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

University

Logo

TRAINING OFFER
LMD

ACADEMIC LICENSE

NATIONAL PROGRAM
2021 – 2022
(2nd update)

Establishment	Faculty / Institute	Department

Domain	Sector	Speciality
Science And Technologies	***Electromechanics***	***Electromechanics***

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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
2021 – 2022

المؤسسة	الكلية/ المعهد	القسم

الميدان	الفرع	التخصص

علوم و تكنولوجيا	كهروميكانيك	كهروميكانيك

Summary	Page

V- Opinions and Visas from administrative and consultative bodies	
VI- Opinion and Visa of the Regional Conference	
VII- Opinion and Visa of the National Pedagogical Committee of the Domain (CPND)	

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:

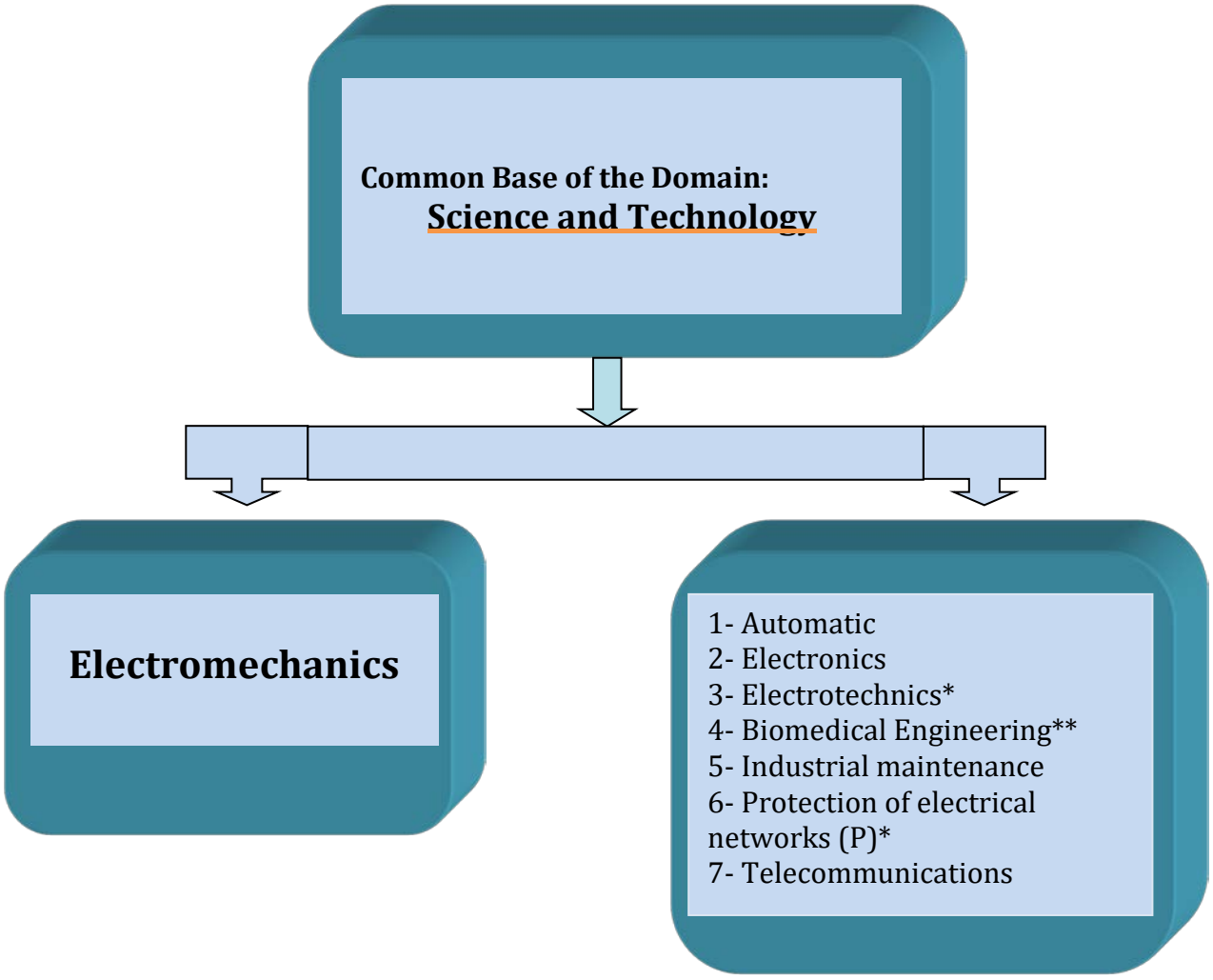
Businesses and other socio-economic partners:

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:

THEprogramtraining inElectromechanicsis located on the border of Electrical Engineering and Mechanical Engineering.At the end of this training,he students will assimilate, on the one hand, the essential concepts of Mechanics (Resistance of materials, Mechanical construction, Technical drawing, Turbomachines, Internal combustion engine, etc.); and on the other hand, they will acquire solid foundations in Electronics, Automation and Electrical Engineering. In addition, they will follow several lessonswhich will allow them to solve problems related to the field of energy conversion from its electrical form to mechanical form and vice versa.

Several objectives are expected from this training which aims to instill in students practical and diversified know-how, in this case:

- ✓ organize the maintenance of electromechanical systems, choose the appropriate equipment and enforce standards and directives.
- ✓ master the control functions of electrical drive systems, master the electronic circuits for controlling electrical power installations, know the functions of electronics, master the operation of electrical machines.
- ✓ choose control laws, choose the sensors and actuators necessary for regulation, implement the optimal solution, master the operating diagnostic tools.

C – Targeted profiles and skills:

At the end of the training, graduates will have the opportunity:

- ✓ to continue their training in a Master's degree,
- ✓ to join the industrial world to carry out one of the many activities in which the electromechanic is in high demand.

Indeed, electromechanics are omnipresent in our daily lives as shown by the wide use of electrical equipment and machines as well as daily means of transport.

THEgraduatescoming from this training and wishing to join the professional world will be able to:

- ✓ Carry out specialized tests and checks, verify the conformity of the equipment with the specifications in the specifications while respecting the regulations in force.
- ✓ Analyze the causes of breakdowns and failures and propose improvements.
- ✓ Ensure the maintenance of electrical machines and equipment.
- ✓ Participate in the establishment of specifications and technical files.
- ✓ Help in the study of preliminary projects and projects.
- ✓ Constantly update their knowledge on technological developments.

D – Regional and national employability potential:

The fields of activity covered by this training concern the Electrotechnical and Electromechanical industries. Sheoffers real professional opportunities in many sectors,to know :

- ✓ Production and distribution of electrical energy,
- ✓ Naval, chemical, petroleum, pharmaceutical, agri-food industries,
- ✓ Hydraulic installations,
- ✓ Field of new energies, etc.

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	**Specialties**
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 Process Engineering 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 of 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 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 to prepare presentations, make reports, 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	40%	08 points

student.		
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 training offered (Required Field) :

D- Personal work and ICT spaces 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 method	
	Titled			**Course**	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 1.1 Credits: 18 Coefficients: 9	Mathematics 1	6	3	3:00	1h30		67h30	82h30	40%	60%
	Physics 1	6	3	3:00	1h30		67h30	82h30	40%	60%
	Structure of matter	6	3	3:00	1h30		67h30	82h30	40%	60%
Methodological EU Code: UEM 1.1 Credits: 9 Coefficients: 5	TP Physics 1	2	1			1h30	10:30	27:30	100%	
	TP Chemistry 1	2	1			1h30	10:30	27:30	100%	
	Computer science 1	4	2	1h30		1h30	45:00	55:00	40%	60%
	Writing methodology	1	1	1h00			3:00	10:00		100%
EU Discovery Code: UED 1.1 Credits: 1 Coefficients: 1	Careers in Science and Technologies 1	1	1	1h30			10:30	02:30		100%
E Transverse Code: UET 1.1 Credits: 2 Coefficients: 2	Ethical and deontological dimension (the foundations)	1	1	1h30			10:30	02:30		100%
	Foreign language 1 (French or English)	1	1	1h30			10:30	02:30		100%
		30	**17**	**4:00**	**4:30**	**4:30**	**375h00**	**375h00**		

Total semester 1										

Semester 2

Teaching unit	Modules	Credits	Coefficient	Weekly hourly volume			Half-yearly Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation method	
	Titled			**Course**	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 1.2 Credits: 18 Coefficients: 9	Mathematics 2	6	3	3:00	1h30		67h30	82h30	40%	60%
	Physics 2	6	3	3:00	1h30		67h30	82h30	40%	60%
	Thermodynamics	6	3	3:00	1h30		67h30	82h30	40%	60%
Methodological EU Code: UEM 1.2 Credits: 9 Coefficients: 5	TP Physics 2	2	1			1h30	10:30	27:30	100%	
	TP Chemistry 2	2	1			1h30	10:30	27:30	100%	
	Computer science 2	4	2	1h30		1h30	45:00	55:00	40%	60%
	Presentation methodology	1	1	1h00			3:00	10:00		100%
EU Discovery 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**	**4:30**	**4:30**	**375h00**	**375h00**		

