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	***Automatic***	***Automatic***

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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
January 2022

المؤسسة	الكلية/ المعهد	القسم

الميدان	الفرع	التخصص
علوم و تكنولوجيا	آلية	آلية

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:

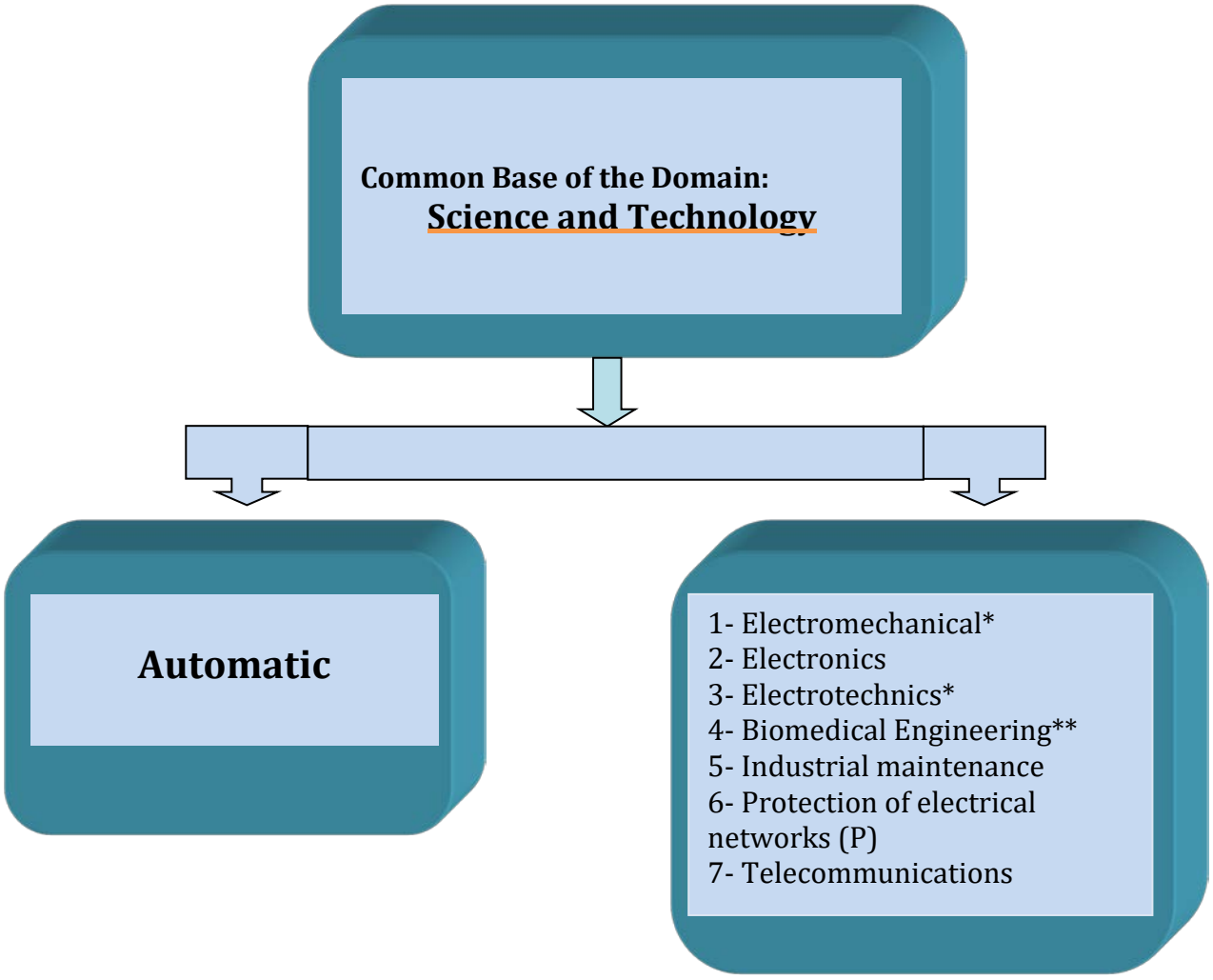
Businesses and other socio-economic partners:

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:

Automation is defined as the science of analysis and control of dynamic systems. It is a constantly evolving discipline located at the frontier of numerous disciplines which give it great importance in terms of applications.

Indeed,Modern industry abounds with industrial automation that uses a wide variety of technologies: pneumatics, electromechanics, electronics, electrotechnics, IT, and others. This is why industrial companies expect the university to provide training for specialists, with a multidisciplinary profile and mastery of IT and industrial control tools, to put their skills and know-how to the benefit of these sectors. They will then contribute to the efficiency of the company by providing the appropriate information for the right decision.

In this regard, this course in Automation aims to respond exactly to the concerns of industrial partners. Its program is designed with the aim of offering students successful, qualifying training aimed at their smooth integration into the professional sector.

This training, lasting three years, is of the academic type. It draws heavily on mathematics, physics, electronics, automation and computer science. It is structured into 6 semesters, the first two of which (common core) are reserved for basic subjects (mathematics, physics, chemistry and computer science). From the third semester, the lessons become more and more specialized. Lthe student receivesbasic knowledge in the field of automation through mastery of the most widespread control and automation techniques in the different industrial sectors and which can be summarized in three missions: control and monitoring of production systems, maintenance of installations, process automation (digital control by programmable logic controllers).

C – Targeted profiles and skills:

The primary purpose of the proposed license is to prepare the student for longer studies (Master's, Doctorate). Furthermore, the proposed course offers the possibility for students who have difficulty continuing their Master's studies to quickly integrate into working life at the end of this training.

They will then be able to act in very varied areas of industry as technical executives for the engineering and industrial maintenance services of medium or large-scale companies.
The trained students will thus be able to understand a medium-sized automation system, to model the control system, to choose the appropriate technologies, to implement classic numerical control algorithms, this in conjunction with (or possibly under the supervision of a) a designer working at a higher level in the management of the workshop or production unit.

More concretely, the knowledge acquired by these young executives will enable thembasicallyof :

- ✓ Integrate effectively into an automation team,
- ✓ Carry out studies, install, operate and repair industrial installations.
- ✓ Know how to evaluate the performance of a system.
- ✓ Propose and detail the solutions envisaged in collaboration with the engineers.
- ✓ Help define project specifications.
- ✓ Ensure project management.
- ✓ Take into account the socio-economic environment of the company by integrating safety and quality aspects.
- ✓ Help inidentifying the needs for restructuring the company's control and command processes

D – Regional and national employability potential:

The remarkable evolution of automated industries in recent years is driving an increased demand for executivesin Automatic.Skillsin this domainare in demand in all branches of industry, regardless of the particular technologies that can be found there. We can cite among others:

- ✓ Industrieschemical, petrochemical.
- ✓ Industries ofsteel industry andmetallurgy.
- ✓ Industries ofmechanical and automobile construction.
- ✓ Industrieshydraulics anddesalination of sea water.
- ✓ Processing, textile and manufacturing industries.
- ✓ Agrifoods industries.
- ✓ Pharmaceutical industries.
- ✓ Construction materials industries.
- ✓ Sectorproduction and distribution of'electric energy.
- ✓ Sectorrenewable energies.

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 :

Student autonomy, considered as a lever for success, relies largely on the personal work that he is required to do, by appropriating the resources and tools made available to him. 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

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

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

B- Internship sites and in-company training:(see agreements/conventions section)

Training place	Number of students	Training period

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 Code: UEF 1.1 Credits: 18 Coefficients: 9	Mathematics 1	6	3	3:00 a.m.	1h30		67h30	82h30	40%	60%
	Physics 1	6	3	3:00 a.m.	1h30		67h30	82h30	40%	60%
	Structure of matter	6	3	3:00 a.m.	1h30		67h30	82h30	40%	60%
Methodological EU Code: UEM 1.1 Credits: 9 Coefficients: 5	TP Physics 1	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Chemistry 1	2	1			1h30	10:30 p.m.	27:30	100%	
	Computer science 1	4	2	1h30		1h30	45:00	55:00	40%	60%
	Writing methodology	1	1	1h00			3:00 p.m.	10:00 a.m.		100%
EU Discovery Code: UED 1.1 Credits: 1 Coefficients: 1	Careers in Science and Technologies 1	1	1	1h30			10:30 p.m.	02:30		100%
E Transverse Code: UET 1.1 Credits: 2 Coefficients: 2	Ethical and deontological dimension (the foundations)	1	1	1h30			10:30 p.m.	02:30		100%

	Foreign language 1 (French or English)	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 1		**30**	**17**	**4:00 p.m.**	**4:30 a.m.**	**4:30 a.m.**	**375h00**	**375h00**		

