluation method:**
Review: 100%.

**Bibliographic references**:


1. M. Badefort, Objective: International French Test, Edulang, 2006.
2. O. Bertrand, I. Schaffner, Succeeding in the TCF, Exercises and training activities, Éditions de l'école polytechnique, 2009.
3. M. Boulares, J.-L. Frerot, Progressive French grammar with 400 exercises, Advanced level, CLE International.
4. Collective, Besherelles: Grammar for all, Hatier.
5. Collective, Besherelles: Conjugation for all, Hatier.
6. M. 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 the French language at school: Grammar, Spelling and Conjugation, Hachette Education, 2005.
11. J. Bossé-Andrieu, Abridged Rules of Grammar and Spelling, Presses de l'Université du Québec, 2001.
12. J.-P. Colin, Simply French, Eyrolles, 2010.
13. Collective, French assessment test, Hachette, 2001.
14. Y. Delatour et al., Practical French grammar in 80 sheets with corrected exercises, Hachette, 2000.
15. Ch. Descotes et al., L'Exercisier: French expression for the 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 – Orthography, Larousse, 2009.

**Semester:1**
**Teaching unit: UET1.1**
**Subject 1: English Language1**
**VHS: 10:30 p.m. (Class: 1h30)**
**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 readings:** | **Examples of Word Study: Patterns** |
|---|---|
| Iron and Steel | Make + Noun + Adjective |
| Heat Treatment of Steel. | Quantity, Contents |
| Lubrication of Bearings. | Enable, Allow, Make, etc. + Infinitive |
| The Lathe. | Comparative, Maximum and Minimum |
| Welding. | The Use of Will, Can and May |
| Steam Boilers. | Prevention, Protection, etc., Classification |
| Steam Locomotives. | The Impersonal Passive |
| Condensation and Condensers. | Passive Verb + By + Noun (agent) |
| Centrifugal Governors. | Too Much or Too Little |
| Impulse Turbines. | Instructions (Imperative) |
| The Petro Engine. | Requirements and Necessity |
| The Carburation System. | Means (by + Noun or –ing) |
| The Jet Engine. | Time Statements |
| The Turbo-Prop Engine. | Function, Duty |
| Aerofoil. | Alternatives |

**Fashion rating:**
Review: 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 of the press: Vocabulary and expressions of the economic, social and political world, Fernand Nathan, 2006.

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

## Teaching objectives

Students are led, step by step, towards understanding mathematics useful to their university studies. At the end of the course, the student should be able to: solve first and second degree differential equations; to solve the integrals of rational, exponential, trigonometric and polynomial functions; to solve systems of linear equations by several methods.

## Recommended prior knowledge

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

## Material content:

**Chapter 1: Matrices and determinants (3 weeks)**
1-1 Matrices (Definition, operation). 1-2 Matrix associated with a linear application. 1-3 Linear application associated with a matrix. 1-4 Change of base, passage matrix.

**Chapter 2: Systems of linear equations (2 weeks)**
2-1 General. 2-2 Study of all the solutions. 2-3 Methods for solving a linear system. Resolution by Cramer's method. Solved by the inverse matrix method. Resolution by 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.3-5Integration defined

**Chapter 4: Differential equations (4 weeks)**
4-1 ordinary differential equations. 4-2 differential equations of order 1. 4-3 differential equations of order 2. 4-4 ordinary differential equations of second order with constant coefficient.

**Chapter 5: Functions with several variables (2 weeks)**
5-1 Limit, continuity and partial derivatives of a function. 5-2 Differentiability. 5-3 Double, triple integrals.

## Evaluation method:

Continuous monitoring: 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. Piskounov, Differential and integral calculus, Volume 1, Moscow edition
6- J. Quinet, Elementary course of higher mathematics 3- Integral calculation and series, Dunod.

7- J. Quinet, Elementary course of higher mathematics 4- Differential equations, Dunod.
8- J. Quinet, Elementary course of higher mathematics 2- Usual functions, Dunod.
9- J. Quinet, Elementary course of higher mathematics 1- Algebra, Dunod.
10- J. Rivaud, Algebra: Preparatory classes and University Volume 1, Exercises with solutions, Vuibert.
11- N. Faddeev, I. Sominski, Collection of exercises in higher algebra, Moscow edition.

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

**Teaching objectives**
Introduce the student to the physical phenomena underlying the laws of electricity in general.

**Recommended prior knowledge**
Mathematics 1, Physics 1.

**Material content:**
**Mathematical reminders:(1 week)**
1- Elements of length, surface, volume in Cartesian, cylindrical, spherical coordinate systems. Solid angle,The 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-Flow of the electric field.5-Gauss's theorem.6-Conductors in equilibrium.7-Electrostatic pressure.8-Capacitance of a conductor and a capacitor.

**Chapter II. Electrokinetics:(4 weeks)**
1- Electrical conductor.2- Ohm's law.3- Joule's law.4- Electric circuits.5- Application of Ohm's law to networks.6- Kirchhoff's laws. Thevenin's theorem.

**Chapter III. Electromagnetism :(4 weeks)**
1-Magnetic field:Definition of a magnetic field,Biot and Savart's law, Ampère'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 gold,FLaplace orce, Faraday's law, Lenz's law, Application to coupled circuits.

**Evaluation method:**
Continuous monitoring: 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 (Class: 3h00, tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives

Provide the necessary foundations of classical thermodynamics with a view to applications to combustion and thermal machines. Homogenize student knowledge. The skills to be understood 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.

## Material content:

**Chapter 1: General information 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 states of thermodynamic equilibrium of a system. 5- Possible transfers between the system and the external environment. 6-Transformations of the state of a system (operation, evolution). 7-Reminders of the ideal gas laws.

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

1. Work, heat, internal energy, concept of energy conservation. 2. The 1st principle of thermodynamics: statement, concept of internal energy of a system, application to the ideal gas, the enthalpy function, heat capacity, reversible transformations (isochoric, isobaric, isothermal, adiabatic).

**Chapter 3: Applications of the first law of thermodynamics to thermochemistry (3 weeks)**

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

**Chapter 4: The 2nd law 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 entropy variation: reversible isothermal transformation, reversible isochoric transformation, reversible isobaric transformation, adiabatic transformation, during a change of state, during a chemical reaction.

**Chapter 5:The 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- Energy and free enthalpy. 3- Chemical balances

## Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

## Bibliographic references:

1. C. Coulon, S. LeBoiteux S. and P. Segonds, Physical Thermodynamics - Courses and exercises with solutions, Edition Dunod.
2. HB Callen, Thermodynamics, Course, Edition John Wiley and Sons, 1960

3. R. Clerac, C. Coulon, P. Goyer, S. LeBoiteux & C. Rivenc, Thermodynamics, Courses and tutorials in thermodynamics, University Bordeaux 1, 2003
4. O. Perrot, Thermodynamics Course IUT of Saint-Omer Dunkirk, 2011
5. CL Huillier, J. Rous, Introduction to thermodynamics, Edition Dunod.

**Semester: 2**
**Teaching unit: UEM 1.2**
**Subject 1: Physics TP2**
**VHS: 45h00 (TP: 1h30)**
**Credits: 2**
**Coefficient: 1**

**Teaching objectives**

Consolidate the theoretical concepts covered in the Physics 2 course through Practical Work sessions.

**Recommended prior knowledge**

Mathematics 1, Physics 1.

**Material content:**

**5 manipulations at least (3h00 / 15 days)**

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

**Evaluation method:**

Continuous control: 100%

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

## Teaching objectives

Consolidate the theoretical concepts covered in the Thermodynamics course through Practical Work sessions.

## Recommended prior knowledge

Thermodynamics.

## Material content:

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 melting 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.

## Evaluation method:

Continuous control: 100%

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

## Teaching objectives

Master basic programming and algorithmic techniques. Acquire the fundamental concepts of computer science. The skills to be acquired are: Programming with a certain autonomy; The design of 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.