Semester 3

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

Total semester 3		**30**	**17**	**1:30**	**7:30**	**4:00**	**375h00**	**375h00**		

Semester 4

Unit teaching	Modules	Credits	Coefficient	Weekly hourly volume			Volume Semester Schedule (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation method	
	Titled			**Course**	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 2.2.1 Credits: 10 Coefficients: 5	Hydraulics and pneumatics	6	3	3:00	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%
	Strength of materials	4	2	1h30	1h30		45:00	55:00	40%	60%
Methodological EU Code: UEM 2.2 Credits: 9 Coefficients: 5	TP Electrical measurements and electronic	2	1			1h30	10:30	27:30	100%	
	Logic TP	1	1			1h00	3:00	10:00	100%	
	Hydraulic and pneumatic TP	2	1			1h30	10:30	27:30	100%	
	TP Numerical methods	2	1			1h30	10:30	27:30	100%	
	Technical drawing	2	1			1h30	10:30	27:30	100%	
EU Discovery Code: UED 2.2 Credits: 2 Coefficients: 2	Systemsenergy conversion	1	1	1h30			10:30	02:30		100%
	Concepts of electrical and electronic measurements	1	1	1h30			10:30	02:30		100%

Transversal EU Code: UET 2.2 Credits: 1 Coefficients: 1	Expression, information and communication techniques	1	1	1h30			10:30	02:30		100%
Total semester 4		**30**	**17**	**12:00**	**6:00**	**7:00**	**375h00**	**375h00**		

Semester 5

Teaching unit	Modules	Credits	Coefficient	Weekly hourly volume			Half-yearly Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation method	
	Titled			**Course**	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 3.1.1 Credits: 10 Coefficients: 5	Power electronics	4	2	1h30	1h30		45:00	55:00	40%	60%
	Electric machine	4	2	1h30	1h30		45:00	55:00	40%	60%
	Mechanical construction	2	1	1h30			10:30	27:30		100%
Fundamental EU Code: UEF 3.1.2 Credits: 8 Coefficients: 4	Thermal transfer	4	2	1h30	1h30		45:00	55:00	40%	60%
	Servo Systems	4	2	1h30	1h30		45:00	55:00	40%	60%
Methodological EU Code: UEM 3.1 Credits: 9 Coefficients: 5	Power electronics TP	2	1			1h30	10:30	27:30	100%	
	TP Electrical machines	2	1			1h30	10:30	27:30	100%	
	TP Controlled Systems	2	1			1h30	10:30	27:30	100%	
	Electrical diagrams and equipment	3	2	1h30		1h00	37:30	37:30	40%	60%
EU Discovery Code: UED 3.1 Credits: 2 Coefficients: 2	Production of electrical energy	1	1	1h30			10:30	2h30		100%
	Electrotechnical materials	1	1	1h30			10:30	2h30		100%
Transversal EU Code: UET 3.1 Credits: 1 Coefficients: 1	Electrical safety	1	1	1h30			10:30	2h30		100%
Total semester 5		**30**	**17**	**1:30**	**6:00**	**5:30**	**375h00**	**375h00**		

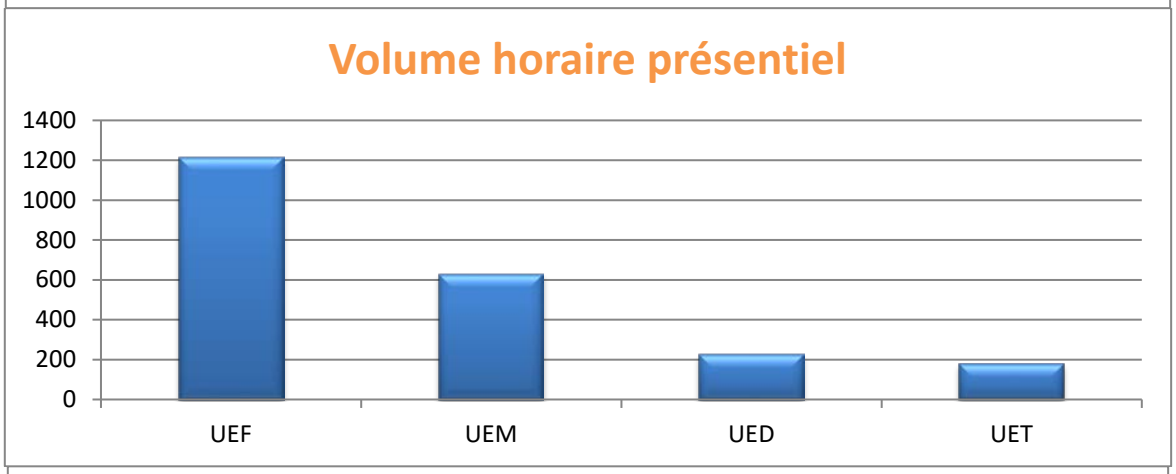
Semester 6

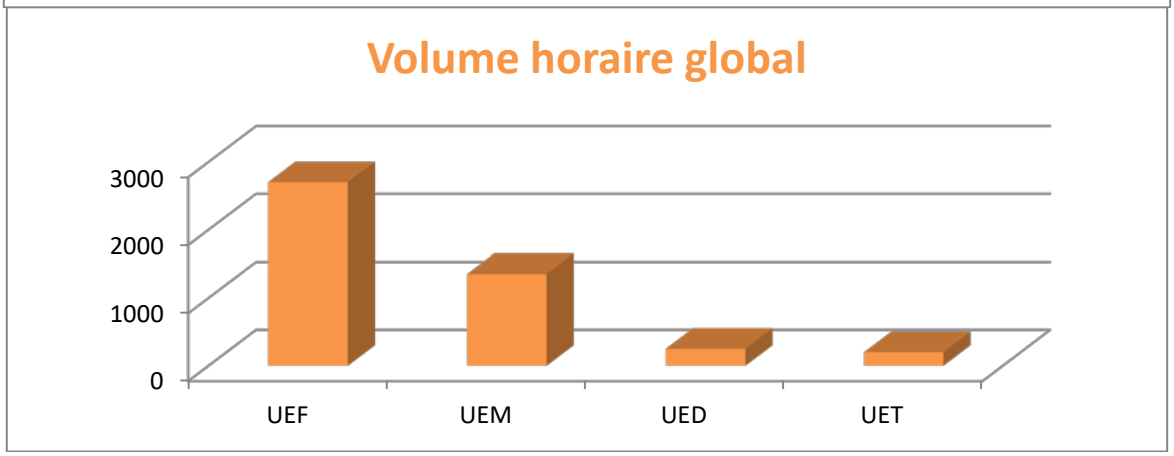
Teaching unit	Modules	Credits	Coefficient	Weekly hourly volume			Half-yearly Hourly Volume (15 weeks)	Additional Work in Consultation (15 weeks)	Evaluation method	
	Titled			**Course**	**T.D.**	**TP**			**Continuous monitoring**	**Exam**
Fundamental EU Code: UEF 3.2.1 Credits: 10 Coefficients: 5	Industrial regulation	4	2	1h30	1h30		45:00	55:00	40%	60%
	Control of electromechanical drives	4	2	1h30	1h30		45:00	55:00	40%	60%
	Sensors and measurement chains	2	1	1h30			10:30	27:30		100%
Fundamental EU Code: UEF 3.2.2 Credits: 8 Coefficients: 4	Automation and industrial computing	4	2	1h30	1h30		45:00	55:00	40%	60%
	Turbomachines	4	2	1h30	1h30		45:00	55:00	40%	60%
Methodological EU Code: UEM 3.2 Credits: 9 Coefficients: 5	End of Cycle Project	4	2			3:00	45:00	55:00	100%	
	TP Regulation and Automation	2	1			1h30	10:30	27:30	100%	
	TP Order	2	1			1h30	10:30	27:30	100%	
	TP Sensors	1	1			1h00	3:00	10:00	100%	
EU Discovery Code: UED 3.2 Credits: 2 Coefficients: 2	Maintenance of electromechanical systems	1	1	1h30			10:30	02:30		100%
	Introduction to the Internal Combustion Engine	1	1	1h30			10:30	02:30		100%
Transversal EU Code: UET 3.2 Credits: 1 Coefficients: 1	Entrepreneurship and business management	1	1	1h30			10:30	02:30		100%

Total semester 6		**30**	**17**	**12:00**	**6:00**	**7:00**	**375h00**	**375h00**		

Overall summary of the training:

EU / V.H.	UEF	EMU	UED	UET	Total
Course	720h00	2:30 p.m.	225h00	180h00	1267h30
T.D.	495h00	10:30 p.m.	---	---	517h30
TP	---	465h00	---	---	465h00
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 method:
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	Make + Noun + Adjective
Heat Treatment of Steel.	Quantity, Contents
Lubrication of Bearings.	Enable, Allow, Make, etc. + Infinitive
The Lathe.	Comparative, Maximum and Minimum
Welding.	The Use of Will, Can and May
Steam Boilers.	Prevention, Protection, etc., Classification
Steam Locomotives.	The Impersonal Passive
Condensation and Condensers.	Passive Verb + By + Noun (agent)
Centrifugal Governors.	Too Much or Too Little
Impulse Turbines.	Instructions (Imperative)
The Petro Engine.	Requirements and Necessity
The Carburation System.	Means (by + Noun or –ing)
The Jet Engine.	Time Statements
The Turbo-Prop Engine.	Function, Duty
Aerofoil.	Alternatives

Fashion rating:
Review: 100%.