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 Code: UEF 1.2 Credits: 18 Coefficients: 9	Mathematics 2	6	3	3:00 a.m.	1h30		67h30	82h30	40%	60%
	Physics 2	6	3	3:00 a.m.	1h30		67h30	82h30	40%	60%
	Thermodynamics	6	3	3:00 a.m.	1h30		67h30	82h30	40%	60%
Methodological EU Code: UEM 1.2 Credits: 9 Coefficients: 5	TP Physics 2	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Chemistry 2	2	1			1h30	10:30 p.m.	27:30	100%	
	Computer science 2	4	2	1h30		1h30	45:00	55:00	40%	60%
	Presentation methodology	1	1	1h00			3:00 p.m.	10:00 a.m.		100%
EU Discovery Code: UED 1.2 Credits: 1 Coefficients: 1	Careers in Science and Technologies 2	1	1	1h30			10:30 p.m.	02:30		100%

Transversal EU Code: UET 1.2 Credits: 2 Coefficients: 2	Foreign language 2 (French and/or English)	2	2	3:00 a.m.			45:00	05:00		100%
Total semester 2		**30**	**17**	**4:00 p.m.**	**4:30 a.m.**	**4:30 a.m.**	**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 a.m.	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 p.m.	27:30	100%	
	Electronics and electrical engineering TP	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Waves and vibrations	1	1			1h00	3:00 p.m.	10:00 a.m.	100%	
EU Discovery Code: UED 2.1 Credits: 2 Coefficients: 2	State of the art of electrical engineering	1	1	1h30			10:30 p.m.	02:30		100%
	Energy and environment	1	1	1h30			10:30 p.m.	02:30		100%
Transversal EU Code: UET 2.1	Technical English	1	1	1h30			10:30 p.m.	02:30		100%

Credits: 1 Coefficients: 1										
Total semester 3		**30**	**17**	**1:30 p.m.**	**7:30 a.m.**	**4:00 a.m.**	**375h00**	**375h00**		

Semester 4

Teaching unit	Titled	Credits	Coefficient	Weekly hourly volume			Half-yearly Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
				Course	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 2.2.1 Credits: 10 Coefficients: 5	Linear and continuous servo systems	6	3	3:00 a.m.	1h30		67h30	82h30	40%	60%
	Combinatorial logic and sequential	4	2	1h30	1h30		45:00	55:00	40%	60%
Fundamental EU Code: UEF 2.2.2 Credits: 8 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 Code: UEM 2.2 Credits: 9 Coefficients: 5	Electrical measurements and electronic	3	2	1h30		1h00	37:30	37:30	40%	60%
	TP Linear and continuous servo systems	2	1			1h30	10:30 p.m.	27:30	100%	
	Combinatorial logic TP and sequential	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Numerical methods	2	1			1h30	10:30 p.m.	27:30	100%	

EU Discovery Code: UED 2.2 Credits: 2 Coefficients: 2	Automated Systems Architecture	1	1	1h30			10:30 p.m.	02:30		100%
	Electrical safety	1	1	1h30			10:30 p.m.	02:30		100%
Transversal EU Code: UET 2.2 Credits: 1 Coefficients: 1	Information expression and communication techniques	1	1	1h30			10:30 p.m.	02:30		100%
Total semester 4		**30**	**17**	**1:30 p.m.**	**6:00 a.m.**	**5:30 a.m.**	**375h00**	**375h00**		

Semester 5

Teaching unit	Titled	Credits	Coefficient	Weekly hourly volume			Half-yearly Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
				Course	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 3.1.1 Credits: 10 Coefficients: 5	Control of linear systems	4	2	1h30	1h30		45:00	55:00	40%	60%
	Power electronics	4	2	1h30	1h30		45:00	55:00	40%	60%
	Modeling and identification of systems	2	1	1h30			10:30 p.m.	27:30		100%
Fundamental EU Code: UEF 3.1.2 Credits: 8 Coefficients: 4	Microprocessors and Microcontrollers	6	3	3:00 a.m.	1h30		67h30	82h30	40%	60%
	Programming in C++	2	1	1h30			10:30 p.m.	27:30		100%
Methodological EU Code: UEM 3.1 Credits: 9 Coefficients: 5	TPControl of linear systems	2	1			1h30	10:30 p.m.	27:30	100%	
	Power electronics TP	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Modeling and identification of systems	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Microprocessors and Micro controllers	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Programming in C++	1	1			1h00	3:00 p.m.	10:00 a.m.	100%	
EU Discovery Code: UED 3.1 Credits: 2 Coefficients: 2	Standards and Certification	1	1	1h30			10:30 p.m.	02:30		100%
	Renewable energies: Production and storage	1	1	1h30			10:30 p.m.	02:30		100%
Transversal EU Code: UET 3.1 Credits: 1 Coefficients: 1	English in Automatic	1	1	1h30			10:30 p.m.	02:30		100%

Total semester 5		**30**	**17**	**1:30 p.m.**	**4:30 a.m.**	**7:00 a.m.**	**375h00**	**375h00**		

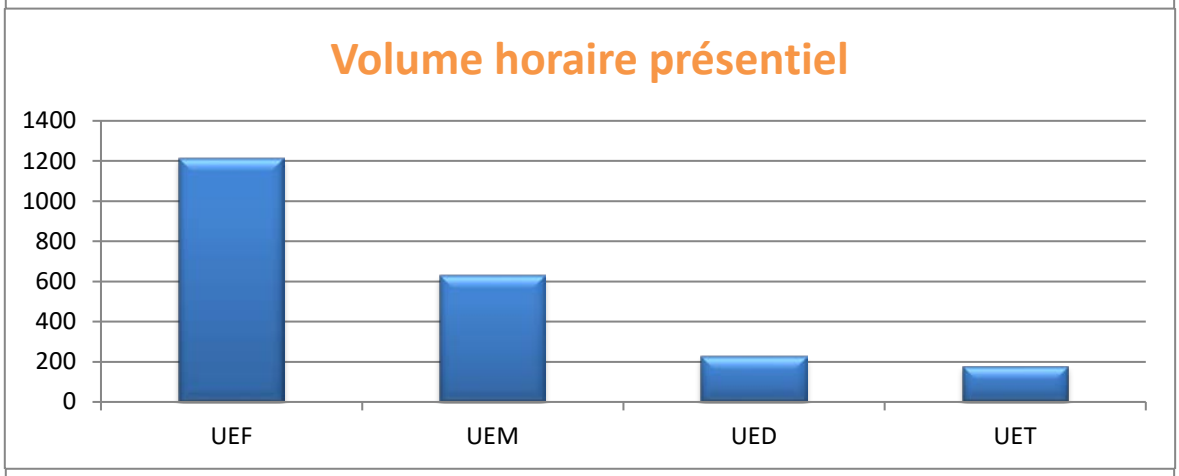
Semester 6

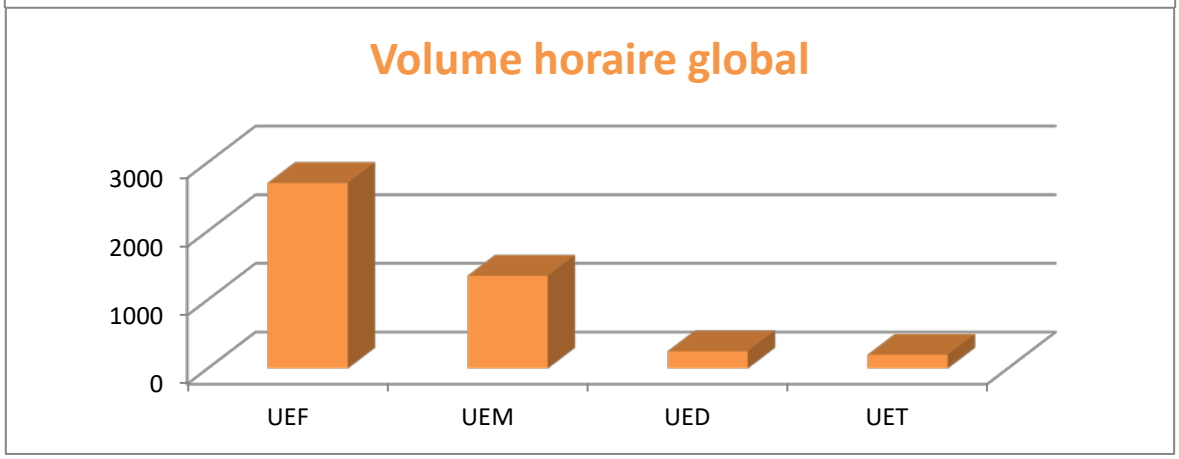
Teaching unit	Titled	Credits	Coefficient	Weekly hourly volume			Half-yearly Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation mode	
				Course	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 3.2.1 Credits: 10 Coefficients: 5	Sampled subserved systems	4	2	1h30	1h30		45:00	55:00	40%	60%
	Actuators	4	2	1h30	1h30		45:00	55:00	40%	60%
	Sensors and measurement chains	2	1	1h30			10:30 p.m.	27:30		100%
Fundamental EU Code: UEF 3.2.2 Credits: 8 Coefficients: 4	Industrial programmable controllers	6	3	3:00 a.m.	1h30		67h30	82h30	40%	60%
	Communication buses and industrial networks	2	1	1h30			10:30 p.m.	27:30		100%
Methodological EU Code: UEM 3.2 Credits: 9 Coefficients: 5	End of Cycle Project	4	2			3:00 a.m.	45:00	55:00	100%	
	TP Sensors and Actuators	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Automata program-industrial mables	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Communication bus and industrial networks	1	1			1h00	3:00 p.m.	10:00 a.m.	100%	
EU Discovery Code: UED 3.2 Credits: 2 Coefficients: 2	Automatic electrical installations	1	1	1h30			10:30 p.m.	02:30		100%
	Maintenance and reliability	1	1	1h30			10:30 p.m.	02:30		100%
Transversal EU	Entrepreneurship and business management	1	1	1h30			10:30 p.m.	02:30		100%