## Material content:

**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, call of functions
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 (concept of fields)
3- Manipulation of record structures
4- Concept of file
5- File access modes
6- Reading and writing to a file

## Computer science lab 2:

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

## Evaluation method:

Continuous monitoring: 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: 1:00)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives

Give the main bases for a successful oral presentation.Among the skills to acquire: Knowing how to prepare a presentation; Know how to present a presentation; Know how to capture the attention of the audience; Learn about the pitfalls of plagiarism and understand intellectual property regulations.

## Recommended prior knowledge

Expression and communication techniques and writing methodology.

## Material content:

**Chapter 1: The oral presentation (3 weeks)**
Communication. Preparation of an oral presentation. Different types of plans.

**Chapter 2: Presentation of 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, sanction of plagiarism, how to borrow the work of other authors, 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 written work. Applications: presentation of an oral presentation.

## Evaluation 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, Succeeding in a presentation. Prepare impactful slides and communicate well in public. Eyrolles, 2009.
5. H. Biju-Duval, C. Delhay, All speakers, Eyrolles, 2011.
6. C. Eberhardt, Practical work with PowerPoint. Create and layout slides, Dunod, 2014.
7. F. Cartier, Written and oral communication, Edition GEP- Groupe Eyrolles, 2012.
8. L. Levasseur, 50 exercises for speaking in public, Eyrolles, 2009.
9. S. Goodlad, Speaking technically – A Handbook for Scientists, Engineers, and Physicians on How to Improve Technical Presentations, Imperial College Press, 2000.
10. M. Markel, Technical communication, eleventh edition, Bedford/St Martin's, 2015.

**Semester:2**
**Teaching unit: UED1.2**
**Subject 1: Careers in Science and Technology 2**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

**Objective of the subject:**
Introduce the student, in a first step, to all the sectors covered by the Field of Sciences and Technologies and in a second step a range of professions leading to these sectors. In the same context, this subject introduces the student to the new challenges of sustainable development as well as the new professions that can result from them.

**Recommended prior knowledge**
None.

**Content of the material:**
**1.Industrial Hygiene and Safety (HSI) sectorsand Gmining industry**: (2 weeks)
- Definitions andapplication areas (Security of goods and people, Environmental problems, Exploration and exploitation of mining resources, etc.)
-Role of the specialist in these areas.

**2.Climatic Engineering and Transport Engineering sectors: (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, Large road and rail infrastructures, Bridges, Airports, Dams, Drinking water supply and Sanitation, Hydraulic flows, Water resources management, Public works and land use planning, Smart cities, …)
- Role of the specialist in these areas.

**4.Aeronautics, Mechanical Engineering, Maritime Engineering and Metallurgy: (2 weeks)**
- Definitions and areas of application (Aeronautics, Avionics, Automotive industry, Ports, Dykes,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 (concepts of profit, costs, performance) and social (concept of corporate social responsibility), Impact of economic activities on the environment (examples), Issues/benefits of SD for the company, Means of engagement in a SD approach (e.g. ISO 14001 certification, labeling (e.g. energy labeling, Ecolabel, Organic/AB Label, FSC Label, etc.), strategic SD plan, Global Reporting Initiative (GRI)…), Global rankings of the most sustainable companies (Dow Jones Sustainable Index, Global 100, ….), Company case studiesefficient/eco-responsible in 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 developing summaries of the main actions undertaken in the field of SD.

Examples of documents for reading and synthesis:

- 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-organizations-2009-1-page-201.htm)
- Mireille Chiroleu-Assouline. Corporate sustainable development strategies. Ideas, The journal of economic and social sciences, CNDP, 2006, p 32-39 (free online access:http://halshs.archives-ouvertes.fr/hal-00306217/document)
- Web page on environmental and societal commitmentsTOTAL: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/

**Evaluation mode:**

100% review

**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: Human Sciences, 2017.

3- Y. Veyret, J. Jalta and M. Hagnerelle, Sustainable developments: All the issues in 12 lessons, Edition: Otherwise, 2010.

4- L. Grisel and Ph. Osset, Life cycle analysis of a product or service: Applications and putting into practice, 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-balance, 3rd Edition: PPUR, 2017.

6- G. Pitron and H. Védrine, The war over rare metals: The hidden face of the energy and digital transition, Edition: Links that liberate, 2018.

7- The environment and sustainable development professions, Collection: Course, Edition: ONISEP, 2015.

**Semester:2**
**Teaching unit: UET1.2**
**Subject 1: French language 2**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives:**
The aim is to develop the following four skills in this subject: Oral comprehension, Written comprehension, Oral expression, Written expression through reading and studying texts.

**Recommended prior knowledge:**
Basic French.

**Material content:**
We offer below a set of themes that deal with fundamental sciences, technologies, economics, social facts, communication, sport, health, etc. The teacher can choose from this list of texts to develop them during the course. Otherwise he is free to address other themes of his choice. The texts can be borrowed from various communication media: daily newspapers, sports or entertainment magazines, specialized or popular magazines, books, websites, audio and video recordings, etc.
For each text, the teacher helps the student develop their linguistic skills: listening, comprehension, oral and written expression. In addition, he must use this text to identify the grammatical structures that he will develop during the same class session. We recall here, by way of illustration, a set of grammatical structures which 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 can be detailed.

| Examples of themes | Grammatical structures |
|---|---|
| Pharmaceutical industry<br>Food industry<br>The national employment agency ANEM<br>Sustainable development<br>Renewable energies<br>Biotechnology<br>The stem cells<br>Road safety<br>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>The advertisement | The subjunctive. The conditional. The imperative.<br>The past participle. 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>Comparisons, superlatives.<br>… |

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

**Evaluation method:**
Review: 100%.

**Bibliographic references**:


1. M. Badefort, Objective: International French Test, Edulang, 2006.
2. O. Bertrand, I. Schaffner, Succeeding in the TCF, Exercises and training activities, Éditions de l'école polytechnique, 2009.
3. M. Boulares, J.-L. Frerot, Progressive French grammar with 400 exercises, Advanced level, CLE International.
4. Collective, Besherelles: Grammar for all, Hatier.
5. Collective, Besherelles: Conjugation for all, Hatier.
6. M. 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 the French language at school: Grammar, Spelling and Conjugation, Hachette Education, 2005.
11. J. Bossé-Andrieu, Abridged Rules of Grammar and Spelling, Presses de l'Université du Québec, 2001.
12. J.-P. Colin, Simply French, Eyrolles, 2010.
13. Collective, French assessment test, Hachette, 2001.
14. Y. Delatour et al., Practical French grammar in 80 sheets with corrected exercises, Hachette, 2000.
15. Ch. Descotes et al., L'Exercisier: French expression for the 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 – Orthography, Larousse, 2009.

**Semester:2**
**Teaching unit: UET1.2**
**Subject 1: English Language 2**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

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

**Recommended prior Knowledge:**
Basic English.

**Contents:**
The English syllabus consists of a set of texts containing scientific and technical parts. The chosen texts must be used to study scientific and technical English and Grammar acquisition.
The texts must be selected according to the vocabulary built up, familiarization with both scientific and 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 readings:** | **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>Batteries for Foundations.<br>Suspension Bridges. | Explanation of Cause<br>Results<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 |

**Fashion rating:**
Review: 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 of the press: Vocabulary and expressions of the economic, social and political world, Fernand Nathan, 2006.

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

## Recommended prior knowledge

Mathematics 1 and Mathematics 2

## Content of the material:

**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 of the ends.

**Chapter 3: Differential equations** **2 weeks**

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

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

4.1 Numerical series. 4.2 Sequences and series of functions. 4.3 Integer series, Fourrier series.

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

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

**Chapter 6: Laplace Transformation** **2 weeks**

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

## Evaluation mode:

Continuous monitoring: 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. Piskounov, Differential and integral calculus, Volume 1, Moscow edition
6- J. Quinet, Elementary course of higher mathematics 3- Integral calculation and series, Dunod.
7- J. Quinet, Elementary course of higher mathematics 4- Differential equations, Dunod.