References:

1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office of University Publications, 1994.
2. AJ Herbert, The Structure of Technical English, Longman, 1972.
3. S. Berland-Delepine, Methodical grammar of modern English with exercises, Ophrys, 1982.
4. Test of English as a Foreign Language – Preparation Guide, Cliffs, 1991.
5. R. Fowler, The Little, Brown Handbook, Little, Brown Company, 1980.

6. Cambridge – First Certificate in English, Cambridge books, 2008.
7. K. Wilson, Th. Healy, First Choice, Oxford, 2007.
8. M. Mann, S. Tayore-Knowles, Destination: Grammar & Vocabulary with Answer Key, MacMillan, 2006.
9. E. Hamby, Ph. Bedford Robinson, Special English Computer Applications, Cassell, 1980.
10. P. Charles Brown, Norma D. Mullen, English for Computer Science, Oxford University Press, 1989.
11. Graeme Kennedy, Structure and Meaning in English: A Guide for Teachers, Pearson, 2004.
12. Anne M. Hanson, Brain-Friendly Strategies for Developing Student Writing Skills, 2nd Edition, Corwin Press, 2008.
13. Ann Bridges, How to Pass Higher English, Hodder Gibson-Hachette, 2009.
14. Claude Renucci, English: 1000 Words and expressions of the press: Vocabulary and expressions of the economic, social and political world, Fernand Nathan, 2006.

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

Teaching objectives

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

Recommended prior knowledge

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

Material content:

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

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

Chapter 3: Integrals (4 weeks)
3-1Indefinite integral, property.3-2Integration of rational functions.3-3Integration of exponential and trigonometric functions.3-4The integral of polynomials.3-5Integration defined

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

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

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1- F. Ayres Jr, Theory and Applications of Differential and Integral Calculus - 1175 corrected exercises, McGraw-Hill.
2- F. Ayres Jr, Theory and Applications of Differential Equations - 560 corrected exercises, McGraw-Hill.
3- J. Lelong-Ferrand, JM Arnaudiès, Mathematics Course - Differential Equations, Multiple Integrals, Volume 4, Dunod University.
4- M. Krasnov, Collection of problems on ordinary differential equations, Moscow Edition
5- N. Piskounov, Differential and integral calculus, Volume 1, Moscow edition
6- J. Quinet, Elementary course of higher mathematics 3- Integral calculation and series, Dunod.
7- J. Quinet, Elementary course of higher mathematics 4- Differential equations, Dunod.

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

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

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

Recommended prior knowledge
Mathematics 1, Physics 1.

Material content:
Mathematical reminders:(1 week)
1- Elements of length, surface, volume in Cartesian, cylindrical, spherical coordinate systems. Solid angle,The operators (gradient, rotational, Nabla, Laplacian and divergence).
2- Multiple derivatives and integrals.

Chapter I. Electrostatics:(6 weeks)
1- Electrostatic charges and fields.Electrostatic interaction force-Coulomb's law.
2-Electrostatic potential. 3- Electric dipole. 4- 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 method:

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 method:

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 method:
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 method:

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 method:

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 method:
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 method:

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 method:

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 method:

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 method: Final exam: 100%.

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

Semester: 3
Teaching unit: UED 2.1
Subject 2:Energy and environment
VHS: 10:30 p.m. (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 method:

Final exam: 100%.

Bibliographic references:

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

Semester: 3
Teaching unit: UET 2.1
Subject 1:Technical English
VHS: 10:30 p.m. (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 method:

Final exam: 100%.

Bibliographic references:

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

Semester: 4
Teaching unit: UEF 2.2.1
Subject 1:Hydraulics and pneumatics
VHS: 67h30 (Class: 3h00, tutorial: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

This course allows the student to be able to study and analyze industrial systems based on hydraulic and pneumatic concepts.

Recommended prior knowledge:

None

Material content:

Chapter 1: Introduction to Fluid Mechanics 1 week
1-Definitions: Perfect fluid, Real fluid, Incompressible fluid, Compressible fluid).
2-Physical characteristics: (Density, Density, Density, Viscosity)

Chapter 2: Fluid Statics 2 weeks
1-Introduction. 2-Notion of pressure at a point in a fluid. 3-Fundamental relationship of hydrostatics. 4-Pascal's theorem. 5- Thrust of a fluid on a vertical wall. 6-Archimedes' Theorem.

Chapter 3: Dynamics of Perfect Incompressible Fluids 2 weeks
1-Introduction. 2-Permanent flow. 3-Continuity Equation. 4-Notion of Flow. 5-Bernoulli's theorem (Case of a flow without exchange of work). 6-Bernoulli's theorem (Case of a flow with exchange of work)

Chapter 4: Dynamics of Real Incompressible Fluids 3 weeks
1- Introduction. 2- Real fluids. 3- Flow regimes (Reynolds number). 4-Load losses: Definition, Singular pressure losses, Linear pressure losses. 5-Bernoulli's theorem applied to a real fluid.

Chapter 5: General information on hydraulic and pneumatic circuits 4 weeks
1-General information on hydraulic fluids: Different hydraulic types (mineral oil, synthetic oil), Influence of temperature on viscosity, Influence of pressure on viscosity. 2-Filtration (Classification of the state of pollution of a hydraulic fluid, Consequence of poor filtration, Control of the level of pollution, Filtration technique). 3-The organs of a hydraulic circuit (The single and double acting cylinder, The distributors, Flow limitation and regulation, Pressure limitation and regulation, Pumps)

Chapter 6: General information on pneumatic circuits 3 weeks
1-General (air composition, pressure unit, power unit). 2-Production of compressed air. 3-Energy treatment: (Compressed air treatment, Compressed air filtration level). 4-The conditioning modules: (The different components, Operating principle - filters, pressure regulators, lubricators, soft starters- 5- The main power units. 6-The distributors.

Evaluation method:

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

Bibliographic references:

1- R. Comolet, Experimental fluid mechanics, Volumes 1, 2 and 3, Edition Masson et Cie.
2- R. Ouziaux, Applied fluid mechanics, Edition Dunod, 1978
3- BR Munson, Fundamentals of fluid mechanics, Wiley & Sons.

RV Gilles, Fluid mechanics and hydraulics: Courses and problems, Schaum Series, Mc Graw Hill, 1975.
4- CT Crow, Engineering fluid mechanics, Wiley & sons
5- VL Streeter, Fluid mechanics, McGraw Hill
6- S. Amiroudine, Fluid mechanics: Courses and corrected exercises, Editions Dunod
7- M.Portelli, Industrial hydraulics technology, lessons and solved exercises, Educalivres, 2005.

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 method:

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 method:

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

Teaching objectives:

Know the methods for calculating the resistance of construction elements and determine the variations in the shape and dimensions (deformations) of the elements under the action of loads.

Recommended prior knowledge:

Analysis of functions; Rational mechanics.

Material content:

Chapter 1 :Introductions and generalities

Goals and hypotheses of the resistance of materials, Classification of solids (beam, plate, shell), Different types of loading, Connections (supports, embeddings, hinges), General principle of equilibrium – Equilibrium equations, Principles of cutting – Reduction elements, Definitions and sign conventions of: Normal force N, Shear force T, Bending moment M

Chapter 2: Tension and Compression

Definitions, Normal stress in traction and compression, Elastic deformation in traction/compression, Condition of resistance in traction/compression.