Code: UET 3.2 Credits: 1 Coefficients: 1										
Total semester 6		**30**	**17**	**1:30 p.m.**	**4:30 a.m.**	**7:00 a.m.**	**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: Physics 1
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- Velocity and acceleration in coordinate systems. 3- Applications: Movement of the material point in the 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 TP 1
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:
•Initiation and training sessionsfamiliarization 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.Sectors in Electronics, Telecommunications, Biomedical Engineering, Electrotechnics, Electromechanics, Optics & Precision Mechanics: **(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 Pollution The electric car The robots Artificial intelligence Nobel prize Olympic Games Sports at school The Sahara The currency The line work Ecology Nanotechnologies The optical fiber The profession of engineer The power plant Energetic efficiency The smart building Wind energy Solar energy	The punctuation. Proper nouns, Articles. Grammatical functions: The noun, The verb, The pronouns, The adjective, The adverb. The complement pronoun ''the, the, the, him, their, y, en, me, te,...'' Agreements. The negative sentence. Don't... don't, Don't... yet, Don't... again, Don't... ever, Don't... not,... The interrogative sentence. Question with ''Who, What, What'', Question with ''When, Where, How Much, Why, How, Which, Which''. The exclamatory sentence. Reflexive verbs. Impersonal verbs. The tenses of the indicative, Present, Future, past perfect, simple past, Imperfect. ...

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, Heinle Cengage 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 Heat Treatment of Steel. Lubrication of Bearings. The Lathe. Welding. Steam Boilers. Steam Locomotives. Condensation and Condensers. Centrifugal Governors. Impulse Turbines. The Petro Engine. The Carburation System. The Jet Engine. The Turbo-Prop Engine. Aerofoil.	Make + Noun + Adjective Quantity, Contents Enable, Allow, Make, etc. + Infinitive Comparative, Maximum and Minimum The Use of Will, Can and May Prevention, Protection, etc., Classification The Impersonal Passive Passive Verb + By + Noun (agent) Too Much or Too Little Instructions (Imperative) Requirements and Necessity Means (by + Noun or –ing) Time Statements Function, Duty Alternatives

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- Electric field flow. 5- Gauss's theorem. 6- Conductors in balance. 7- Electrostatic pressure. 8- Capacity 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. Le Boiteux 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. Le Boiteux & 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 TP 2
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.Climate 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 sectors: (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 the ST sectors (e.g. SIEMENS, Cisco, Henkel AG & Co, TOTAL, Peugeot, Eni SPA ...).

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 Food industry The national employment agency ANEM Sustainable development Renewable energies Biotechnology The stem cells Road safety Dams Water – Water resources Avionics Automotive electronics Electronic newspapers Carbon 14 dating Violence in stadiums Drugs: a social scourge Smoking School failure The Algerian war Social networks China, an economic power Superconductivity Cryptocurrency	The subjunctive. The conditional. The imperative. The past participle. Passive form. Possessive adjectives, Possessive pronouns. Demonstratives, Demonstrative pronouns. The expression of quantity (several, a few, enough, many, more, less, as much, etc.). Numbers and measurements. The pronouns ''who, that, where, whose''. Subordinate preposition of time. The cause, the consequence. The goal, the opposition, the condition. Comparisons, superlatives. …

The advertisement 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, Heinle Cengage 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. Chain Reaction. Reactor Cooling System. Conductor and Conductivity. Induction Motors. Electrolysis. Liquid Flow and Metering. Liquid Pumps. Petroleum. Road Foundations. Rigid Pavements. Batteries for Foundations. Suspension Bridges.	Explanation of Cause Results Conditions (if), Conditions (Restrictive) Eventuality Manner When, Once, If, etc. + Past Participle It is + Adjective + to Ace It is + Adjective or Verb + that… Similarity, Difference In Spite of, Although Formation of Adjectives 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 at a degree offreedom **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 amplifiers with several LF stages 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: Mass – spring
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 courses 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, acquisition of vocabulary, 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
Subject 1:Linear and continuous servo systems
VHS: 67h30 (Class: 3h00, tutorial: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

This course will allow the student to acquire knowledge of the theory of control of continuous linear systems as well as representation and analysis methods.. At the end of the course, students will be able to model, analyze and design simple controllers for automated systems.

Recommended prior knowledge

- Basic mathematics (Algebra, analysis,in particular the manipulation of complex values,…)
- Fundamentals of basic electronics(linear circuits)and physics.

Content of the material:

Chapter 1: General information on servo systems (2 weeks)

Overview of the history of control systems, Terminology of controlled systems (disturbance, setpoint, control, output, measurement noise, deviation, tracking, regulation, corrector, etc.),Automatic functions (monitoring/safety, servo-control/regulation), Open loop/closed loop control, Structure and organs of a control system.

Chapter 2: Laplace Transforms andRepresentation of servo systems (3 weeks)

Laplace transform of usual functions (definitions, properties, initial and final value theorem, etc.), Inverse Laplace transform (definitions, properties, etc.),Mathematical model of a system, Representation by differential equations,Representation of controlled systems by transfer functions (definition of static gain, poles, zeros of a transfer function), Block diagrams and simplification rules: series, parallel, unitary and non-unitary return systems, etc.

Chapter 3: Time Domain Analysis (2 weeks)

Transient state, steady state and notions of stability, speed and static precision, Concept of impulse response, Response of first and second order systems for typical signals, Case of higher order systems, Identification of first and second order systems order from the temporal response.

Chapter 4: Analysis of systems in the frequency domain (4 weeks)

Introduction, Graphical representation of transfer functions (Bode diagrams, Nyquist locus, Black-Nichols charts), Analysis and stability criteria (reverse criterion in the Bode/Nyquist plan, Nyquist criterion, Evans locus, criterion of Routh)

Chapter 5: Systems Summary (4 weeks)

Introduction, Synthesis specifications (stability, speed, precision), Different structures of regulators (phase advance/delay, PID, RST), Choice of regulator according to the imposed specifications, Sizing of regulators: Synthesis using empirical methods (Ziegler- Nichols, Flat, symmetrical, etc.), Synthesis by graphic methods (Evans, Bode, Black, Nyquist, etc.).

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

Bibliographic references:
1- Y. Granjon,Automatic - linear and continuous systems, Dunod 2003.
2-S. Le Ballois and P. Cordon,Automatic - linear and continuous systems, Dunod 2006.
3-K. Ogata, Modern Control Engineering, Prentice Hall, 2010.
4- B. Kuo et al., Automatic Control Systems, John Wiley and Sons, 2008.

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: Combinational 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. Choeleski MMt 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. Energy spectral 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 the 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
Subject 2:TP Linear and Continuous Servo Systems
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives

Introduce students to put into practice the knowledge acquired on the theory of control systems. Teach the student the use of tools to model, analyze and design simple controllers for automated systems.

Recommended prior knowledge:

Linear and continuous servo systems. Fundamentals of electronics and physics

Content of the material:

The practicals can be organized into three parts: modeling/simulation, analysis and synthesis. The content of this module and the number of practical exercises to be carried out can be adjusted according to the equipment available in the laboratory. Simulations can be used to reinforce practice tests or to fill material gaps.