8- MR Spiegel, Laplace Transforms, Courses and problems, 450 Corrected exercises, McGraw-Hill.

**Semester: 3**
**Teaching unit: UEF 2.1.1**
**Subject 2:Waves and Vibrations**
**VHS: 45h00 (Class: 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 subject:

***Preamble**: This subject is split into two parts, the Waves part and the Vibrations part, which can be approached independently of the 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 sectors (Group A). While for students of Groups B and C (Civil Engineering, Mechanical Engineering and Process Engineering), it is wise 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 asked to go over all the parts of the course which require demonstrations or theoretical developments and to focus only on the application aspects. Furthermore, demonstrations can be the subject of auxiliary work to be asked of students as activities within the framework of the student's personal work. On this subject, consult the paragraph ''G- Student evaluation through continuous assessment and personal work'' present in this training offer.*

**Part A: Vibration**

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

1.1 Lagrange equations for a particle
1.1.1 Lagrange equations
1.1.2 Case of conservative systems
1.1.3 Case of speed-dependent friction forces
1.1.4 Case of an external force depending on time
1.2 System with several degrees of freedom.

**Chapter 2: Free oscillations of systems with one degree of freedom** **2 weeks**

2.1 Undamped oscillations
2.2 Free oscillations of damped systems

**Chapter 3: Forced oscillations of systems with one degree of freedom 1 week**

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

**Chapter 4: Free oscillations of systems with two degrees of freedom** **1 week**

4.1 Introduction
4.2 Systems with two degrees of freedom

**Chapter 5: Forced oscillations of systems with two degrees of freedom 2 weeks**
5.1 Lagrange equations
5.2 Mass-spring-damper 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 General and basic definitions
1.2 Propagation equation
1.3 Solution of the propagation equation
1.4 Sinusoidal traveling wave
1.5 Superposition of two progressive sinusoidal waves

**Chapter 2: Vibrating strings 2 weeks**
2.1 Wave equation
2.2 Harmonic traveling waves
2.3 Free oscillations of a string of finite length
2.4 Reflection and transmission

**Chapter 3: Acoustic waves in fluids 1 week**
3.1 Wave equation
3.2 Speed of sound
3.3 Sinusoidal traveling 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

## Evaluation mode:
Continuous monitoring: 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 (Class: 1h30, tutorial: 1h30)**
**Credits:4**
**Coefficient:2**

## Teaching objectives:

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

## Recommended prior knowledge

Notions of materials physics and fundamental electricity.

## Content of the material:

*The number of weeks displayed are indicated for information purposes only. It is obvious that the course manager is not required to strictly respect this dimensioning 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 of the physics of semiconductors: Definition of a semiconductor, Crystalline Si, Doping concepts, N and P semiconductors, PN junction, Constitution and operation of a diode, direct and reverse polarization, Current characteristic -voltage, static and variable regime, Equivalent diagram. Applications of diodes: Single and double alternation rectification. Voltage stabilization by the 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, Rest point, etc. Study of the three fundamental assemblies: EC, BC, CC, Equivalent diagram, Gain in voltage, Gain in decibels, Bandwidth, Current gain, Input and output impedances. Study of multi-stage LF amplifiers in static and dynamic conditions, connection 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, Characteristics of the op-amp,Basic configurations of the operational amplifier: Inverter, Non-inverter, Adder, Subtractor, Comparator, Follower, Derivator, Integrator, Logarithmic, Exponential, etc.

**Evaluation mode:**
Continuous monitoring: 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: The Components, Volume 1, McGraw-Hill, 1982.
5. P. Horowitz, Treatise on Analogue and Digital Electronics, Volumes 1 and 2, Publitronic-Elektor, 1996.
6. M. Ouhrouche, Electric circuits, Presses international Polytechnique, 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 (Class: 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 electricity concepts.

## Content of the subject:

**Chapter 1. Mathematical reminders about complex numbers (NC) (1Week)**

Cartesian form, conjugated 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 NC electricity.

**Chapter 2. Reminders on the fundamental laws of electricity (2 weeks)**

Continuous regime: electric dipole, association of dipoles R, C, L.
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 powers. Three-phase systems: Balanced and unbalanced (symmetrical components) and electrical powers.

**Chapter 4.Magnetic circuits (3 weeks)**

Magnetic circuits in sinusoidal alternating regime. Self and mutual inductances. Magnetic electrical analogy.

**Chapter 5. Transformers (3 weeks)**

Ideal single-phase transformer. Real single-phase transformer. Other transformers (insulation, impulse, autotransformer, three-phase transformers).

**Chapter 6.Introduction to electrical machines (3 weeks)**

General information on electrical machines. Principle of operation of the generator and the engine. Power balance and efficiency.

## Evaluation mode:

Continuous monitoring: 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. Fouille,Electrotechnics for the Use of Engineers, 10th edition, Dunod, 1980.
3. C. François, Electrical engineering, Ellipses, 2004
4. L. Lasne, Electrotechnique, 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, Electric Machines - Volume 1, Volume 2, Editions MIR, Moscow, 1979.
8. M. Jufer, Electromechanics, Presses polytechniques et universitaire romandes- Lausanne, 2004.
9. A. Fitzgerald, Electric Machinery, McGraw-Hill Higher Education, 2003.
10. J. Lesenne, Introduction to in-depth electrical engineering. Technique and Documentation, 1981.
11. P. Maye, Industrial electric motors, Dunod, 2005.
12. S. Nassar, Electric circuits, Maxi Schaum.

**Semester:3**
**Teaching unit: UEM2.1**
**Subject 1:Probability and statistics**
**VHS: 45h00 (Class: 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 over a finite universe and random variables.

## Recommended prior knowledge

Mathematics 1 and Mathematics 2

## Material content:

**Part A: Statistics**

**Chapter 1: Basic Definitions** **(1 week)**

A.1.1 Concepts of population, sample, variables, modalities
A.1.2 Different types of statistical variables: qualitative, quantitative, discrete, continuous.

**Chapter 2: One-variable statistical series** **(3 weeks)**

A.2.1 Number, Frequency, Percentage.
A.2.2 Cumulative number, Cumulative frequency.
A.2.3 Graphical representations: bar chart, circular chart, bar chart. Polygon of numbers (and frequencies). Histogram. Cumulative curves.
A.2.4 Position characteristics
A.2.5 Dispersion characteristics: extent, variance and standard deviation, coefficient of variation.
A.2.6 Shape characteristics.

**Chapter 3: Statistical series in two variables** **(3 weeks)**

A.3.1 Data tables (contingency table). A cloud of dots.
A.3.2 Marginal and conditional distributions. Covariance.
A.3.3 Linear correlation coefficient. Regression line and Mayer line.
A.3.4 Regression curves, regression corridor and correlation ratio.
A.3.5 Functional fit.

**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.2.3Probable spaces
B.2.4General probability theorems

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

B.3.1Conditioning,
B.3.2Independence,
B.3.3Bayes formula.

**Chapter 4: Random variables** **(1 week)**
B.4.1Definitions and properties,
B.4.2Distribution function,
B.4.3Expectation,
B.4.4Covariance and moments.

**Chapter 5: Usual discrete and continuous probability laws** **(3Weeks)**
Bernoulli, binomial, Poisson, ... ; Uniform, normal, exponential,...

## Evaluation mode:

Continuous monitoring: 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 calculation and statistics. Handout ENSTA, 2008.
3. W.Feller. an Introduction to Probability Theory and its Applications, Volume 1. Wiley & Sons, Inc., 3rd edition, 1968.
4. G. Grimmett, D. Stirzaker, Probability and Random Processes, Oxford University Press, 2nd edition, 1992.
5. J. Jacod and P. Protter, Probability Essentials, Springer, 2000.
6. A. Montfort. Mathematical statistics course. Economica, 1988.
7. A. Montfort. Introduction to statistics. Polytechnic School, 1991

**Semester:3**
**Teaching unit: UEM2.1**
**Subject 2:Computer science 3**
**VHS: 10:30 p.m. (TP: 1:30 a.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 digital methods in S4.