Chapter 3: Shear

Definitions, Simple shear – pure shear, Shear stress, Elastic deformation in shear, Shear resistance condition.

Chapter 4: Geometric characteristics of straight sections

Static moments of a straight section, Moments of inertia of a straight section, Formulas for transforming moments of inertia.

Chapter 5: Twist

Definitions, Tangential or sliding stress, Elastic torsional deformation, Torsional resistance condition.

Chapter 6: Simple plane bending

Definitions and hypotheses, Shear forces, bending moments, Diagram of shear forces and bending moments, Relationship between bending moment and shear force, Deformation of a beam subjected to simple bending (deflection), Calculation of stresses and dimensioning.

Evaluation method:

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

Bibliographic references:

1- F. Beer, Mechanics for engineers – statics, McGraw-Hill, 1981.
2- P. Stepine, Resistance of materials, Editions MIR; Moscow, 1986.
3- W. Nash, Strength of Materials 1, McGraw-Hill, 1974.
4- S. Timoshenko, Resistance of materials, Dunod, 1986.

Semester: 4
Teaching unit: UEM 2.2
Subject 1: TPElectrical and electronic measurements
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

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:

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 method:

Continuous control: 100%.

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:TPLogic
VHS: 3:00 p.m. (TP: 1:00 a.m.)
Credits: 1
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 counter circuits
Incomplete asynchronous counter circuits using flip-flops, Irregular cycle synchronous counter circuits using flip-flops

Evaluation method:

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 3:TPHydraulics and pneumatics
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

The student is expected to be able to use the tools necessary to assemble certain special functions of hydraulic and pneumatic circuits used to control industrial systems and in particular electromechanical systems.

Recommended prior knowledge:

Hydraulic and pneumatic.

Material content:

TP No. 1: Verification of the Bernoulli relation
TP No. 2: Determination of pressure losses in a pipe
TP No. 3: Study of components and determination of hydraulic parameters
TP No. 4: Speed adjustment of a single and double acting hydraulic cylinder
TP No. 5: Using a hydraulic accumulator
TP No. 6: Study of components and determination of pneumatic parameters
TP No. 7: Control of a single and double acting pneumatic cylinder
Air motor speeds

Noticed : It is up to those responsible for the subject to choose at least 5 manipulations depending on the availability of the material.

Evaluation method:

Continuous control: 100%.

Bibliographic references:

1- R. Comolet, Experimental fluid mechanics, Volumes 1, 2 and 3, Edition Masson et Cie.
2- R. Ouziaux, Applied fluid mechanics, Edition Dunod, 1978
3- BR Munson, Fundamentals of fluid mechanics, Wiley & Sons.
4-RV Gilles, Fluid mechanics and hydraulics: Courses and problems, Schaum Series, Mc Graw Hill, 1975.
5- CT Crow, Engineering fluid mechanics, Wiley & sons
6- VL Streeter, Fluid mechanics, McGraw Hill
7- S. Amiroudine, Fluid mechanics: Courses and corrected exercises, Editions Dunod
8- M.Portelli, Industrial hydraulics technology, lessons and solved exercises, Educalivres, 2005.

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 method:

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: UEM 2.2
Subject 5: Technical drawing
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives

This teaching will allow students to acquire the principles of representing parts in industrial drawing. Even more, this subject will allow the student to represent and read the plans.

Prior knowledge

In order to follow this course, basic knowledge of the general principles of drawing is required.

Content of the subject

Chapter 1: General. **2 weeks**

1.1 Usefulnesstechnical drawings and different types of drawings.
1.2 Drawing materials.
1.3 Standardization(Types of lines, Writing, Scale, Drawing and folding format, Cartridge, etc.).

Chapter 2: Elements of descriptive geometry **6 weeks**

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

Chapter 3: The outlook **2 weeks**

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

Chapter 4: Cuts and Sections **2 weeks**

4.1 Sections, standardized representation rules (hatching).
4.2 Projections and sections of simple solids (Projections and sections of a cylinder, a prism, pyramid, cone, sphere, etc.).
4.3 Half-cut, Partial cuts, broken cuts, Sections, etc.
4.4 Vocabularytechnical (terminology of machined shapes, profiles, piping, etc.
Application exercises and evaluation (TP).

Chapter 5: Quotation **2 weeks**

5.1 General principles. 5.2 Rating, tolerance and adjustment. Exercisesapplications and evaluation (TP).

Chapter 6: Concepts on definition and assembly drawings and parts lists.
1 week

Application exercises and evaluation (TP).

Evaluation method:
Continuous control: 100%.

Bibliographic references:

1. Industrial designer's guide Chevalier A. Edition Hachette Technique;
2. Technical drawing 1st part descriptive geometry Felliachi d. and Bensaada s. Edition OPU Algiers;
3. Technical drawing part 2 industrial drawing Felliachi d. and bensaada s. Edition OPU Algiers;
4. First notions of technical drawing Andre Ricordeau Edition Andre Casteilla;
5. **المدخل إلى الرسم الصناعي**ماجد عبد الحميد ديوان المطبوعات الجامعية الجزائر
6. **مبادئ أساسية في الرسم الصناعي**عمر أبو حنيك المعهد الجزائري للتقييس والملكية الصناعية طبع الحميد ديوان المطبوعات الجامعية الجزائر

Recommendation: A large part of the practical work must be in the form of personal work at home.

Semester: 4
Teaching unit: UED 2.2
Subject 1: Systems ofenergy conversion
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Review the different types of energy converters and in particular electromechanical energy conversion systems.

Recommended prior knowledge:

Electrical engineering 1, Electrical engineering 2.

Material content:

Chapter 1 :Energy and energy variables

Energy and forms of energy, Units of energy and power, Magnetostatics: Production of torque and force, Sizing of the power chain, Power in sinusoidal regime.

Chapter 2: Electromechanical energy conversion

General: Technological structure of electromechanical converters (Theoretical models of rotating converters), Classification of converters, Variation of the electromagnetic energy of the system, Powers and torques.

Chapter 3: Other Forms of Conversion

Photovoltaic conversion and solar energy (Photovoltaic effect, principle and technology, Efficiency of solar panels), Heat energy conversion, Combustion engines.

Evaluation method:

Final exam: 100%.

Bibliographic references:

(Books and handouts, websites, etc.)

Semester: 4
Teaching unit: UED 2.2
Subject 2: Notions of Melectrical and electronic measurements
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

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

Material content:

Chapter 1: Fundamentals of measurement5weeks

Definition and purpose of a measure,Electrical quantities and units of measurement, Equations with dimensions, Usual characteristics of signals (instantaneous, average and effective values), Range of currents used in electronics and electrotechnics (voltage, current, power), Characteristics of the measurement (precision, resolution, fidelity, etc.), Errors of measurement: Absolute uncertainty, Relative uncertainty, Rules for calculating uncertainties, presentation of a measurement result. Quality of a measuring device, Error and precision class.

Chapter 2: Classification of electrical and electronic measuring devices 3 weeks

The different types of measuring devices: Review and briefly explain the usefulness, specificities and use of each of these devices: Ammeter, Voltmeter, Ohmmeter, Wattmeter, Frequency meter, Function generators, Logic probe, …

Chapter 3: Operating principles of measuring devices 2 weeks

Analog measuring devices: Operating principle
Digital measuring devices: Operating principle
Cathode oscilloscope: Operating principle.

Chapter 4: Electrical measurement methods 4weeks

Measurement of voltages and currents, Resistance measurement methods, Impedance measurement methods, Phase shift measurement methods, Frequency measurement methods, DC and AC power measurement methods.

Chapter 6: Measurement in industry 1week

Measurement problems in industry. Equipment installation and environment. Choice of devices used in industry.

Evaluation method:

Review: 100%.

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: 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: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 method:

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: UEF3.1.1
Subject 2:Electric machine
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

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

Recommended prior knowledge:

Concepts of fundamental electricity, electrostatics and basic magnetostatics.

Material content:

Chapter 1. General (2 weeks)

Single-phase alternating current, three-phase alternating current, elementary properties of the magnetic circuit.

Chapter 2. Transformer (3 weeks)

General, operating principle of the single-phase transformer, the ideal transformer, calculation of the induced electromotive force, the real transformer, the transformer in the Kapp approximation, energy balance and efficiency, three-phase transformer, different types of coupling and hourly index.

Chapter 3. Direct current machines (3 weeks)

General, operating principle, constitution, direct current generator, characteristic equations, calculation of electromotive force and torque, different excitation modes, direct current motor, operating principle, starting, braking and speed adjustment of motors , energy balance and efficiency.

Chapter 4. Synchronous machines (3 weeks)

General, operating principle of the machine, rotating field, alternator operation, study of the different alternator operating diagrams, synchronous motors.