Part 01: PC simulation practical work (theoretical part)

TP N°1: Solving differential equations representing the dynamics of systems (electrical, mechanical and electromechanical) using Matlab software

Using Matlab software commands such as: ode45, ode123, Rang-Kutta order4, …etc.

TP N°2: Determining the transfer function of a system and plotting the temporal and frequency responses

Using commands*: Ident, Step, Impulse, Lsim, Ltiview, Bode, Nyquist,…*etc*.*

TP N°3: Improving the performance of a looped system - Introduction to Simulink software

Define Simulink tools such as: scope, source, comparator, step, pure delay, transfer function, disturbance, measurement noise, etc.
Use the RLTOOL command to synthesize the controller that stabilizes the transfer function.
Improve the performance of the looped system by adding poles and zeros in the corrector provided by the RLTOOL command.

Part 02: Practical validation

TP No. 1: Modeling and identification of an RLC electrical circuit using a first/second order model (random excitation by a voltage generator and measurement of the output voltage by a voltmeter). Same thing for the two NTC and PT100 temperature sensors.

TP No. 2: Study of a PID corrector made using operational amplifiers.

TP No. 3: Temperature regulation by ALL or NOTHING.

TP No. 4: Radjustment of a first order system by a P and PI regulator.

TP No. 5: Adjustment of a second order system by a P, PI and PID regulator.

TP No. 6: Adjusting the speed of a DC motor.

Evaluation mode:
Continuous control: 100%.

Bibliographic references:
1-S. Le Ballois,P. Codron,Automatic: Linear and continuous systems,Dunod 2006.
2- P. Prouvost, Automatic - Control and regulationCourses, exercises and corrected problems, Dunod 2010.
3- E. Godoy, Industrial regulation Modeling tools, methods and control architectures,Dunod.

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 1:Architecture of Automated Systems
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

Introduce students to Industrial Automated Systems (AS) and their Architecture. Know the constituent bodies of SAs as well as their operating principles. This program is an introduction to different subjects of semesters five and six where they will be detailed.

Recommended prior knowledge:

Content of the material:

Chapter 1: Introduction **(2 weeks)**

Overall approach to a production system, Objectives of production automation, Profitability of automation, Example of application.

Chapter 2: Structure of a production system **(3 weeks)**

Breakdown of the OPERATIVE PART and CONTROL PART (PO – PC), Elements of the PO and the PC,Effector, Actuator (electric motor, pneumatic cylinder, etc.), Pre-Actuator (contactors, relays, pneumatic distributors), Sensor (digital sensors, analog sensors, transmitters), Processing (PLC, industrial PC, etc.), Dialogue (HMI, SCADA ...).

Chapter 3: Order part (**2 weeks**)

PC type, Architecture, Programming

Chapter 4: Architecture of production systems **(3 weeks)**

Autonomous machines, Online associated machines, Production cell with centralized control, Cell with decentralized and coordinated control, Flexible cell with distributed and hierarchical control.

Chapter 5: Network concepts **(2 weeks)**

Industrial local networks, Computer networks.

Chapter 6: Presentation and case study **(3 weeks)**

Electrical distribution, petrochemical, thermal process regulation, ovens, etc.

Noticed :

Favor an animated presentation using slides and videos,
Plan and organize a visit to the industrial site, if possible.

Evaluation mode: Final exam: 100%.

Bibliographic references:

1-Industrial process control architectures Engineering technology AG3510
2- Automation and agri-food industrial processes Engineering technology

F1290
3- Industrial programmable logic controllers Engineering technology S8015
4- Jean-Pierre THOMESSE, Industrial local networks - Concepts, typology, characteristics Engineering technologyRef.S7574v1

Semester: 4
Teaching unit: UED 2.2
Subject 2:Electrical safety
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

The objective of the material is to inform the future licensee on the nature of electrical accidents, the methods of rescue of electrical accidents and to give him sufficient knowledge to enable him to best dimension the protection devices of the equipment and the personnel involved in industry and other areas of use of this equipment.

Recommended prior knowledge:

Electricity concepts.

Material content:

Chapter 1:Electrical risks (2 weeks)

Definition and purpose of occupational safety, Legend and history of electrical risk, Standards body, Statistics on electrical accidents.

Chapter 2:Nature of electrical accidents and dangers of electric current (3 weeks)

Classification (direct and indirect actions of electric current), Impedance of the human body, Parameters of influence of human current, Pathophysiological effects of the passage of electric current, Electrification without loss of consciousness, Electrification with loss of consciousness (ventricular fibrillation).

Chapter 3:Protective measures (6 weeks)

Introduction, Protection of people, Regulations, Safety measures, Work without voltage, Work near electrical installations, Individual and collective protection, Protection against direct and indirect currents, Safety voltage, Earth connection diagram (SLT), Effects of electric and magnetic fields, Equipment protection, Protective devices (types and reliability of devices), LV, MV and HV indoor installations, LV mobile devices, Checks and controls.

Chapter 4:Safety measures against indirect effects of electric current (2 weeks)

Fires, Harmful materials, Explosions, Noise and vibrations (Definition, standards and techniques for combating noise).

Chapter 5:Relief measures and care (2 weeks)

Attitude to be observed in the event of electrical accidents, First aid, Assisted ventilation (mouth to mouth and Sylvester methods), External cardiac massage, Burn care.

Evaluation mode:

Final exam: 100%.

Bibliographic references:

1-V. Semeneko, General Requirements for Technical Safety in a Company, University of Annaba, 1979.
2- A.Novikov, Work Protection Course Book, University of Annaba, 1983.
3- Edgar Gillon, Electrotechnics Course, Dunod, Paris 1966.
4- Encyclopedia of Industrial Sciences, Quillet, Paris, 1983.
5- LG Hewitson, Guide to the protection of electrical equipment, Dunod, 2007.

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
6. Baron GL, and Bruillard E. Computer science and its users in education. Paris, PUF, 1996. ISBN-10: 2130474926; ISBN-13: 978-2130474920
7. OnlineChantepie P. and Le Diberder A. Digital revolution and cultural industries. 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
Subject 1: Control of linear systems

VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

This module is a consolidation of the knowledge acquired in the second year and allows mastery of the representation of dynamic systems and their properties in the state space as well as the acquisition of the main methods of analysis and synthesis of control systems. .

Recommended prior knowledge:

Basic mathematics. Scontinuous and sampled linear systems.

Material content:

Chapter 1.Calculation of controllers in the frequency domain (4 weeks)
Frequency response and frequency properties of controllers (P, PI, PID, PD, phase lead, phase delay, phase lead), Specification in the frequency domain (gain and phase margin, resonance factor, bandwidth, their interpretations), Calculation of controllers using the Bode diagram, Settings using the Black-Nichols chart.

Chapter 2.System state representation (2 weeks)
Introduction, Concepts (state, state variables, etc.), State representation of continuous linear systems, State representation of discrete systems, Canonical forms, State representation of nonlinear systems, Linearization.

Chapter 3.Analysis of systems in state space (3 weeks)
Resolution of state equations and transition matrix, Transition matrix calculation methods, Modal analysis (diagonalization), Stability, Concepts of controllability and observability (definitions and test methods).

Chapter 4.Control by status feedback (3 weeks)
Formulation of the pole placement problem by state feedback, Calculation methods for monovariable systems, Case of multivariable systems, Implementation.

Chapter 5.Summary of state observers (3 weeks)
Introduction, Deterministic observers (Luenberger) and calculation methods, Reduced observers, Stochastic observers (Kalman filter).

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Philippe de Larminat, “Automatic: Control of linear systems”, Hermès Lavoisier, 1996.
2. Hubert Egon, “Sampled linear servos and state representation”, Methods, 2001.
3. Luc Jaulin, “State representation for modeling and control of systems”, Lavoisier, 2005.
4. Robert L. Williams, Douglas A, “Lawrence,Linear State-Space Control Systems», Published by John Wiley & Sons, 2007.
5. R. Longchamp, “Numerical control of dynamic systems”, Presses Polytechniques et Universitaires Romandes, 1995.
6. GF Franklin, JD Powell, LM Workman, “Digital control of dynamic systems,” Addison-Wesley Series in Electrical and Computer Engineering: Control Engineering, 1990.
7. KJ Aström, B. Wittenmark, “Computer controlled systems: theory and design”, Prentice-Hall, 1984.
8. RH Middleton, GC Goodwin, “Digital control and estimation: a unified approach”, Prentice Hall, 1990.

Semester: 5
Teaching unit: UEF 3.1.1
Subject 2: Power electronics
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Know the basic principles of power electronics, Know the operating principle and use of power components, Master the operation of the main static converters, Acquire the basic knowledge for a technical choice depending on the field of application a power converter.

Recommended prior knowledge

Fundamental electronics1, Fundamental electrical engineering1.