## Recommended prior knowledge:

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

## Content of the subject:

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

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

**Lab 2: Script Files and Types of Data and Variables (2 weeks)**

**TP 3: Reading, displaying and saving data (2 weeks)**

**TP 4: Vectors and matrices (2 weeks)**

**TP 5: Control instructions (for and while loops, if and switch instructions)(2 weeks)**

**Lab 6: Function files (2 weeks)**

**TP 7: Graphics (Management of graphic windows, plot) (2 weeks)**

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

## Evaluation mode:

Continuous control: 100%.

## Bibliographic references:

1. Jean-Pierre Grenier,Getting started in algorithms with MATLAB and SCILAB,Ellipses,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 scientific preparatory classes 1st and 2nd years, Ellipses, 2010.

**Semester:3**
**Teaching unit: UEM 2.1**
**Subject 3:Electronics and electrical engineering TP**
**VHS: 10:30 p.m. (TP: 1:30 a.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 material:

The TP teacher is required to carry out at least 3 Electronics TPs and 3 Electrical Engineering TPs from the list of TPs offered below:

**Electronics TP 1**
**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.

**Electrotechnical TP 1**
**TP 1:**Single-phase voltage and current measurement
**TP 2:**Three-phase voltage and current measurement
**TP 3:**Three-phase active and reactive power measurement
**TP 4:**Magnetic circuits (hysteresis cycle)
**TP 5:**Transformer testing
**TP 6:**Electrical machines (demonstration).

## Evaluation mode:

Continuous control: 100%

## Bibliographic references:

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

**Teaching objectives**

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

**Recommended prior knowledge**

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

**Content of the subject:**

**TP1:**Spring mass
**TP2:**Simple pendulum
**TP3:**Torsion pendulum
**TP4:**Oscillating electrical circuit in free and forced mode
**TP5:**Coupled pendulums
**TP6:**Transverse oscillations in vibrating strings
**TP7:**Groove 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 TPs among the 10 offered.

**Evaluation mode:**

Continuous control: 100%.

**Bibliographic references:**

**Semester:3**
**Teaching unit: UED 2.1**
**Subject 1:State of the art of electrical engineering**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits:1**
**Coefficient:1**

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

**Recommended prior knowledge**
None

**Content of the subject:**

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

**2- Impact of Electrical Engineering on the development of society**: Advances in Microelectronics, Automation and supervision, Robotics, Telecommunications development, Instrumentation in health development, …

**Evaluation mode:**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. (Class: 1h30)**
**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 subject:

**Chapter 1:**The different energy resources

**Chapter 2:**Energy storage

**Chapter 3:**Consumption, reserves and developmentsResourceenergy

**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.

## Evaluation mode:

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. (Class: 1h30)**
**Credits:1**
**Coefficient:1**

## Teaching objectives:

This course must allow the student to acquire a fairly significant level of language capable of allowing him to use a scientific document and talk about his specialty and his sector in English, at least, with a certain ease and clarity. .

## Recommended prior knowledge:

English 1 and English 2

## Content of the material:

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

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

-Use of numbers, symbols, equations.

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

- Describe scientific experiments.

- VScharacteristics of scientific texts.

## Evaluation mode:

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 (Class: 3h00, tutorial: 1h30)**
**Credits: 6**
**Coefficient: 3**

## Teaching objectives:

The course aims to provide a global vision 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 subject:

**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)**
Sources and signals of telecommunications, Basic diagram and principles of a communication system, Transmission medium (Transmission lines: two-wire line, coaxial cable, printed lines, Waveguides, Optical fibers, Free space)

**Chapter 3. Analog transmission techniques** (4 weeks)
Mathematical reminders: Classes of signals, Examples of elementary signals, Principle of analog transmission, Filtering, Amplification, Modulation, Mixing.

**Chapter 4. Digital transmission techniques (4 weeks)**
Principle of digital transmission, Sampling, Quantification, Coding, Transmission channel.

## Evaluation method:

Continuous monitoring: 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, Electricity Treatise, 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 (Class: 1h30, tutorial: 1h30)**
**Credits:4**
**Coefficient:2**

## Teaching objectives:

Know the usual combinational circuits. Know how to design some applications of combinatorial circuits using standard tools such as truth tables and Karnaugh tables. Introduce sequential circuits through flip-flop circuits, counters and registers.

## Recommended prior knowledge

None.

## Content of the material:

*The number of weeks displayed are indicated for information purposes only. It is obvious that the course manager is not required to strictly respect this dimensioning or the arrangement of the chapters.*

**Chapter 1: Boolean Algebra and Simplification of Logical Functions 2 weeks**

Logic variables and functions (OR, AND, NOR, NAND, XOR). Laws of Boolean algebra. De Morgan's theorem. Complete and incomplete logic 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 detector and corrector codes, ascii code, etc.) , arithmetic operations in binary code.

**Chapter 3: Combinatorial transcoder circuits 2 weeks**

Definitions, decoders, priority encoders, transcoders, Cascading, Applications, Analysis of the technical sheet of a decoder integrated circuit, List of decoding integrated circuits.

**Chapter 4: Combinatorial switching circuits 2 weeks**

Definitions, multiplexers, demultiplexers, Cascading, Applications, Analysis of the technical sheet of a switching integrated circuit, List of integrated circuits.

**Chapter 5: Combinatorial comparison circuits 2 weeks**

Definitions, 1-bit, 2-bit and 4-bit comparison circuit, Cascading, Applications, Datasheet analysis of a comparison integrated circuit, List of integrated circuits.

**Chapter 6: Flip-flops 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 applications with flip-flops: Frequency divider by n, Pulse train generator, etc.
It is advisable to present the truth table, examples of timing diagrams as well as the limits and imperfections for each flip-flop.

**Chapter 7: Counters 2 weeks**

Definition, Classification of counters (synchronous, regular, irregular, asynchronous, complete and incomplete cycles). Creation of complete and incomplete synchronous binary counters, Excitation

tables of JK, D and RS flip-flops, Creation of modulo (n) asynchronous binary counters: complete, incomplete, regular and irregular. Programmable counters (start from any state).

**Chapter 8. The Registers** **1 week**

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

## Evaluation mode:

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

## Bibliographic references:

1- J. Letocha, Introduction to logic circuits, McGraw Hill Edition.
2- JC Lafont, Courses 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, Edition Dunod.
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: combinatorial logic and technology, McGraw Hill, 1987
9- C. Brie, Combinatorial and sequential logic, Ellipses, 2002.
10-JP. Ginisti, Combinatorial logic, Paris, PUF (coll. “Que sais-je?” 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 (Class: 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 subject:

**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 root mean square. 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 method, 4. Quadrature formulas.

**Chapter 5.Solving ordinary differential equations**
**(Problem of the initial condition or of Cauchy)** (2 weeks)
1. General introduction, 2. Euler method, 3. Improved Euler method, 4. Runge-Kutta method.

**Chapter 6.Direct solution method for systems of linear equations (2 Weeks)**
1. Introduction and definitions, 2. Gauss method and pivot, 3. LU factorization method, 4. ChoeleskiMMt factorization method, 5. Thomas algorithm (TDMA) for three-diagonal systems.

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

## Evaluation mode:

Continuous monitoring: 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, Digital 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. Presses Universitaires de Grenoble, 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 (Class: 1h30, tutorial: 1h30)**
**Credits:4**
**Coefficient:2**

## Teaching objectives:

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

## Recommended prior knowledge:

Basic mathematics course.

## Content of the subject:

**Chapter 1. General information about signals (3 weeks)**

Objectives of signal processing. Areas of use. 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, triangular pulse, ramp, step, sign, Dirac, etc.)