Chapter 5. Asynchronous machines (4 weeks)

General, operating principle, constitution of asynchronous machines, equation and equivalent single-phase diagram, mechanical characteristics, simplified circle diagram, energy balance and efficiency, generator and brake operation, the different types of motors starting asynchronous motors, adjustment speed of asynchronous motors.

Evaluation method:

Continuous control: 40%; Exam: 60%.

Bibliographic references:

1. JP Perez. Electromagnetism Foundations and Applications, 3rd Edition, 1997.
2. A. Searched. 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. Mr. Kostenko. Electric Machines - Volume 1, Volume 2, Editions MIR, Moscow, 1979.
8. M. Jufer Electromécanique, 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.
13. Theodore Wildi.Electrotechniques, de Boeck, 2005
14. Electric Drive, J.Fandino., Volume 1, ISBN: 2-7462-1305-2, 2006
15. Electric machine; Francis Milsant, Ellipses, 1992
16. M.Kostenko and L.Piotrovsky. Electric machine: alternating current machine, Volume II, Mir edition 1979.
17. M.Kostenko and L.Piotrovsky. Electric machine: direct current machine, Volume I, Mir edition 1979.
18. Francis Milsant. Electrical engineering course: Direct current machine, Volume II, Eyrolles, Paris 1981.

Semester: 5
Teaching unit: UEF3.1.1
Subject 3:Mechanical construction
VHS: 10:30 p.m. (Class: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

Know the different assemblies and components constituting electromechanical systems: modes of assembly, transmission of movements, etc. Know how to use the tools necessary to study, analyze and size machine elements.

Recommended prior knowledge:

Knowledge of materials and general mechanics. Knowledge of industrial design and material strength calculation.

Material content:

Chapter 1. Fundamentals and design methodology (2 weeks)
General construction rules, fundamental notions of methodical procedure, construction process (planning, design, projection).

Chapter 2. Introduction to the calculation of machine elements (2 weeks)
Selection of materials, allowable strengths and stresses, normal numbers, roughness and fits, construction based on manufacturing aspects.

Chapter 3. Assemblies (3 weeks)
Gluing, brazing, welding, riveting, assembly using threaded elements.

Chapter 4. Shaft guidance (3 weeks)
Shafts, axles and journals, lubrication, plain bearings, bearings.

Chapter 5. Couplings and brakes (3 weeks)
Permanent couplings, temporary couplings, special couplings, brakes.

Chapter 6. Transmission (2 weeks)
Friction wheels, chains, belts, gears (cylindrical with straight and helical teeth, conical, worm wheels and screws)

Evaluation method:

Review: 100%.

Bibliographic references:

1. Rene Basquin. Mechanics: Static-Dynamic Kinematics, Volume I, Edition Paris 1995.
2. G. Lenormand. Mechanical construction: elements of technology.2, the connection function, other elementary functions, Paris, Foucher, 1969.
3. Pierre Agati. Connections, mechanisms and assemblies: courses, exercises and applications, 2ed, Paris, Dunod, 1994.
4. Philippe Arquès. Mechanical power transmissions: application to automatic gearboxes, Paris, Ellipses, 2001.
5. I. Artobolevsky. Theory of mechanisms and machines, Moscow, Mir, 1977.
6. D. Feliachi Technical drawing.1, descriptive geometry, Algiers, Office of University Publications, 1995.

7. D. Feliachi. Technical drawing.2, industrial drawing, Algiers, Office of University Publications, 1995.
8. Michel Georges Technical drawing: understanding and mastering localization, Paris, Afnor, 1991.
9. Thomas Gmur Elements of structural mechanics, 1 ed., Lausanne, Presses Polytechniques et Universitaires Romandes, 2001.

Semester: 5
Teaching unit: UEF3.1.2
Subject 1:Thermal transfer
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Master the three modes of heat transfer (conduction, convection and radiation) and the calculation methods for heat exchangers.

Recommended prior knowledge:

Have some knowledge of thermodynamics.

Material content:

Chapter 1. General information on heat transfers (2 weeks)
Introduction, definitions, formulation of a heat transfer problem.

Chapter 2. Steady-state conduction heat transfer (3 weeks)
The heat equation, unidirectional transfer, multidirectional transfer, fins.

Chapter 3. Heat transfer by conduction in variable regime (3 weeks)
Governing equation; unidirectional conduction in variable regime without change of state, multidirectional conduction in variable regime.

Chapter 4. Heat transfer by radiation (3 weeks)
General. Definitions, laws of radiation, reciprocal radiation of several surfaces, emission and absorption of gases.

Chapter 5. Heat transfer by convection (3 weeks)
Reminders on dimensional analysis, convection without change of state, convection with change of state.

Chapter 6. Application: Sizing an exchanger (1 week)

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Lucien Borel. Thermodynamics and energetics, diffusion, 1991.
2. Brebes.Thermodynamics, Hachette, 1999.
3. Yves Janniot. Thermal transfers, course, 2002.
4. Arnold. Applied Thermodynamics, course, Sommerfeld, 2003.
5. George. G Thermodynamics, Edition Ellipse 2005.
6. Lucien Borel. Thermodynamics, PPUR, 2005.
7. P Amiot. Thermodynamics, Laval University, Quebec, Canada, 2006.

Semester: 5
Teaching unit: UEF3.1.2
Subject 2: Systems Aserved
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Review the properties of control structures of continuous linear systems, address models of basic dynamic systems, explore tools for temporal and frequency analysis of basic systems.

Recommended prior knowledge:

Basic mathematics (Algebra, Integral and differential calculus, Analysis, complexes, etc.). Fundamental notions of signal processing, basic electronics (linear circuits).

Material content:

Chapter 1.Introduction to servo systems (2 weeks)

History of automatic control systems, Terminology and definition, Systems concept, Dynamic behavior, Static behavior, Static systems, Dynamic systems, Linear systems, Introductory examples, Open loop systems, Closed loop systems, Main elements of a control chain servo, Reasoning of a servo, Performance of servo systems.

Chapter 2.Systems modeling (4 weeks)

Representation of systems by their differential equations, Laplace transform, From the differential equation to the transfer function, From the transfer function to the state model, Functional blocks and simplification rules, Representation of dynamic systems by fluence graphs , Mason's rule, Calculation of transfer functions of looped systems.

Chapter 3.Answerstemporal aspects of linear systems (3 weeks)

Definition of the response of a system, Transient regime, Permanent regime, Notions of stability, speed and static precision, Impulse response (1st and 2nd order), Temporal characteristics, Index response (1st and 2nd order), Identification of first systems and second order from the temporal response, Higher order systems, Influence of poles and zeros on the response of a system.

Chapter 4.Frequency responses of linear systems(3 weeks)

Definition, Bode and Nyquist diagram, Frequency characteristics of basic dynamic systems (1st and 2nd order), Phase and gain margins.

Chapter 5.Stability and precision of servo systems (3 weeks)

Definition, Stability conditions,Routh-Herwitz algebraic criterion, Backhand criteria in Nyquist plans andBode, Margins of stability,Accuracy of controlled systems, Static precision, Calculation of the static deviation, Dynamic precision, Characterization of the transient regime.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. EK Boukas, Enslaved systems, Editions de l'École Polytechnique de Montréal, 1995.
2. P. Clerc. Continuous automatic, sampled: IUT Electrical Engineering-Industrial Computer Science, BTS Electronics-Mechanics-Computer Science, Editions Masson (198p), 1997.
3. Ph. de Larminat, Automatic, Editions Hermes 2000.
4. P. Codron and S. Leballois, Automatic: continuous linear systems, Editons Dunod 1998.

5. Y. Granjon, Automatic: Linear, nonlinear, continuous-time, discrete-time systems, state representation, Editions Dunod 2001.
6. K. Ogata, Modern control engineering, Fourth edition, Prentice Hall International Editions 2001.
7. B. Pradin, Course of Automatics. INSA Toulouse, 3rd year GII specialty.
8. M. Rivoire and J.-L. Ferrier, Cours d'Automatique, volume 2: servocontrol, regulation, analog control, Editions Eyrolles 1996.
9. Y. Thomas, Signals and linear systems: corrected exercises, Editions Masson 1993.
10. Y.Thomas. Signals and linear systems, Editions Masson 1994.

Semester: 5
Teaching unit: UEM 3.1
Subject 1:Power electronics TP
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Complete, consolidate and verify the knowledge already acquired in the course.

Recommended prior knowledge:

Basic electrical and electronic circuits.

Content oftherematter:

TP 1: Single-phase and three-phase uncontrolled rectifier (R, L, E load).

TP 2: Single-phase and three-phase controlled rectifier (R, L, E load).