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. Introduction to power electronics 3weeks

Introduction to power electronics, its role in electrical energy conversion systems.Introduction to static converters.Classification of static converters (according to switching mode, depending on conversion mode). Non-sinusoidal periodic quantities (rms values, averages, form factor, ripple rate).

Chapter 2. Alternating current – direct current converters 3weeks

Power elements (diodes and thyristors),Single-phase rectification, load type R, RL, RLE., Rectifiers-three-phase, load types R, RL, RLE.Analysis of the switching (encroachment) phenomenon in uncontrolled and controlled static rectifier converters.

Chapter 3. AC-AC converters 3weeks

Power elements (triacs with a quick reminder of the diodes and thyristors),Single-phase dimmer, with R, RL load. Principle of the single-phase cycloconverter

Chapter 4. DC-DC converters 3weeks

Power elements (GTO thyristor, bipolar transistor, MOSFET transistor, IGBT transistor),Chopper and booster chopper, withload R, RL and RLE.

Chapter 5. Direct current - alternating current converters 3weeks

Single-phase inverter, half-bridge and bridge mountingwith R and RL load.

Evaluation mode:

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

Bibliographic references:

1. L. Lasne, “Power electronics: Courses, case studies and corrected exercises”, Dunod, 2011.
2. P. Agati et al. “Cheat sheet: Electricity-Electronics of control and power-Electro-technical”, Dunod, 2006.
3. J. Laroche, “Power electronics – Converters: Courses and corrected exercises”, Dunod, 2005.
4. G. Séguier et al. “Power electronics: Courses and corrected exercises”, 8th edition; Dunod, 2004.
5. D. Jacob, “Power electronics - Operating principle, sizing”, Ellipses Marketing, 2008.
6. G. Séguier, “Power electronics, basic functions and their main applications”, Tech et Doc.
7. H. Buhler, “Power electronics”, Dunod

8. CW Lander, “Power Electronics”, McGraw-Hill, 1981
9. H. Buhler, “Electronics of Adjustment and Control; Treatise on electricity.
10. F. Mazda, “Power Electronics Handbook: Components, Circuits and Application”, 3rd Edition, Newness, 1997.
11.R. Chauprade, “Controls of alternating current motors (Power electronics)”, 1987.
12.R. Chauprade, “Direct current motor controls (power electronics)”, 1984.

Semester: 5
Teaching unit: UEF 3.1.1
Subject 3: Modeling and identification of systems
VHS: 10:30 p.m. (Class: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

The objective of this teaching is the presentation of fundamental notions and basic methods which allow an automation engineer to develop representation models describing the input-output behavior of a process to be controlled with the aim of developing an efficient regulator. .

Recommended prior knowledge:

Basic notions in mathematics and controlled systems.

Material content:

Chapter 1.Modelization (3 weeks)
Representation model, Knowledge model (modeling of mechanical, electrical, fluidic, thermal systems, etc.).

Chapter 2.Reminder of basic methods in Automatic (4 weeks)
Temporal response of a system, Direct identification from the temporal response, Frequency approach.

Chapter 3.Principle of model adjustment (4 weeks)
Linear model in relation to the parameters, Minimization of the adjustment criterion and calculation of the optimal solution, Matrix writing of the least squares method.

Chapter 4.Least-method analysissquares (3 weeks)
Estimation bias, Variance of the estimate, Maximum likelihood estimator, Rejection of outlier measurements.

Chapter 5.Recursive least squares (1 week)
Principle of recursive calculation, Implementation of the recursive method, Weighting factor, forgetting factor.

Evaluation method:

Review: 100%.

Bibliographic references:

1. Jean-François Massieu, Philippe Dorléans, “Modelling and analysis of linear systems”, Ellipses, 1998.
2. Pierre Borne, Geneviève Dauphin-Tanguy, Jean-Pierre Richard, “Modeling and identification of processes”, Technip, 1992.
3. Ioan D. Landau, “Identification of systems”, Hermès, 1998.
4. E. Duflos, Ph. Vanheeghe, “Estimation Prediction”, Technip, 2000.
5. R. Ben Abdenour, P. Borne, M. Ksouri, M. Sahli, “Identification and digital control of industrial processes”, Technip, 2001.

Semester: 5
Teaching unit: UEF 3.1.2
Subject 1: Microprocessors and Microcontrollers
VHS: 67h30 (Class: 3h00, tutorial: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

This course allows students to understand how microprocessors, their peripherals and their interfacing work. It also allows them to become familiar with the different types of computers used in industrial installations.

Recommended prior knowledge:

Combinatorial and sequential logic, programming concepts.

Content of the subject:

Chapter 1.Architecture of a microprocessor (2 weeks)
Introduction to microprocessor-based systems, External architecture of a microprocessor, Internal architecture of a microprocessor.

Chapter 2.Introduction to the instruction set and interrupts (4 weeks)
The instruction set, The mnemonic code, The addressing modes, The interrupts.

Chapter 3.Memories (2 weeks)
Introduction, Memory technology: ROM, RAM, Refreshing techniques, Memory characteristics, Addressing modes.

Chapter 4.Interfaces (2 weeks)
Serial interface, Parallel interface.

Chapter 5.The microcontroller (5 weeks)
General information on the microcontroller, Architecture of the microcontroller, Peripherals, Interrupts, Programming microcontrollers, Putting it into practice.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. A. Farouki, T. Laroussi, T. Benhabiles, "8086 Microprocessors", Univ. Constantine.
2. JY Haggège, "Microprocessor: Course support", INSET, 2003.
3. Lilen, "Fundamental course of microprocessors", Dunod, 1993.
4. Alain-Bernard Fontaine, "The 16-bit Microprocessor-8086-8088", 2nd edition, Computer manuals", Masson, 1997.
5. Michel Aumiaux, "16-bit microprocessors", 1997.
6. J. Crisp, "Introduction to microprocessors and microcontrollers", Elsevier, 2nd edit 2004.
7. Christian Tavernier, "PIC 10, 12, 16 microcontrollers, Description and implementation", Dunod, 2007.
8. Pascal Mayeux, "Learn Mid-Range PIC programming through experimentation and simulation", Dunod, 2010.

Semester: 5
Teaching unit: UEF 3.1.2
Subject 2: Programming in C++
VHS: 10:30 p.m. (Class: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

This course will allow the student to become familiar with programming languages and in particular the C++ language.

Recommended prior knowledge:

Basics in mathematics, Algorithmic notions, Numerical methods, Binary logic.

Material content:

Chapter 1.Presentation of theC++ language (1 week)
History, C++ development environment (object creation, compilation, debugging, execution, etc.).

Chapter 2.Basic syntax in C++ language (1Week)
Instructions Comments, Keywords and reserved words – Constants and variables, Fundamental types Operators (unitary, binary, priority, etc.).

Chapter 3.Conditional Structures and Loops (2 weeks)
If/else, Switch/case, for loop, while loop, do/while loop.

Chapter 4.Entries exits (2 weeks)
Output flow for display, Keyboard input flow, Case of character strings,Lhe files.

Chapter 5.Pointers and Arrays (2 weeks)
Pointers, References, Static arrays, Arrays and pointers, Dynamic arrays, Multidimensional arrays.

Chapter 6.Functions (2 weeks)
Prototype of a function, Definition of a function, Calling a function, Passing arguments to a function, Overloading a function, Files.

Chapter 7.Object-oriented programming in C++ (5 weeks)
Introduction, Concept of classes and objects, Inheritance, Special methods (constructors, destructors, etc.), Procedural or structured programming, Programming by objects.

Evaluation method:

Review: 100%.

Bibliographic references:

1. Bjarne Stroustrup, Marie-Cécile Baland, Emmanuelle Burr, Christine Eberhardt, “Programming: Principles and practice with C++”, Edition Pearson, 2012.
2. Jean-Cédric Chappelier, Florian Seydoux, “C++ through practice. Collection of corrected exercises and memory aids”, PPUR Edition: 3rd edition, 2012.
3. Jean-Michel Léry, Frédéric Jacquenot, "Algorithmics, applications to C, C++ languages in Java", Edition Pearson, 2013.
4. Frédéric DROUILLON, “From C to C++ - From procedural programming to objects”, Eni; Edition: 2nd edition, 2014.
5. Claude Delannoy, “Programming in C++ language”, Edition Eyrolles, 2000.
6. Kris Jamsa, Lars Klander, “C++ The Programmer’s Bible”, Edition Eyrolles, 2000.
7. Bjarne Stroustrup, “The C++ Language”, Addison-Wesley Edition, 2000.

Semester: 5
Teaching unit: UEM 3.1.1
Subject 1: Practical work Control of linear systems
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 corresponding theoretical subject through practical work.