**Chapter 2. Fourier analysis (4 weeks)**

Introduction, Mathematical reminders (dot product, Euclidean distance, linear combination, orthogonal base, 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 (Temporal and Frequency Analysis).

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

Formulation of convolution product, Properties of 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. Spectral energy density and power spectral density. Wiener-Khintchine theorem. Case of periodic signals.

## Evaluation mode:

Continuous monitoring: 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 PPUR.
4. F. Cottet, “Signal processing and data acquisition, Courses and solved exercises”, Dunod.
5. B. Picinbono, “Theory of signals and systems with solved problems”, Edition Bordas.
6. Mr. Benidir,“Signal Theory and Processing, volume 1: Representation of signals and systems - Courses and corrected exercises, Dunod, 2004.
7. Mr. Benidir,“Signal Theory and Processing, volume 2: Basic methods for signal analysis and processing - Courses 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 (Class: 1h30, TP: 1h00)**
**Credits:3**
**Coefficient:2**

## Teaching objectives:

Introduce the student to techniques for 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 material:

*The number of weeks displayed are indicated for information purposes only. It is obvious that the course manager is not required to strictly respect this dimensioning or the arrangement of the chapters.*

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

Introduction, Quantity, Standard, Systems of units, Table of multiples and submultiples, Equations with dimensions, Useful formulas, Measurement precision, Measurement error, Classification of errors, Uncertainties in indirect measurements, Qualities of measuring devices, Calibration of measuring devices, Graphic symbols of measuring devices, General measuring methods (deviation, zero, resonance methods), Application exercises.

**Chapter 2. Measurement methods 6 weeks**

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

**Chapter 3. Measuring devices 4 weeks**

Introduction
**Analog measuring devices**: Classification of deflection devices, The moving frame galvanometer, Structure of the magnetoelectric ammeter, Structure of the magnetoelectric voltmeter, Operation of the alternating electrodynamic wattmeter
**Digital measuring devices:**Analog-to-digital converters (ADC), Principle of operation of a digital measuring device, Examples of digital measuring devices (The multimeter, the oscilloscope, etc.).

**TP Electrical and electronic measurements:**

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

Measure resistances 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:**

Measure 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 capacitance measurement 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:**

Measure the resistances using the following 2 methods: Phasemeter and oscilloscope.

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

Measure the resistances 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 the resistance measurement using the following methods: Star system and triangle system, balanced and unbalanced.

## Evaluation mode:

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

## Bibliographic references:

1- M. Cerr, Industrial instrumentation: T.1, Edition Tec and Doc.
2- M. Cerr, Industrial instrumentation: T.2, Edition Tec and Doc.
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, Edition Dunod.
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/apparatusdemesure

**Semester:4**
**Teaching unit: UEM 2.2**
**Subject2:TPFundamental telecommunications**
**VHS: 10:30 p.m. (TP: 1:30 a.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 subject:**

**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 Demodulation Modulation

**TP No. 4:**Principles of Modulation of PM phase demodulation

**TP No. 5:**Analog/digital and digital/analog converters

**Evaluation mode:**
Continuous control: 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, Electricity Treatise, 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:TP Combinatorial and sequential logic**
**VHS: 10:30 p.m. (TP: 1:30 a.m.)**
**Credits:2**
**Coefficient:1**

## Teaching objectives:

Consolidate the knowledge acquired during the course of the material "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 material:

*The teacher chooses from this list of practical exercises between 4 and 6 practical exercises to carry out and dealing with the two types of logic circuits (combinatorial 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 creation of usual combinatorial logic functions**
Example: switching circuits (MUX, DMUX), coding and decoding circuits, etc.

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

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

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

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

**TP8: Study and creation of registers**

## Evaluation mode:

Continuous control: 100%

## Bibliographic references:

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

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

**Subject 4:TP Numerical methods**
**VHS: 10:30 p.m. (TP: 1:30 a.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 material:

**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. Trapeze method, 3. Simpson method

**Chapter 4:Differential equations** **2 weeks**
1.Euler method, 2. Runge-Kutta methods

**Chapter 5:Systems of linear equations** **4 weeks**
1. Gauss-Jordon method, 2. Crout decomposition and LU factorization, 3. Jacobi method, 4. Gauss-Seidel method

## Evaluation mode:

Continuous control: 100%.

## Bibliographic references:

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

**Semester: 4**
**Teaching unit: UED 2.2**
**Subject: Telecommunications and Applications**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives**:
This courts aims to paint the picture ofmain concepts and applications encountered in telecommunications

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

**Content of the material:**

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

**Chapter 2: Introduction to telephony (4 weeks)**
Basic principle of telephony, Introduction to the switched telephone network (PSTN), Introduction to the Mobile (cellular) telephone network.

**Chapter 3: Introduction to radio and television broadcasting (4 weeks)**
Broadcasting, Terrestrial television networks and cable television, Satellite television.

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

**Evaluation mode:**
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**
**Subject2:Telecommunications Law**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives**:
Telecommunications law therefore constitutes one of the basic elements of the legal regime for information technologies. The course presents the foundations and essential aspects of the regulation of telecommunications networks and services. It examines in particular the rules which aim to ensure the proper functioning of the telecommunications market.

**Recommended prior knowledge:**
None

**Content of the material:**

1. Introduction: Evolution of information and communication technologies and the law relating thereto.
2. International Telecommunications Organizations.
   - International Telecommunications 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 Democratic and Popular Algerian Republic, No. 48.

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

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

**Semester:4**
**Teaching unit: UET2.2**
**Matter :Expression, information and communication techniques**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits:1**
**Coefficient:1**

## Teaching objectives:

This teaching aims to develop the student's skills, on a personal or professional level, in the field of communication and expression techniques. It also allows the student to know the techniques, tools and methods used to facilitate communications.

## Recommended prior knowledge:

Languages (Arabic; French; English)

## Material content:

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

**Chapter 2 :Improve expression ability (2 weeks)**
Take into account the Communication situation, Produce a written message, Communicate orally, Produce a visual and audiovisual message, Improve the ability to communicate in a group.

**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 of 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: Search, use and retrieval of 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, Reading 'a local HTML file, Playback of 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, …

**Chapter 7: Securing sensitive information, Protection of confidential data and Preservation of nuisances. (3 weeks)**
Backup of important data, “Informatics and freedoms” law, Internet dangers, 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.), Preventing data loss, Spam, Hoaxes, Cryptology, Electronic signature….

## Evaluation method:

Final exam: 100%.

**Bibliographic references:**

(Books and handouts, websites, etc.)


1. Jean-Denis Commeignes, 12 methods of written and oral communications – 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
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7. OnlineChantepie P. and Le Diberder A. Digital revolution and cultural industries. Landmarks. 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


**Semester: 5**
**Teaching unit: UEF 3.1.1**
**Matter:Analog communications**

**VHS: 67h30 (Class: 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. The student, through this subject, will master the concepts of analog communication and telecommunications systems. He will then be able to understand the limits as well as the advantages of such systems.

## Recommended prior knowledge:

Fundamental electronics 1, Fundamental telecommunications, signal theory.

## Material content:

**Chapter 1. Basic concepts of radiofrequency (1 week)**
Analog transmission channels, Frequency bands, bandwidth, wavelength and power, The decibel scale.

**Chapter 2. The 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, Shape of the modulated signal. Parameters (modulation index), Over-modulation, Different types of amplitude modulation (carrier-free, single-sideband), Spectra and bandwidth, Power, Modulation rate, Envelope detection demodulation, Demodulation synchronous or coherent, Demodulation and noise.

**Chapter 4. Angular modulations and demodulations and frequency and phase demodulation (2 weeks)**
Principle and parameters of frequency modulation,Shape of the FM modulated signal,Spectrum and Bessel functions, Bandwidth, FM demodulations (derivation and envelope detection), Analogy with phase modulation or PM, 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 Noise 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 RF (Radio frequency) amplifier of the input, Automatic frequency control (AFC), Control automatic gain of the RF amplifier.