TP 3: Switching component (IGBT, MOS).

TP 4: Thyristor chopper.

TP 5: Single-phase inverter (resonance, current source).

TP6: Single-phase dimmer (Load R, L).

TP7: Three-phase dimmer.

Evaluation method:

Continuous control: 100%

Bibliographic references:

Semester: 5
Teaching unit: UEM 3.1
Subject 2:TP Electrical machines
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Complete, consolidate and verify the knowledge already acquired in the course.

Recommended prior knowledge:

Electric machine.

Material content:

TP 1: Transformers

- Creation of the assembly diagram for different coupling modes and verification of nominal data,
- No-load, load and short-circuit tests.

TP 2: Direct current generator

- Creation of the assembly diagram and verification of nominal data,
- Checking the influence of the switching poles,
- Record of no-load, external, adjustment and short-circuit characteristics for different excitation modes.

TP 3: DC motor

- Creation of the assembly diagram and verification of nominal data,
- Start-up study,
- Study of the different modes of speed variation,
- Survey of electromechanical and mechanical characteristics.

TP4: Synchronous machine

- Creation of the assembly diagram and verification of nominal data,
- No-load and short-circuit tests.
- Operation under load and determination of alternator parameters.

TP 5: Asynchronous cage motor

- Creation of the assembly diagram and verification of nominal data,
- No-load and short-circuit test,
- Operation under load and recording of electromechanical and service characteristics.

Evaluation method:

Continuous control: 100%.

Bibliographic references:

Course notes, Lab brochures.

Semester: 5
Teaching unit: UEM 3.1
Subject 3:TPSystems aserved
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Complete, consolidate and verify the knowledge already acquired in the course.

Recommended prior knowledge:

Systems aserved.

Material content:

TP 1: Simulation on Matlab
Solving differential equations using Matlab software, use of commands: ode45, ode23, dsolve, diff, int, ... etc., determination of the transfer function of a system and plotting of time and frequency responses, Identification by graphic methods, usecommands: Ident, Step, Impulse, Lsim, Ltiview, Bode, Nyquist,... etc., open and closed loops, temporal, frequency and stability characteristics.

TP 2: Study of the behavior of systems 1st; 2nd and 3rd order
Analog and Computer Simulation, measure the parameters that characterize the different responses: rise time, response time, 1st maximum overshoot, peak time and precision.
Observe the response of an unstable system.

TP 3: Frequency responses and system identification
Determination of the frequency characteristics of a servo, with the aim of identifying the transfer function of a system. Applications on an engine.

TP 4: Position control of a DC motor, difference between position and speed
The influence of gain on the stability and static error of the system, the influence of speed feedback on the behavior of the system.

TP 5: Speed control of a DC motor
The operation of the elements and the controlled system in open and closed loop, the influence of the gain on the stability of the system, the influence of the gain and the load on the static error of the system, the influence of the feedback of current on the dynamic behavior of the system.

Evaluation method:

Continuous control: 100%.

Bibliographic references:

Semester: 5
Teaching unit: UEM 3.1
Subject 4:Electrical diagrams and equipment
VHS: 37h30 (Class: 1h30, TP: 1h00)
Credits: 3
Coefficient: 2

Teaching objectives:

Learn the different types of protection and control equipment for electrical installations as well as the creation of an electrical installation.

Recommended prior knowledge:

Concepts of fundamental electricity, electrostatics and basic magnetostatics.

Material content:

Chapter 1. General information on the equipment (3 weeks)
Operating faults and anomalies, role and classification of protection, basic functions of the equipment, sectioning, control, protection, classification of the equipment, choice of equipment, characteristics of electrical equipment, protection of equipment, classes of electrical equipment, protection provisions. . Phenomena related to currents and voltage; overcurrents, electrodynamic forces, calculation of arc resistance, effects of the arc on contact, overvoltages, insulation, breakdown, rigidity, ionization of gases.

Chapter 2. Electric current interruption phenomena (2 weeks) Arc formation (in air and in oil), arc breaking principle (in air and in oil), arc extinguishing conditions, recovery voltage, different arc cutting techniques.

Chapter 3. Connection and interruption apparatus (3 weeks)
Contacts, terminals and connections, socket outlets, disconnectors, switches (definition, role and characteristic), switches (definition, role and characteristic), contactors (definition, role and characteristic).

Chapter 4. Protective equipment (2 weeks)
Fuses (role and operation, types), thermal relay (definition, role, type and characteristics), circuit breakers (definition, role, types and characteristics).

Chapter 5. Development of electrical diagrams (2 weeks)
Symbols of electrical installations, conventions and standardization, examples of reading control and power diagrams, practical determination of the minimum cross-section of pipeline conductors.

Chapter 6. Application of diagrams and equipment (3 weeks)
Application in lighting circuits;Single ignition assembly; Dual ignition assembly; Back and forth assembly; Ignition by remote switch Ignition by timer; Principle of a timer connected in 4 wires; Principle of a timer connected in 3 wires.
Application for controlling an electric motor;Direct start with only one direction of rotation; Direct motor start with double direction of rotation; Star triangle starting.

Practical work:
TP1: Main arrangements for lighting
Socket assembly, single ignition assembly, double ignition assembly, two-way assembly, assembly with remote control switch, assembly with timer.

TP2: Contactor control
- Control of a contactor: by switches, by push button, remotely by two impulse buttons, remotely by several push buttons.
- Control of two contactors: by switches, by push buttons, etc.

TP3: Starting a three-phase asynchronous cage motor

TP4: Starting a two-way asynchronous motor

TP5: Protection of an Asynchronous Motor
- By thermal circuit breaker
- By magneto circuit breaker....

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Christophe Prévé. Protection of electrical networks, Hermès, Paris, 1998.
2. S.-H. Horowitz & A.-G. Phadke, John Wiley & Sons. Power System Relaying, 2nd edition, 1995.
3. Féchant L., LV electrical equipment, Distribution devices, Engineering techniques, treatise, Electrical engineering, D 4 865.

Semester: 5
Teaching unit: UED 3.1
Subject 1:Production of electrical energy
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Understand, master and acquire the basic principles of the different modes of producing electrical energy. At the end of this subject,the student must become aware of the energy issue in general, and the impact of electrical energy on socio-economic life, in particular.

Recommended prior knowledge:

Have notions of thermodynamics and fluid mechanics and above all basic knowledge of fundamental electrical engineering (electricity and circuit, electric and magnetic field, power, three-phase regime, alternator, motor, transformer).

Material content:

Chapter 1. General (2 weeks)

History of electricity production**.** History of the evolution of electrical energy production in Algeria.Eco-design and sustainable development, renewable and non-renewable energies, economic aspects.

Chapter 2. Thermal power plants (2 weeks)

Chapter 3. Generators (2 weeks)

Chapter 4. Nuclear power plants (2 weeks)

Chapter 5. Hydraulic power plants (2 weeks)

Chapter 6. Wind energy (2 weeks)

Principle of aerodynamics and types of wind turbines, operating principle, network interfacing, protection and voltage adjustment.

Chapter 7. Solar energy (2 weeks)

Operating principle and technologies, characteristic and optimum operating point.

Chapter 8. Fuel cells (1 week)

Types of fuel cells and principle of operation

Evaluation method:

Review: 100%.

Bibliographic references:

1. Sabonnadière Jean Claude, New energy technologies 1: Renewable energies, Ed. Hermès.
2. Gide Paul, The great book of wind power, Ed. Moniteur.
3. A. Labouret, Photovoltaic Solar Energy, Ed. Dunod.
4. Viollet Pierre Louis, History of hydraulic energy, Ed. Press ENP Chaussée.
5. Weigh Felix A, Solar thermal installations: design and implementation, Ed. Monitor,Dunod/L'Usine nouvelle, 2013.

6. B. Robyns et al, Production of electrical energy from renewable sources (Coll. Sciences and technologies of electrical energy), Lavoisier, 2012.
7. G. Laval, Nuclear fusion: from fundamental research to energy production?, EDP Sciences, 2007.
8. V. Crastan, Power plants and alternative electricity production, Hermès-Lavoisier, 2009.

Semester: 5
Teaching unit: UED 3.1
Subject 2:Electrotechnical materials
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Know the physical, mechanical and chemical properties of materials. Master the phenomena determining the properties of materials used in industry.

Recommended prior knowledge:

Have notions of mechanics and atomic physics and above all basic knowledge of fundamental electrical engineering (electricity and circuit, electric and magnetic field).

Material content:

Chapter 1.Magnetic materials (2 weeks)
Classification of magnetic materials, technical characterization of magnetization.

Chapter 2. Ferromagnetic materials (4 weeks)
Hard ferromagnetic materials and their applications,msoft ferromagnetic materials and their applications; characterization of permanent magnets.