Recommended prior knowledge:

Servo systemscontinuous, Study of systems in the frequency domain and in the state space.

Material content:

TP1: Introduction to MATLAB/Simulink

TP2: Study and synthesis of regulators in the frequency domain

TP3: State representation in canonical forms

TP4: Study and analysis of systems in state space

TP5: Study and synthesis of regulators by placement of poles

TP6: Study and synthesis of state observers

Evaluation method:

Continuous control: 100%.

Semester: 5
Teaching unit: UEM 3.1.1
Subject 2:Power electronics TP
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

The aim is to understand the operation and know the characteristics of the different types of basic converters and their applications to machines.

Recommended prior knowledge:

Power electronics course content.

Content of the subject:

TP No. 1. Uncontrolled rectifiers: single-phase and three-phase
Analyze the evolution of the voltage and current at the output of the converter with resistive and inductive loads, Analyze the evolution of the currents and voltages of the semiconductors in the two cases of resistive and inductive loads, Determine the form factor and the ripple rate.

TP No. 2. Controlled rectifiers, single-phase and three-phase
Analyze the evolution of the voltage and current at the output of the converter with resistive and inductive loads, Analyze the evolution of the currents and voltages of the semiconductors in the two cases of resistive and inductive loads, Determine the form factor and the ripple rate.

TP No. 3. Choppers, serial chopper, parallel chopper
Study the behavior of a series chopper on the inductive load and in particular determine the shape of the current absorbed by the load during operation in transient then permanent mode, Understand the operation by observing the characteristic signals of the assembly and comparing them to the results of the TD on the parallel chopper.

TP No. 4. Single-phase inverters
Study the operation of single-phase voltage inverters and on the other hand the filtering of the waveforms obtained. “Active” and “passive” filtering solutions will be discussed.

TP No. 5. Single-phase and three-phase dimmers
Study the operation of a dimmer discharging different types of loads (R and RL) and compare the different results obtained theoretically in class with practical results (formulas and chronograms).

Evaluation method:

Continuous control: 100%.

Semester: 5
Teaching unit: UEM 3.1.1
Subject 3:TP Modeling and identification of systems
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

The aim of these practical exercises is to put into practice the modeling and identification methods presented in the course.

Recommended prior knowledge:

The student must master the computer tool, in particular simulation using the Simulink toolbox of MATLAB, Systems modeling and identification course.

Content of the subject:

TP1: Introduction to MATLAB/Simulink

TP2: Simulation of a system described by the state equation and transfer function (Simulink)

TP3: Non-parametric identification by the deconvolution method

TP4: Non-parametric identification by the correlation method

TP5: Parametric identification by the Broida Method

TP6: Least squares method

Evaluation method:

Continuous control: 100%.

Semester: 5
Teaching unit: UEM 3.1.2
Subject 1: TPMicroprocessors and Microcontrollers
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Acquire the ability to implement a small system based on microcontrollers and microprocessors through knowledge of the main families and the operation of a microcontroller and its peripherals.

Recommended prior knowledge:

Basic knowledge of digital electronics (Boolean logic, logic gates, flip-flops, counters, registers), Computer architecture, Knowledge of assembly language.

Content of the subject:

TP1: Getting started with the 6809/8086 emulator

TP2: Arithmetic and logic operations on the microprocessor

TP3: Application of different addressing modes

TP4: Interruptions

TP5: Learn to program with a PIC 16F84

TP6: Control of a display (7 segments, LCD)

Evaluation mode:

Continuous control: 100%.

Semester: 5
Teaching unit: UEM 3.1
Subject 2: Practical programming in C++
VHS: 3:00 p.m. (TP: 1:00 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

This module will allow the student to put into practice and consolidate the knowledge acquired in the C++ programming module.

Recommended prior knowledge:

C++ programming module

Content of the subject:

TP 1: Familiarization with the lC++ language
(Development environment, compilation, debugging, execution…)

TP 2: Elementary syntax, ddeclaration of variables and operators

Lab 3: Conditional Structures and Loops

TP 4: Arrays and pointers

TP 5: Functions

Lab 6: Files

TP 7:Object-oriented programming in C++
Classes, Special methods (constructors, destructors, etc.), Inheritance

Evaluation method:

Continuous control: 100%.

Semester: 5
Teaching unit: UED 3.1
Subject 1: Standards and Certification
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

The objective of this course is to give the student the basic elements to understand what an industrial standard and certification is, while explaining the differences, levels and types of existing certifications and the institutions that can issue this type of certificate.

Recommended prior knowledge:

None.

Content of the subject:

Chapter 1. Introduction (1 week)
- Definitions (ISO / CEI 2 2004 guide) Standardization, norm, standard, consensus. Comments

Chapter 2. Standardization Objectives and Standardization Benefits (1 week)
- Reminder on the history of quality: from craftsmanship to the digital industry
-Quality and quality assurance
-Roles of standardization
-Advantages of a quality system (ISO 9000 for example)

Chapter 3. Commercial legislation (1 week)
-Law, decree, circular etc. regulatory text and standard
-Standardization and economic actors
Examples: the PC computer versus Apple, IBM PC versus PC compatible
-Quality control and compliance laboratories
-Border control: health, product quality, health impacts, techniqueseconomic, political (protectionism)

Chapter 4. Types of standards and organization of standardization work (2Weeks)
-Concept of voluntary standard
-Internal or local organizations: European and American organizations, Algerian organizations
- International organizations: the CGPM and the SI system, ISO, EN standards, specific electricity and telecommunications standards

Chapter 5. Development of standards, standardization and security (3 weeks)
-Manufacturing of standards: case of Afnor and Ianor, organization and functioning of Algerian standardization, process of developing Algerian standards
- Main legal texts relating to standardization in Algeria
-Standardization and security
-Applications to home electrical safety:
- Creation of a compliant domestic electrical installation (example of the nfc18510 standard): distribution of circuits (depending on their use), choice of wire sections and line circuit breakers.
- Creation of the earth connection according to standards

Chapter 6. Certification (4 weeks)
-Accreditation
-Certification

-Different types of certification most common in Algeria (and partly financed by the state)
-Certification process

Chapter 7. ISO 9000 standards (2 weeks)
-Description
-The ISO 9000 family
- Fields of application of the different ISO 9000 standards
- Important notes on ISO 9001:2015 and ISO 9004:2015

Evaluation method:

Review: 100%.

Bibliographic reference:

1. Robert Obert, "Practice of IFRS standards, Comparison with French rules and US GAAP", Dunod, 2004.
2. Daniel Boeri, Mastering quality: everything about certification and total quality, Editions Maxima, 2003, p. 26. (ISBN 2840013134)
3. ISO 9000:2015 standard "Quality management system – Essential principles and vocabulary"
4. Standard, ISO 9001:2015 "Quality management system – Requirements
https://fr.wikipedia.org/wiki/S%C3%A9rie_des_normes_ISO_9000
5. Appendix D: accreditation, retraining, ED6127 standard: general training and retraining plan for accreditation in the nfc18510_inrs_habilitation standard.
6. 2014 catalog of Algerian standards pdf document 447 pages (free download)
http://www.ianor.dz/Site_IANOR/Catalogue.php?id=8
7. List of Organizations accredited by Algerac: certification, inspection, testing-analysis, etc. (updated 09/14/2017)

Semester: 5
Teaching unit: UED 3.1
Subject 2: Renewable Energy: Production and storage
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

This course allows the student to know the principles of electricity production from renewable energies, in order to be able to propose renewable alternatives for the production of electrical energy.

Recommended prior knowledge:

Energy and environment courses

Content of the subject:

Chapter 1.General information on energy **(3 weeks)**
Definition, measurement, power and energy.

Chapter 2.The different types of energy and their transformation **(3 weeks)**

Chapter 3.Main sources of electrical energy production **(3 weeks)**
Fossils and renewables.

Chapter 4.Principle of production from solar and wind **(2 weeks)**

Chapter 5.Autonomous energy sources with storage systems **(4 weeks)**
Batteries, capacitors, others.

Evaluation method:

Review: 100%.

Bibliographic references:

1. Jean-Christian Lhomme, Alain Liébard, "Renewable energies", Delachaux & Niestlé, Edition: 2nd edition, 2004.
2. Leon Freris and David Infield, "Renewable energies for electricity production", Dunod, 2013.
3. Philippe Terneyre, "Renewable energies: Implementation contracts: Implementation of production units, suspensive clauses, contract models", Sa Lamy, April 2010.
4. Michel Lavabre and Fabrice Baudoin, "Exercises and problems in energy conversion: Volume 5, Renewable energies (1): wind turbines, energy management and storage", Casteilla, 2010.