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

## Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

## Bibliographic references:


1. AP Malvino, “Principles of electronics”, 6 edition, Sciences-Sup, Dunod.
2. P. Rochette, “Fundamentals in Electronics”, Technosup, Ellipses.
3. J. Millman, “Microelectronics”, Ediscience.
4. J. Encinas, “Phase-locked system (PLL): achievements 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, “Analogue 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. LE 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 (Class: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

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:

*The number of weeks displayed are indicated for information purposes only. It is obvious that the course manager is not required to strictly respect this dimensioning 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)**
Notions on random variables (discrete and continuous, probability density, mathematical expectation, variance, standard deviation, etc.), Characteristics of random processes: average, autocorrelation functions, inter-correlation, stationarity in the broad and narrow sense , ergodism, power spectral density. Specific processes (Gauss process, Poisson process, telegraph signal, pseudo-random sequences). Noises (thermal noise, shot noise, etc.)

**Chapter 3. Analysis and synthesis of analog filters (3Weeks)**
Reminders on the Laplace transform. Temporal 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, Ellipticals, etc.)

**Chapter 4.Signal Sampling (3Weeks)**
Sampling: Principles and definition (theoretical, averaging, blocking etc.). Anti-aliasing filter. Shannon condition. Restitution of the analog signal 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 algorithms of the TFD (FFT).Z transform and introduction to digital filtering (interest, equationstemporal,transfer function, classification, realization structures, etc.).

## Evaluation mode:

Continuous monitoring: 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, Courses and solved exercises”, Dunod.
5. B. Picinbono, “Theory of signals and systems with solved problems”, Edition Bordas.
6. Mr. Benidir,“Signal Theory and Processing, volume 1: Representation of signals and systems - Courses and corrected exercises, Dunod, 2004.
7. Mr. Benidir,“Signal Theory and Processing, volume 2: Basic methods for signal analysis and processing - Courses and corrected exercises, Dunod, 2004.

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

## Teaching objectives:

Any remote transmission chain using the radio channel 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, taking into account the specificities of the environments where they propagate.

## Recommended prior knowledge:

Physics 2, Waves and vibrations, Fundamental telecommunications.

## Material content:

**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 emptiness.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 environments (2 weeks)**

- Maxwell's equations and Propagation equation in a conductor.
- Skin effect.
-Reflection on a perfect conductive surface and standing waves.
-Maxwell's equations and propagation equation in adissipative medium.
- Propagation settings in onedissipative medium. Electrical characteristics of the ground.

**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. Polarized wave 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.

## Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

## Bibliographic references:


1. F. Gardiol, “Electromagnetism: Treatise on electricity”, Edition Lausanne.
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 conductive media: Exercises and corrected problems”, 1998.
8. By Josef A. Edminister, “Electromagnetism”, Dunod, 2004.
9. T. Kahan, “Hertzian waves”,Editor. 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, “Microwaves”,
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 (Class: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

The objective of this module is to familiarize the student with the basic notions 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 mainly due 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.

## Material content:

**Chapter 1. Digital transmission systems (4 weeks)**

Introduction, Standardization organizations, Transmission medium and channels, Principle of a data link General structure of a transmission chain (Digitization of information, source of information, 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, connections 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.

## Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

## Bibliographic references:

1. Tanenbaum, “Networks”, 4th edition, Prentice Hall, 2003.
2. R. Perfect, “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. Present, S. Lohier, “Transmissions and Networks, courses and corrected exercises”, Dunod.
9. P. Clerc, P.Xavier, “Fundamental Principles of Telecommunications”, Ellipses, Paris, 1998.

10. D. Battu, “Initiation to Telecoms: Technologies and Applications”, Dunod, Paris, 2002.
11. P. Rolin, G. Martineau, L. Toutain, A. Leroy,“Networks, fundamental principles“,EditingHermes, 1997.
12. G. Pujolle, “Networks and telecoms courses: 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 (Class: 1h30, TP: 1h00)**
**Credits: 3**
**Coefficient: 2**

## Teaching objectives:

Digital signal processing today requires real-time hardware implementation. Programmable circuits are at your fingertips. But their uses require perfect mastery by the specialist. The student must therefore begin by mastering the basic foundations of microprocessor systems followed by a detailed study on the operation of 16-bit microprocessor cards.

## Recommended prior knowledge:

Combinatorial and sequential logic.

## Material content:

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

**Chapter 2. Architecture of a 16-bit microprocessor (5 weeks)**
Internal architecture, Pinout, 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 exchange (2Weeks)**
General, Data exchange protocols (by testing the device status bit (polling), by interruption, by direct memory access).

**Chapter 5. Memories (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:**Control loops and structures,
**TP4:**Subroutines,
**TP5:**I/O management (serial, parallel interfacing).

## Evaluation method:

Continuous monitoring: 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, “8086-8088 microprocessors: Architecture and programming”, 8087 calculation coprocessor, Eyrolles.
5. H. Lilen, “Fundamental course of 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. Fox,P. Desgoutte,Z.Mammeriet al,“Data acquisitionFrom sensor to computer“,Technical and Engineering,Dunod/The New Factory2011 - 3rd edition - 544 pages.
13. E. Mesnard, “Industrial data; from binary to processor; digital circuit design methods“,Publisher: ELLIPSES, 2004, 316 pages.
14. O.Cauet,“Assembly language; master the code of the X86 family processors“,Publisher: Eniservices2011 424 pages.

**Semester: 5**
**Teaching unit: UEM 3.1**
**Matter:TP Waves and Propagation**
**VHS: 10:30 p.m. (TP: 1:30 a.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 subjectWaves and Propagation.

## Recommended prior knowledge:

Physics 2, Waves and vibrations, Fundamental telecommunications.

## Material content:

**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).
- Emission and reception of waves (for example: emission and reception by two 1m parallel and very close wires. The first must be connected to the input of the GBF and the second to the input of the oscilloscope).

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

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

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

Decimeter waves and microwaves, the effects linked to propagation in a metal waveguide, guided propagation devices, measurement of important parameters such as the standing wave rate (TOS) and the wavelength of the guide.

**TP4: Waves, reflection and adaptation**

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

## Evaluation method:

Continuous control: 100%

**Semester: 5**
**Teaching unit: UEM 3.1**
**Material: TPSignal processing**
**VHS: 10:30 p.m. (TP: 1:30 a.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

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.

## Material content:

**TP1:**Getting started with Matlab:Reminders on usual commands:

- Help (Matlab help), Variables, Basic operations, Character string, Display, Input/output,Files (script/function), …
- Upgradefor using Matlab toolboxes [Toolbox /Matlab, signal and Simulink].

**TP2:**Generation and display of signals

- 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.Transforms ofFourier Discrete direct (TFD) and inverse (TFD-1).Transforms ofDirect and inverse Fast Fourier (FFT, IFFT). Comparisons of calculation times between TFD and FFT in relation to the number of samples N.

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

## Evaluation method:

Continuous control: 100%

**Semester: 5**
**Teaching unit: UEM 3.1**
**Material: TPAnalog communications**
**VHS: 10:30 p.m. (TP: 1:30 a.m.)**
**Credits: 2**
**Coefficient: 1**

## Teaching objectives:

This subject allows the student to put into practice the knowledge acquired during the analog communication course by analyzing circuits, understanding the operating principle and measurement.

## Recommended prior knowledge:

Fundamental electronics 1, Fundamental telecommunications, signal theory.

## Material content:

**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 (Phase Locked Loop = PLL),Characterize the phase comparator used,Applications.

## Evaluation method:

Continuous control: 100%

**Semester: 5**
**Teaching unit: UED 3.1**
**Matter:Telephony**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

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

## Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and applications.