Chapter 3. Dielectric Materials (4 weeks)
Polarization phenomenon, dielectric resistivity, dielectric rigidity, dielectric losses, physicochemical properties.

Chapter 4. Conductive and superconducting materials (3 weeks)
General and Application.

Chapter 5. Semiconductors (2 weeks)
General and Applications

Evaluation method:

Review: 100%.

Bibliographic references:

1. P.Robert. Electrical engineering materials, Dunod
2. F.Piriou. Electrical engineering materials, MGE 2000, Hermès
3. Breal. Treatise on materials 3: experimental characterization of materials II.
4. Gerald Roosen. Semiconductor materials and nitrides for optoelectronics, Hermès
5. P. Tixador. Superconducting materials, Hermès.
6. Treatise on electricity, vol II, "Electrotechnical materials

Semester: 5
Teaching unit: UET 3.1
Subject 1: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 method:

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: 6
Teaching unit: UEF3.2.1
Subject 1:Industrial regulation
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Master the principle and structure of regulation loops. VSchoose the appropriate regulator for an industrial process in order to have the required performance (stability, precision).

Recommended prior knowledge:

Knowledge of continuous linear servos and general electricity.

Material content:

Chapter 1.Introduction to industrial regulation (2 weeks)

Concepts of industrial process,Organs of a regulation loop (industrial process, actuators, sensors, regulators, signal conditioner,setpoint, measurement, disturbance, characteristic quantities, regulating quantities, regulated quantities, disturbing quantities), Diagram of a regulated system, Constituent elements of a regulation loop, symbols, functional diagrams and loops, performance criteria for regulation.

Chapter 2.On-off regulator (2 weeks)

On-off regulator, On-off regulator with threshold, On-off regulator with hysteresis, On-off regulator with threshold and hysteresis.

Chapter 3. Identification of open and closed loop systems (2 weeks)

Purpose of identification, choice of model, identification in open chains (S-curves, integrating curve, oscillatory curve), identification in closed chains (oscillation methods).

Chapter 4.Standard regulators: P, PI, PD, PID (2 weeks)

Characteristics, Structures of PID regulators (parallel, series, mixed), Electronic and pneumatic achievements.

Chapter 5.Choice and sizing of regulators (4 weeks)

Selection criteria, Sizing methods (flat criterion, symmetrical criterion, Ziegler Nichols method, etc.), Adjustment of Regulators by imposing a tracking model.

Chapter 6.Industrial applications (3 weeks)

Regulations oftemperature, flow, pressure, level.

Evaluation method:

Continuous control: 40%; Exam: 60%.

Bibliographic references:

1. E. Dieulesaint, D. Royer, “Applied automation”, 2001.
2. P. De Larminat, “Automatic: Control of linear systems. Hermes 1993.
3. KJ Astrom, T. Hagglund, "PID Controllers: Theory, Design and Tuning", Instrument Society of America, Research Triangle Park, NC, 1995.

4. A. Datta, MT Ho, SP Bhattacharyya, "Structure and Synthesis of PID Controllers", Springer-Verlag, London, 2000.
5. Jean-Marie Flaus, “Industrial regulation”, Editions, Hermes, 1995.
6. P. Borne, “Analysis and regulation of industrial processes volume 1: Continuous regulation”. Technip Editions.
7. T. Hans, P. Guyenot, “Regulation and enslavement” Editions, Eyrolles.
8. R.Longchamp,"Numerical control of dynamic systems automation course", Presses Polytechniques et Universitaires Romandes, 2006.
9. http://www.technologuepro.com/cours-genie-electrique/cours-6-regulation-industrielle/.

Semester: 6
Teaching unit: UEF3.2.1
Subject 2:Control of electromechanical drives
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Master the different types of variable speed drive control

Recommended prior knowledge:

Electrical machines, machine modeling, power electronics, notions of mechanics, control and regulation.

Material content:

Chapter 1. General information on electric drives (2 weeks)

Variable speed electric drive (definition, interest in speed variation, characteristics, application examples); General structure of an electric drive (Electric Machines, Static Converters, Adjustment and control unit, Driven loads); Equation of motion and mechanical characteristics (Fundamental equation of dynamics, Mechanical characteristics of electrical machines and driven loads, Quadrants of operation; Stability of an operating point).

Chapter 2. Speed variation of DC machine (4 weeks)

Reminders on direct current machines (Operating principle, Equations and equivalent electrical diagram, different types of direct current machines); Speed variation techniques of the separately excited DC machine and their characteristics (variation of the equivalent resistance of the armature, variation of the excitation flux, variation of the armature supply voltage); Static DC machine converter association (operation in 1, 2 and 4 quadrants, voltage and current reversibility, Rectifier/MCC Association, Chopper/MCC Association); Speed regulation and control of the separately excited DC machine (general structure of speed adjustment, speed adjustment without and with current adjustment).

Chapter 3. Speed variation of the asynchronous machine (5 weeks)

Reminder on the asynchronous machine (Constitution of the machine, operating principle, permanent regiment model, electromechanical characteristic); Techniques for varying the speed of the asynchronous machine (action on the equivalent resistance of the rotor, action on the stator supply voltage, action by recovery of rotor energy -Hyposynchronous cascade-, action on the number of poles, action on the power frequency); Inverter / asynchronous machine association (PWM technique, frequency and voltage variation); Introduction to the decoupling between flow and torque control (V/f, scalar control, vector control).

Chapter 4. Synchronous machine control (4 weeks)

Reminder on the synchronous machine (Constitution of the machine, operating principle, types of synchronous machine, permanent regiment model); Synchronous machine start (stall, machine start modes); Autopilot of the synchronous machine powered by a current switch; Concept on scalar control associated with the autopilot of the machine powered by a voltage inverter; Introduction to the vector control of the smooth pole synchronous machine.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Jean PaulLouis,Bernard Multon, Yvan Bonnassieux, Michel Lavabre, "Control of variable speed direct current (mcc) machines", Engineering Techniques, Electrical Engineering treatise,D3 610,2002
2. Jean PaulLouis, Bernard Multon, Yvan Bonnassieux, Michel Lavabre, "Static converters for the speed variation of mcc", Engineering Techniques, Electrical Engineering treatise,D3 611,2003.
3. B. De Fornel, “Power supply of asynchronous machines”, Engineering Techniques, Electrical Engineering treatise, D 3 621, 1990.
4. Michel LAJOIE-MAZENC, Philippe VIAROUGE "Power supply of synchronous machines", Techniques of
5. the Engineer, treatise Electrical Engineering, D 3 630, 1991
6. Michel Pinard, “Electronic control of electric motors”, DUNOD 2004
7. Gay Sturtzer, “Modeling and controls of three-phase motors”, Ellipses 2000
8. Gay Séguier, “Introduction to in-depth electrical engineering”. (Tec&Doc).
9. Jean Bonal, “Variable speed electric drives”, Lavoisier Tec&Doc, 1997.
10. Dominique Bareille, Jean-Pierre Daunis, "Electrotechnics (transformers and rotating machines) - Courses and corrected exercises -", Dunod, Paris 2006. Cote: 03-04-585
11. Pierre Mayé, “Industrial electric motors”, Dunod, Paris 2005.
12. Guy Seguier, Francis Notelet, “Industrial Electrotechnics”,

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: UEF3.2.2
Subject 1:Automation and industrial IT
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Acquire the operating principles of APIs and their implementation in automated systems,

Recommended prior knowledge:

Combinatorial and sequential logic, Computer programming languages.

Material content:

Chapter 1. General information on automated systems and industrial computing (3 Weeks)
Automation and structure of automated systems, classification of automated systems, methods of analyzing the operation of automated systems, the determining role of IT in industry, specification of the levels of specifications, performances and issues.

Chapter 2. The Grafcet (3 weeks)
Definition and notions ofbases, rules for establishing GRAFCET, transionsAndoriented connections,rrules of evolution,ssequence electionAndsimultaneous sequences, materialization of a GRAFCET.

Chapter 3. Industrial Programmable Controllers (PLC) (6 weeks)
Introduction to the study of computers, architectural study of microprocessors, architectural study of microcontrollers, internal structure and description of the elements of a API, choice of an industrial programmable controller, input-output interfaces, graphical and textual tools for programming, implementation of an industrial programmable controller, introduction to communication buses and principles of PLC networks, industrial applications.