Semester: 5
Teaching unit: UET 3.1
Subject 1: English in Automatic
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Describe automatic equipment, its operation and its applications, Express yourself on automation in general, Use the appropriate technology and adapted grammatical structures, Deepen your general knowledge, Understand a document of current affairs and general interest.

Recommended prior knowledge:

English 1 and 2.

Content of the subject:

Chapter 1.Reminder of English grammatical rules **(3 weeks)**
Reminder of English grammatical rules.

Chapter 2.Terminology used in the field of Automation **(3 weeks)**
Terminology used in the field of automation, The use of technical tutorials.

Chapter 3.Study of technical texts **(3 weeks)**
Study of technical texts in the field of automation, Reading of scientific or general articles.

Chapter 4.Working on various technological media **(2 weeks)**

Chapter 5.Report presentation techniques and summary briefs(4 weeks)
Preparation of a presentation on the theme of Automation. This activity allows learners to construct a presentation and deliver it in English in front of their peers. This activity has one condition: its development must be done in pairs. Which involves collaborative work. It also allows for a class debate on the theme presented.

Evaluation method:

Review: 100%.

Semester: 6
Teaching unit: UEF 3.2.1
Subject 1: Sampled servo systems
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Know the sampling and signal reconstruction techniques, Be able to study the stability and evaluate the precision of a sampled servo system, Apply some methods of analysis and synthesis of sampled servo systems.

Recommended prior knowledge:

Linear and continuous servo systems, Basic mathematics (Algebra, analysis, etc.).

Content of the subject:

Chapter 1.Structure of a digital control system (1 week)
History, Advantages and disadvantages of digital control, General structure of a digital control system, A/D and D/A conversions, Samplers/holders.

Chapter 2.Signal Sampling (2 weeks)
Modeling of A/D and D/A converters, Sampling, Signal reconstruction, Blockers, Transmittance in Z and frequency response of a BOZ (zero order blocker), Shannon sampling theorem, Practical considerations.

Chapter 3.Representation of sampled systems (3 weeks)
Definitions, Representation by difference equations, Lead/lag operators, Representation by impulse response, Z transform, Z transmittance and block/diagram simplification, Pole/zero transformation by sampling.

Chapter 4.Analysis of sampled systems (4 weeks)
Stability conditions, Temporal nature of transient signals, Stability criteria (Schur-Cohn, Jury, Routh-Hurwitz, Discrete Nyquist, Discrete Evans Locus).

Chapter 5.Summary of sampled systems (4 weeks)
Introduction, Speed, Static precision, Standard PID regulators, P-plane synthesis and digitalization, Z-plane synthesis, practical implementation of regulators.

Chapter 6.RST controller (1 week)

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. JR Ragazzini, GF Franklin, “Sampled servo systems”, Dunod, 1962.
2. Daniel Viault, Yves Quenec'hdu, “Sampled controlled systems”, ESE, 1977.
3. Christophe Sueur, Philippe Vanheeeghe, Pierre Borne, “Automation of sampled systems: course elements and solved exercises”, Technip, December 5, 2000.
4. P. Borne. GDTanguv. JP Richard. F. Rotella, I. Zambetalcis, “Analysis and regulation of industrial processes-digital regulation”, Volume 2-Editions Technip, 1993.
5. Emmanuel Godoy, Eric Ostertag, “Numerical control of systems: Frequency and polynomial approaches”, Ellipses Marketing, 2004.

Semester: 6
Teaching unit: UEF 3.2.1
Subject 2: Actuators
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

This course aims to enable learners to acquire the knowledge necessary to choose the constituents of the pneumatic, hydraulic, electrical and thermal operating parts. It will also allow them to understand the issues and the solutions available in the field of actuators in industrial automation.

Recommended prior knowledge:

Power electronics, Fundamental electronics1, Fundamental electrical engineering1.

Material content:

Chapter 1: Reminders (2 weeks)

Reminders: Operational and control parts of an automated system, Structure of an automation in pneumatic, electrical, electronic technologies

Interfaces: Interfaces modifying the parameters of a signal; Interfaces modifying the nature of a signal

Chapter2- Pneumatic actuator: The cylinder (2 weeks)

1-Description. 2-Sizing. 3-End of stroke sensors. 4-Different types of cylinders. 5-Application example

Chapter3- Take precautions for pneumatic actuator: The distributor (2 Weeks)

1-Means of piloting or control. 2-Standardized symbols. 3-Electro distributors. 4-Distribution auxiliaries. 5-Application example.

Chapter4- Electric actuator: The motor (3 weeks)

1- DC motor. 2- Single-phase motor. 3- Stepper motor. 4- Three-phase asynchronous motor.

Chapter5- Precautionary for electric actuator (2 weeks)

1-Manually controlled switching unit: the circuit breaker and the motor circuit breaker. 2-Automatically controlled switching unit: the contactor. 3-Electronically controlled switching unit: the electronic variator.

Chapter6- Reminders: the motor in an electrical installation (1 week)

1-Single-phase and three-phase power supply network. 2-Functional structure of an electrical installation (power and control parts and the different functions). 3-Sectioning or isolation function of the installation (the disconnector). 4-Protection of the power circuit (against short circuits, overcurrents, overloads). 5- Switching function. 6-Protection of the control circuit.

Chapter7- Three-phase motor control (3 weeks)

1-Stator coupling (star, triangle). 2-Rotor coupling (caged or short-circuited, wound rotor). 3-Starting modes (direct, star-delta, stator resistances, rotor resistances). 4- Braking of three-phase asynchronous motors. 5-Different types of control (manual, semi-automatic, automatic). 6- Summary example:1 - Semi-automatic control -2- Automatic control by API.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Guy Clerc, Guy Grellet, “Electric actuators, Models, Control”, Eyrolles, 1999.
2. Gérard Lacroux, “Electric actuators for robotics and servo-controls”, 1994.
3. Pierre Mayé, Industrial electric motors, Dunod, 2011.
4. J. Faisandier, “Hydraulic and pneumatic mechanisms”, Dunod 1999.
5. R. LABONVILLE, “Design of hydraulic circuits, an energy approach”, Editions de l’Ecole Poly technique de Montréal 1991.
6. P. MAYE, “Electric motors for robotics”, Dunod Paris 2000.
7. José RoldanViloria, Industrial pneumatics cheat sheet, Dunod, 2015.

Semester: 6
Teaching unit: UEF 3.2.1
Subject 3: Sensors and measurement chains
VHS: 10:30 p.m. (Class: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

After having acquired this unit, the student is expected to master the different constituent elements of a measurement chain, the basic operating principle of a sensor and the metrological characteristics which must be taken into account when using and choosing of a sensor.

Recommended prior knowledge:

General Electricity, Electrical and Electronic Measurements.

Material content:

Chapter 1. Measuring chain concepts: (1 week)
Definition, overview of an industrial regulation chain, active and passive sensors, classification of sensors.

Chapter 2. Metrological characteristics of sensors: (1 week)
Definition, calibration of a sensor, sensitivity, linearity, precision, dynamic sensitivity.

Chapter 3. Sensor conditioning circuit: (3 weeks)
MBasic configurations of operational amplifiers (inverting, non-inverting, differential, summing, etc.).Instrumentation amplifier, Isolation amplifier.Bridgesconditioners. Linearization of the static characteristics of the sensors.

Chapter 4. Temperature measurement: (3 weeks)
Introduction to thermometry, Resistance thermometry, Thermocouple, Thermistor, Pyrometer.

Chapter 5. Pressure measurement: (2 weeks)
NOToptions of pressure, absolute pressure, relative pressure and differential pressure.Piezoresistive pressure sensors

Chapter 6. Level and flow measurement: (3 weeks)
Float sensors, Doppler ultrasonic sensors

Chapter 7. Measurement of displacements and speed: (2 weeks)
Optical encoders, Incremental encoders, Variable reluctance sensors.

Evaluation method:

Review: 100%.

Bibliographic references:

1. George Asch and Coll, “sensors in industrial instrumentation”, 6th edition Dunod, 2006.
2. Pascal Dassonvalle, “Sensors: 50 exercises and corrected problems”, Dunod, 2004.
3. Georges Asch, Patrick Renard, Pierre Desqoutte, Zoubir Mammeri, Eric Chambérod, Jean Gunther, “Data acquisition”, 3rd edition, Dunod, 2011.
4. Fèrid Bélaïd, “Introduction to sensors in industrial instrumentation”, University Publication Center 2006.
5. JP Bentley, “Principles of measurement systems”, Pearson education 2005.
6. J. Niard et al, “Electrical measurements”, Nathan, 1981.