## Material content:

**Chapter 1. Analog switching 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. The new generations of digital telephony** **(4 weeks)**
3G and UMTS, 3.5 G, 4G, …

**Chapter 5. Telephony interconnection equipment** **(2 weeks)**
Switches, routers, interfaces, gateways

## Evaluation method:

Exam: 100%

## Bibliographic references:


1. C. Servin, “Networks and Telecoms”, Dunod, 2006.
2. G. Pujolle, “Networks and telecoms courses: 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 Que sais-je? 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”, Engineering Techniques, 2009.
11. J. Cellmer, “Cellular networks, From the GSM system to the GPRS system”, Engineering techniques, 2004.
12. A. Oumnad,“Switched Telephone Network“, Course, http: //www.oumnad.123.fr/RTCP /RTCP.pdf.
13. D. Seret et al,“NETWORKS and TELECOMMUNICATIONS“, License 3 mathematics and computer science course, 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: 1h30)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

Transmission channels and media form the central part of telecommunications systems. They often affect the transmitted signals by different types of disturbances and degradations mainly due to their characteristics. Knowing these transmission media is an absolute necessity for telecommunications students.

## Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and applications.

## Content of the material:

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

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

**Chapter 2. Electrical conductors (2 weeks)**

Coaxials, 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, main frequencies and bands or channels, satellite links.

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

Specters. Scopes.Interests and limits. Infrared sources. Visible light sources (Examples: LED and Laser). Applications.

## Evaluation method:

Exam: 100%

## Bibliographic references:

1. T. KAHAN, “Hertzian waves”,Editor. 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 notions (cables, connectors, components, protocols, networks)”, ENI Epsilon, 2012.
7. Z. Toffano, “Optoelectronics: Photonic components and optical fibers”, Ellipses, 2001.
8. DA Dealoue, “Telecommunications by optical fibers“, Sciences Technology.
9. P. Lecoy, “Communications on optical fibers“, Hermès, Lavoisier, 2014.
10. G. Barué, “Telecommunications and Infrastructure”, Ellipses, 2002.
11. D. Present, S. Lohier, “Transmissions and Networks, Courses and corrected exercises”, Edition Dunod, 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 Telecommunications, 3rd ed., 2002, 1210 p.
18. Aerospace Law: Telecommunications Satellites, Montreal, McGill University, 1982, 354 p.

**Semester: 5**
**Teaching unit: UET 3.1**
**Matter:Telecommunications sensors and measurements**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

In this module the student will learn the basic foundations of measurement systems mainly used in the field of telecommunications. He must also know the different sensors used as well as their characteristics.

## Recommended prior knowledge:

Fundamental telecommunications,Telecommunications and applications.

## Content of the material:

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

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

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

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

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

## Evaluation method:

Exam: 100%

## Bibliographic references:

1. M. Grout and P. Saloun, “Industrial instrumentation”, editionDunod, 2010.
2. G. Asch et al, “Data acquisition: From sensor to computer”, Editions Dunod.
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, “Hyperfrequences”, Presses Polytechniques Romandes, 1996.

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

## Teaching objectives:

Telecommunications systems are essentially composed of three parts, namely: the Transmitter, the Channel and the Receiver. At the transmitter and receiver level of digital telecommunications systems, several digital processing steps are carried out. The objective of this subject is to give the student the basic foundations of these numerical operations.

## Recommended prior knowledge:

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

## Material content:

**Chapter 1. Baseband digital transmission (3 weeks)**

Elements of a digital transmission chain, baseband modulation. Online Codes (Bit/Symbol Conversion and Formatting), Bipolar NRZ Code, Unipolar NRZ Code, Unipolar RZ Code, Biphase/Manchester Code, HDB3 Code (High Density Bipolar of order 3), M-ary Line Codes (Codes NRZ M-aires), Power spectral density of online codes, Criteria for choosing an online 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 filtering adapted on each of the channels then decision) .

**Chapter 3. Transmission without interference between symbols (3 Weeks)**

Effect of the Channel on the waveform of the line code, Characteristics of the Interference between symbols, Eye diagram, Condition of absence of interference between symbols, Nyquist criterion, raised cosine filter, Performance in terms error probability of an M-ary system with Nyquist filtering, Distribution of filtering between transmission and reception.

**Chapter 4. Performance for baseband transmission (3 Weeks)**

Detection of a binary signal and testing of hypotheses, maximum likelihood criterion, likelihood ratio, optimal binary receiver with two correlators, with a single correlator and based on an adapted filter. Probability of error for the case of Gaussian white noise with low pass filter and adapted filter.

**Chapter 5. Narrowband digital modulations (3 Weeks)**

Principle, Amplitude Shift Modulation (ASK), OOK Modulation, Symmetric M-ASK Modulations, Physical Realization and Performance, Phase Shift Modulation (PSK), Constellations, M-PSK Modulations, Physical Realization and Performance, Two-Way Modulation quadratic carriers (QAM), Physical realization and performance, Frequency shift keying (FSK), MSK modulation, Physical realization and performance of a binary FSK

## Evaluation method:

Continuous monitoring: 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”, éditions l'Harmattan, 2010.
4. A. Glavieux, M. Joindot, “Digital Communications”,Masson,1996.
5. A. Glavieux, M. Joindot “Introduction to digital communications“, Collection: Sciences Sup, Dunod, 2007.
6. HP Hsu, “Analog and digital communications: lessons and problems", 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 (Class: 1h30, Tutorial: 1h30)**
**Credits: 4**
**Coefficient: 2**

## Teaching objectives:

To introduce students to the technologies relating to the transmission of radio frequency waves, the different types of antennas used and transmission lines in general. On the other hand, this material aims to provide some information regarding the basic foundations of microwaves.

## Recommended prior knowledge:

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

## Material content:

**Chapter 1. Propagation and transmission lines (4 weeks)**

- Reminders: Incident wave, reflected wave and standing wave (Reflection, transmission coefficient and standing wave rate).
- 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) on the basis of three environments (Generator, Line and Load).
-The Smith chart and its use for impedance matching.

**Chapter 2.Types of transmission lines and their applications (1Semaine)**

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

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

- Radiation characteristics: Characteristic surface, Radiation diagram,Power surface density, Radiated power, Radiation intensity, Directivity, Efficiency, Gain, EIRP.
- Electrical Specifications :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 long-distance electromagnetic field of the electric doublet (Characteristic surface, and Radiation diagram, radiated power, Equivalent height, Radiation resistance).
- Calculation of the long-distance electromagnetic field of a spatially isolated dipole antenna (characteristic surface and radiation pattern, radiated power, equivalent height, radiation resistance).

**Chapter 5. Antenna Types and Their Applications (4 weeks)**

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

## Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

## Bibliographic references:

1. F. Gardiol, “Electromagnetism: Treatise on electricity”, Edition Lausanne.
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 (Class: 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 computer networks. Master the specific constraints of local networks. Choose a local network and associated equipment. Size, install, configure, diagnose a local network.

## Recommended prior knowledge

Combinatorial and sequential logic.

## Content of the material:

*The number of weeks displayed are indicated for information purposes only. It is obvious that the course manager is not required to strictly respect this dimensioning or the arrangement of the chapters.*

**VSchapter 1. Concepts on data transmission (2 weeks)**
Digital transmission systems (Introduction, standardization organizations, 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 networks (3 weeks)**
The main organizations, 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 Frame), access method: CSMA/CD, rules and laws for the Ethernet Network, Ethernet frame formats, topologies, cables and connectors. Interconnection, repeaters, concentrators, bridge, switches. Concepts 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.Address with class, Address without class, network segmentation, connectivity test (ping, tracert and pathping commands, etc.). IPv6 address, migration from IPv4 to IPv6

**Chapter 5. Wireless local networks (WIFI) (2 weeks)**
Introduction to WLAN (Wireless Local Area Network), presentation of WiFi or 802.11, features of the MAC layer. Access methods. Different topologies with and without infrastructure (or access point).