Semester: 6
Teaching unit: UEF 3.2.2
Subject 1: Industrial programmable controllers
VHS: 67h30 (Class: 3h00, tutorial: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

Identify the technological elements making it possible to control the operation and monitor an automated production system, Use the tools for specifying industrial automation in order to predict a cycle duration or a production rate.

Recommended prior knowledge:

Basic notions of calculator and programming.

Content of the subject:

Chapter 1.General information on automated systems (2 weeks)

Description of the different parts, Different types of control, Areas of application of automated systems.

Chapter 3.The Grafcet (3 weeks)

Description of Grafcet, Rules for evolving Grafcet, Basic structures, Operating and stopping modes.

Chapter 4.API architecture (3 weeks)

Automation technology, Environment of a PLC, External appearance, Internal structure, Criteria and choice of PLCs, Wiring of the PLC to the different I/Os and interfaces of a SAP (Automated Production System)

Chapter 5.Programming an API (7 weeks)

Processing of the PLC program and execution cycles, Different programming languages (Ladder or ladder, Boolean or logic or List Mode, graphic or Logigram, SFC or grafcet), single sequence grafcet programming, multiple sequence grafcet programming.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Hamdi Hocine, “Logical automation: modeling and control”, volumes 1 and 2, editions of L’UMC, 2006.
2. William Bolton, “Industrial programmable logic controllers”, Dunod, 2010.
3. JC Humblot, “Industrial programmable logic controllers”, Hermes Science Publications, 1993.
4. Simon Moreno, Edmond Peulot, “The GRAFCET: design, implementation in industrial programmable logic controllers”, Delagrave, 2009.
5. Kevin Collins, “Programming industrial programmable logic controllers,” Meadow Books, 2007.
6. G. Michel, “AP I: architecture and applications of industrial programmable logic controllers”, Dunod, 1988.

Semester: 6
Teaching unit: UEF 3.2.2
Subject 2: Communication buses and industrial networks
VHS: 10:30 p.m. (Class: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

This course aims to allow the student to become familiar with the concepts of digital data transmission, more particularly the different types of networks existing in the industrial world. The emphasis will be placed on understanding the different topologies with their advantages and disadvantages with respect to a given industrial installation.

Recommended prior knowledge:

Basic notions of Boolean logic.

Content of the subject:

Chapter 1. Network architecture (2 weeks)

- General information on networks
- Network classification
- Network topologies
- Communication protocols
- Data transmission techniques

Chapter 2. Fieldbus and industrial local area networks (3 weeks)

- Industrial local networks
- Fieldbus Objectives
- Fieldbus classification

Chapter 3. CAN Bus (Controller Area Network) (3 weeks)

- CAN bus classification.
- CAN communication protocols
- Representation of CAN frames

Chapter 4.: Sensor actuator interface (AS-I) (3 weeks)

- Architecture of an AS-I fieldbus
- AS-I communication protocols

Chapter 5. ProfiBus field networks (4 weeks)

- Classification of ProFiBus networks
- Profibus and OSI model (communication protocols)
- Principle of access to the bus in a profibus network

Evaluation method:

Review: 100%.

Bibliographic references:

1. Pascal Vrignat, "Local industrial networks - Courses and practical work", 1999.

2. Jean-François Hérold, Olivier Guillotin, Patrick Anaya, “Industrial computing and networks”, Dunod 2010.
3. Eric DECKE, “Course module, Industrial Local Networks and Field Buses”, mimeograph.
4. Tanenbaum, Andrew, “Networks”, Dunod 4th edition 2003.
5. Stéphane Lohier, Dominique Present, “Transmissions and networks”, Éditions DUNOD
6. Francis Lepage et al, “Local industrial networks”, Hermes 1991.
7. Fred Halsal, “Mutimedia Communications: Applications, Networks, Protocols and Standards”, Addison Wesley, 2001.
8. http://lysjack.free.fr/jack/RLI.htm.

Semester: S6
Teaching unit: UEM3.2
Subject 1: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.

Content of the subject:

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:

Continuous control: 100%.

Semester: 6
Teaching unit: UEM 3.2
Subject 2: Practical Sensors and Actuators
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

These practical exercises allow students to use and master the theoretical concepts studied during the course.
Teachers must choose four practical exercises suitable for each subject.

Recommended prior knowledge:

Sensors and measurement chains, Actuators.

Content of the subject:

TP Sensors

TP1:Sensor conditioning

TP2: Temperature measurement

TP3: Pressure measurement

TP4: Level and flow measurement

TP5: Photometric measurement

TP6: Rotation speed measurement

TP Actuators

TP1: Implementation of a pneumatic system

TP2: Adjustment valve

TP3: Stepper motor

TP4: DC and AC motor

TP5: Three-phase motor

Evaluation method:

Continuous control: 100%.

Semester: 6
Teaching unit: UEM 3.2.1
Subject 3: Practical work on industrial programmable logic controllers
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Once having acquired this material, the student will be able to understand and implement a basic automated system. Thanks to the different manipulations, he will be able to program a programmable controller to intelligently manage and coordinate the actions planned in the specifications which will be presented to him.

Recommended prior knowledge:

Industrial programmable logic controllers course.

Content of the subject:

Provide some practical work in relation to the available industrial programmable controllers.

Evaluation method:

Continuous control: 100%.

Semester: 6
Teaching unit: UEM 3.2.1
Subject 4: Practical communication bus and industrial networks
VHS: 3:00 p.m. (TP: 1:00 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:

The aim of these practical exercises is to put into practice the general data transmission methods and techniques used in communication networks and understand the specificities of field networks used in automated production chains.

Recommended prior knowledge:

Bus communications and industrial networks course.

Content of the subject:

Plan some practical work in relation to industrial networks according to the means available.

Evaluation method:

Continuous control: 100%.

Semester: 6
Teaching unit: UED 3.2
Subject 1: Automatic electrical installations
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Allow the graduate to have an idea on the choices of electrical power supplies installed according to the type of environment, on how to connect them to the process and other elements of the control and command system.

Recommended prior knowledge:

General electricity, continuous controlled systems, fundamental electrical engineering1.

Content of the subject:

Chapter 1.Power supplies (5 weeks)
Low voltage distribution, grounding, protection and conditioning interface.

Chapter 2. Standardized electrical equipment and connection diagrams (6 Weeks)

Internal overpressure "p", explosion-proof enclosure, protection devices, control devices, use of sensors, standardized symbols, electrical connection of PLCs to actuators, creation of electrical assemblies.

Chapter 3.Instrument wiring (4 weeks)
Connections between the different elements of the control system, standardized cables, instrumentation cables, safety cables and wiring.

On-site visits (which can be found anywhere) will be welcome to complete the student's training in this very important subject from a practical point of view. These visits could be incorporated into the hourly volume.

Evaluation method:

Review: 100%.

Bibliographic references:

Michel Grout and Patrick Salaun, "Industrial instrumentation", 3rd edition, DUNOD, 2012.

Semester: 6
Teaching unit: UED 3.2
Subject 2: Maintenance and reliability
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Know the basic concepts of maintenance and operational safety, become familiar with maintenance methods.

Recommended prior knowledge:

Sensors and measurement chains, actuators.

Content of the subject:

Chapter 1.The maintenance function **(2 weeks)**
Definition, maintenance strategies, maintenance standards

Chapter 2.Mechanism and failure modes **(3 weeks)**
Concept of failure, cause of failure, failure mode, failure mechanisms.

Chapter 3.Quantitative maintenance analysis **(4 weeks)**
ABC analysis, Noiret Abaque, decision tree, criticality matrix, correlation relationships.

Chapter 4.The diagnosis **(4 weeks)**
Definition and methodology, conduct of the diagnosis, diagnostic tools (cause and effect table, fault tree, diagnostic diagram, etc.), comparative study of the tools.

Chapter 5.Predictive failure analysis **(2 weeks)**

Evaluation method:

Review: 100%.

Bibliographic references:

1. Jean HENG, "Practice of preventive maintenance", Dunod, 2002.
2. Renaud CUIGNET, "Maintenance management", Dunod, 2002.
3. Introduction to TPM, USINOR, Quality and Management Institute, 1997.
4. "Practice of autonomous maintenance", USINOR, Quality and Management Institute 1997.
5. F. MONCHY, Maintenance: methods and organization, Dunod, 2000.
6. JM BLEUX, JL FANCHON, Maintenance: automated production systems, Collection Etapes, Nathan, 1997.

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.

SIGNATUREof the legally authorized person:

FUNCTION :

Date :

OFFICIAL STAMP or COMPANY SEAL

V - Opinions and Visas from Administrative and Consultative Bodies

License Title: Automatic

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