## Evaluation mode:

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

## Bibliographic references:

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

3. A. Perfect; 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 Inter éditions.
9. D. Present, S. Lohier; Transmissions and Networks, courses and corrected exercises; Dunod.
10. P. Clerc, P. Xavier; Fundamentals of Telecommunications; Ellipses, Paris, 1998.
11. D. Battu; Introduction to Telecoms: Technologies and Applications; Dunod, Paris, 2002.

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

## Teaching objectives:

Digital communication techniques and technologies have evolved significantly in recent years. Several constraints and difficulties are still posed, mainly linked to transmission channels. Therefore, to increase transmission rates and guarantee 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,Theory and signal processing,Telecommunications systems and networks.

## Content of the material:

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

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

**Chapter 3. Transmission channel (3Sweeks)**
Definition of a transmission channel, models, discrete channel without memory, causal channel, symmetrical discrete channel, erasure channel. Transition matrix, channel capacity, capacity calculation examples.

**Chapter 4. General principles of error correcting codes (4Sweeks)**
Introduction to channel coding, Reminders on linear algebra. Shannon channel coding theorems. Concepts on 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.

## Evaluation method:

Continuous monitoring: 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, "Information and coding theory",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 Corrective 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", educational collection of Telecommunication, MASSON, 1997
17. Louis Wehenkel, Information and coding theory, course at the University of Liège, 2003, http://www.montefiore.ulg.ac.be/~lwh/Info/
18. E. Roubine, "Introduction to the theory of communication. Volume III: Information Theory", collectionMASSON et Cie, 1970
19. A. Spataru, "Foundations of the theory of information transmission", presses polytechniques romandes, supplement to the electricity treaty, 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, courses and exercises", Science and Technologies collection, Technip editions, 1999
22. RG Gallager, "Information Theory and reliable communication", Wiley, 1968
23. Geneviève Jourdain, "Information Theory", DEA SIPT (INPG) course handout, 1992
24. Jean Brini, "Information Theory course", handout of ENSERG 2nd year 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 global and complementary manner. Concretely put into practice the concepts instilled during the training. Encourage a sense of autonomy and a spirit of initiative in students. Teach him to work in a collaborative setting by arousing intellectual curiosity in him.

## Recommended prior knowledge:

The entire Bachelor's program.

## Material content:

The theme of the End of Cycle Project must come from a concerted choice between the tutor teacher and a student (or a group of students: pair or even three). The content of the subject must necessarily fit with the objectives of the training and the real skills of the student (Bachelor 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 during which the students are immersed in the purpose of their project and its feasibility (bibliographic research, search for software or hardware necessary for carrying out the project, revision and consolidation of teaching having a direct link with the subject, etc.), the subject manager must take advantage of this face-to-face time to remind students of the essential content of the two subjects.Writing methodology''And ''Presentation methodology''addressed during the first two semesters of the common base.

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

- The detailed presentation of the study theme, emphasizing its interest in its socio-economic environment.
- The means implemented: methodological tools, bibliographical references, contacts with professionals, etc.
- Analysis of the results obtained and their comparison with the initial objectives.
- Criticism of the discrepancies observed 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 teacher and an examining teacher who can ask questions and thus evaluate the work accomplished on the plan. technical and that of the presentation.

## Evaluation method:

Controlcontinuous: 100%

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

## Teaching objectives:

Give the student the basic foundations of these numerical operations.

## Recommended prior knowledge:

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

## Material content:

**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, receive filter, sampling, decision and decoding.

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

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

## Evaluation method:

Continuous control: 100%

**Semester: 6**
**Teaching unit: UEM 3.2**
**Material: TP Antennas Transmission lines**
**VHS: 10:30 p.m. (TP: 1:30 a.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.

## Material content:

**TP1**:SWR measurements and adaptation of a transmission line. Measurement of frequency, power, wavelength, coupling.Measurement of the reflection coefficient in module and 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.). Checking the reciprocity of an antenna.

**TP3**:Adaptation of antennas and measurement of the reflection coefficient.

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

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

## Evaluation method:

Continuous control: 100%

**Semester: 6**
**Teaching unit: UEM 3.2**
**Matter:TP Local computer networks**
**VHS: 3:00 p.m. (TP: 1:00 a.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.

## Material content:

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

**TP2:**Implementation of a peer-to-peer network between two PCs (IP addressing, folder 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 analysis of data frames (Use of Wireshark).

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

## Evaluation method:

Continuous control: 100%

**Semester: 6**
**Teaching unit: UED 3.2**
**Matter:Optoelectronics**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

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

## Recommended prior knowledge:

Fundamental electronics 1,Fundamental telecommunications, Transmission media.

## Content of the material:

**Chapter 1. Optical fibers** **(3 weeks)**
Notions 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 an optical fiber transmission system, The transmission and reception block, EDFA optical amplifiers, The link budget.

**Chapter 5. Methods for measuring optical links** **(3 weeks)**
OTDR Reflectometer, Error Rate Measurement and Eye Diagram.

## Evaluation method:

Exam: 100%

## Bibliographic references:

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

**Semester: 6**
**Teaching unit: UED 3.2**
**Matter:Information security**
**VHS: 10:30 p.m. (Class: 1h30)**
**Credits: 1**
**Coefficient: 1**

## Teaching objectives:

In the field of telecommunications and computer networks, information security has become a major issue. Making students understand the basics of computer security and its criteria is the objective of this subject. Understanding the basic foundations of the techniques and technologies used in communications network security is also the goal of this subject.

## Recommended prior knowledge:

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

## Material content:

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

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

**Chapter 4. Switching Safety (2 weeks)**
Concepts on VLANs, "data link" layer attacks and responses.

**Chapter 5. Virtual Private Networks (VPN) (2 weeks)**
Principle of operation of a VPN, The different types of VPN, The protocols used.

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

## Evaluation method:

Exam: 100%

## Bibliographic references:

1. O. Paul, "Prevention of denials of service in public networks",Information systems security, 2003.
2. F. Raynal, "Hidden channels",Information systems security, 2003.
3. T. Noel, "Mobile IP",Information Systems Security,2002.
4. D.Trezentos, "Standard for wireless networks: IEEE 802.11",Information systems security, 2002.
5. vs.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: 1h30)**
**Credits: 1**
**Coefficient: 1**

**Teaching objectives:**

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

**Recommended prior knowledge:**

No special 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 reactive and proactive. Be made aware of entrepreneurship by presenting an overview of management knowledge useful for creating activities.

**Material content:**

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

Writing the cover letter and developing the CV, Job interview, etc., Documentary research on professions in the sector, Conducting interviews with professionals in the profession and Simulation of job interviews.

Chapter 2 - Entrepreneurship and entrepreneurial spirit: **(2 weeks)**

Getting started, Businesses 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 success factors when creating a VSE/SME

Chapter 4 – Finding a Good Business Idea: **(2 weeks)**

Creativity and innovation, Recognizing and evaluating business opportunities

Chapter 5–Lancerand Running a Business: **(3 weeks)**

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

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

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

**Evaluation method:**Review: 100%

**References :**

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

- LégerJarniou, Catherine, 2013, The entrepreneur's great 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, Editor 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 license co-sponsored by another academic establishment)

**(Official paper on the header of the university establishment concerned)**

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

The university (or academic center) hereby declares that it co-sponsors the above-mentioned license throughout the license authorization period.

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,
- Participating in seminars organized for this purpose,
- By participating in defense juries,
- By working to pool human and material resources.

SIGNATURE of the legally authorized person:

FUNCTION :

Date :

# STANDARD LETTER OF INTENT

## (If licensed in collaboration with a user sector company)

### (Official company letterhead)

**OBJECT :**Approval of the project to launch a License training course entitled:

Provided to:

The company hereby declares its willingness to demonstrate 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 educational programs,
- Participate in seminars organized for this purpose,
- Participate in defense juries,
- Facilitate as much as possible the reception of interns either as part of end-of-study theses or as part of tutored projects.

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

Mr. (or Madam)*……..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 from Administrative and Consultative Bodies

**Title of the License: Telecommunications**

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

## VI – Opinion and Visa of the Regional Conference

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