Chapter 4. Applications in Electromechanics (3 weeks)
Automatic start-stop of asynchronous and synchronous motors, aconveyor automation, elevator automation, elevator automation.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Ronald J. Tocci, Reynald Goulet. Digital Circuits: Theory and Applications. 1996 edition.
2. Mouloud Sbai. Combinatorial logic and digital components, Courses and Corrected Exercises, Edition Ellipses, 2013.
3. Jean-Yves Fabert. Automation and Automatics: Courses and Corrected Exercises. Edition Ellipses, 2003.
4. René David, Hassan Alla. From Grafcet to Petri Nets. Edition Hermès, 1992.
5. Simon Moreno, Edmond Peulot. Grafcet: Design-Implementation in industrial programmable logic controllers. Edition Casteilla, 2009.
6. G. Michel. APIs: Architecture and applications of industrial programmable logic controllers. Edition Dunod 1988.
7. William Bolton. Industrial Programmable Automata. Edition Dunod 2010.
8. Frederic P. Miller, Agnes F. Vandome, John McBrewster. Industrial Programmable Automata: Computer programming. Edition Alphascript Publishing 2010.
9. Khushdeep Goyal and Deepak Bhandari. Industrial Automation and Robotics. Katson Books. 2008.
10. Gérard Boujat and Patrick Anaya. Industrial automatic in 20 files. Dunod. 2013.

Semester: 6
Teaching unit: UEF3.2.2
Subject 2:Turbomachines
VHS: 45h00 (Class: 1h30, Tutorial: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Discover the different machines and turbomachines used in industry and their operating characteristics.

Recommended prior knowledge:

Thermodynamic cycles, thermal machines, rotating flows

Material content:

Chapter 1. Principles of a turbomachine **(3 weeks)**
Operation, conveyed fluid, characteristic curve, efficiency, similarity, areas of use.

Chapter 2. Turbomachines with incompressible fluid **(3 weeks)**
Pumps, centrifugal and axial fans.

Chapter 3. Hydraulic turbines **(2 weeks)**

Chapter 4. Compressible fluid turbomachines **(2 weeks)**

Chapter 5. Gas turbines **(3 weeks)**
Gas turbine cycle, efficiency, turbojets, turboprops, ramjets.

Chapter 6. Steam turbines **(2 weeks)**
Steam turbine cycle, efficiency, withdrawal turbine.

Evaluation method:

Continuous monitoring: 40%; Exam: 60%.

Bibliographic references:

1. Patrick H. Oosthuizen, William E. Carscallen. Compressible fluid flow, McGraw-Hill editions, 1997.
2. HW Liepmann, A. Roshko. Elements of Gasdynamics, John Wiley & Sons, 1957.
3. Roger Ouziaux. Applied fluid mechanics; 2004, Dunod.

Semester: 6
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.

Material content:

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

Noticed:

During the weeks during which the students are immersed in the purpose of their project and its feasibility (bibliographic research, search for software or hardware necessary for carrying out the project, revision and consolidation of teaching having a direct link with the subject, etc.), the subject manager must take advantage of this face-to-face time to remind students of the essential content of the two subjects.Writing methodology''And ''Presentation methodology''addressed during the first two semesters of the common base.

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

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

The student or group of students finally presents their work (in the form of a brief oral presentation or on a poster) in front of their tutor teacher and an examining teacher who can ask questions and thus evaluate the work accomplished on the plan. technical and that of the presentation.

Evaluation method:

Controlcontinuous: 100%

Bibliographic references:

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

Semester: 6
Teaching unit: UEM3.2
Subject 2:TP Regulation and Automation
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Carry out manipulations to enrich knowledge on industrial automation. Observe the behavior of a regulated system and the influence of regulator parameters

Recommended prior knowledge:

Content of automation and industrial regulation courses.

Material content:

Industrial Automation TP:

In this practical work, the student must master PLC programming software, namely STEP7 for the Siemens PLC range or PL7 for the Schneider PLC range or others…
In this context we propose the following TPs:

1. Getting started with API programming software (depending on the range available for each establishment),
2. Management of intersection lights,
3. Starting the asynchronous motor with two directions of rotation,
4. Controlling the speed of a DC motor,
5. Control of a stepper motor.

Regulation TP:

TP1: Temporal and frequency responses and system identification.
TP2: All-or-nothing regulation of temperature or humidity, or.....
TP3: Analog regulation (PID) of fluid level.
TP4:Speed regulation of an MCC motor.
TP5: Pressure regulation.
TP6: Temperature regulation.

Evaluation method:

Continuous control: 100%.

Bibliographic references:

Industrial Automation Course Notes; Lab brochures.

Semester: 6
Teaching unit: UEM3.2
Subject 3:TP Order
VHS: 10:30 p.m. (TP: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

Discover the different types of drives at variable speeds of electrical machines as well as their electromechanical characteristics.

Recommended prior knowledge:

The basic principles of Electrical Engineering and the characteristics of electrical machines.

Material content:

TP1: Speed variation of the DC motor by action on the equivalent resistance of the armature, the voltage and the excitation field.
TP2: Rectifier/DC machine association.
TP3: Chopper/DC machine association.
TP4: Speed variation of the asynchronous motor by action on the rotor resistance and the supply voltage.
TP5: Inverter association (constant V/f)/Asynchronous machine.
TP7: Inverter association (constant V/f)/synchronous machine.
TP8: Self-piloting of the synchronous machine.

Evaluation method:

Continuous control: 100%.

Bibliographic references:

Course notes: electrical machines, power electronics; systems control;

Semester: 6
Teaching unit: UEM3.2
Subject 4: TP Sensors
VHS: 3:00 p.m. (TP: 1:00 a.m.)
Credits: 1
Coefficient: 1

Teaching objectives:
Carry out manipulations to enrich knowledge about sensors and their calibration.

Recommended prior knowledge:
Electrical and electronic measurements.

Material content:
TP1: Photometric sensors.
TP2: Strain and force sensors.
TP3: Position sensors (capacitive and inductive).
TP4: Temperature sensors.
TP5: Rotational speed sensors.
TP6: Piezoelectric vibration sensors.

Evaluation method:
Continuous control: 100%.

Bibliographic references:
Sensors and Conditioners Course Notes, Lab Brochures.

Semester: 6
Teaching unit: UED3.2
Subject 1:Maintenance of electromechanical systems
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Ensure continuity of service of an industrial installation, identify the functions and components of electrical and electronic equipment, determine the causes of system failure and repair them.

Recommended prior knowledge:

Statistics, equipment, measurements and instrumentation.

Material content:

Chapter 1: General information on maintenance**(6 weeks)**
Definition of the maintenance function (According to ISO, ANSI, NE, DIN, AFNOR); The different forms of maintenance; The essential functions of maintenance; Maintenance operations, maintenance levels; The objectives of maintenance; Role and strategy of maintenance; Related activities; Corrective maintenance; Preventive maintenance. Machine diagnostics; The application of preventive maintenance for a mechanical system; The application of preventive maintenance for an electrical system.

Chapter 2:**General concepts of operational safety (6 weeks)**
The fundamentals of operational safety; Parameters necessary for measuring reliability the main laws used in reliability, System reliability; Probability distribution of discrete random variables; Probability distribution of continuous random variables; Operational safety analysis methods [failure and effects methods (FMEA), fault tree methods (MAD), etc.]. Exercises and Applications.

Chapter 3. Introduction to computer-aided maintenance (CAM) (3 weeks)

Evaluation method:

Review: 100%.

Bibliographic references:

1. Zwingelstein G, Failure diagnosis, Hermès, Paris 1997;
2. Jean Henq. Practice of preventive maintenance, Dunod, 2000.
3. Raymond Magnan. Practical industrial maintenance, Dunod, 2003.
4. Yves Lavina.Industrial maintenance, Company function, 2005.
5. François M. Maintenance: method and organization, Dunod, Paris 2000.
6. Boulenger A & Pachaud C. Vibration diagnosis in preventive maintenance, Dunod. Paris 2000.
7. Jean Henq. Practice of preventive maintenance, Dunod, Paris 2002.
8. Cuigent R. Maintenance management, Dunod, Paris 2002.
9. Robert S & Stéphane S. Maintenance: the Maxer method, Dunod, Paris 2008.
10. JFD Beaufort. Use of relays for the protection of installations, 1972.
11. Michel Pierre Villoz. Protection and environment,; Technical and engineer, 2006.
12. Nichon Margossian.Professional risks, Technical and engineering, 2006.
13. Rachid Chaib. Maintenance and industrial safety in the company, Dar El Houda, Algiers, 2007.

Semester: 6
Teaching unit: UED3.2
Subject2:Introduction to the Internal Combustion Engine
VHS: 10:30 p.m. (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Provide an analytical description of the operation of internal combustion engines as well as the principles of calculating their performance and basic sizing.

Recommended prior knowledge:

General knowledge of the basic elements of mechanics, applied thermodynamics, kinematics and machine dynamics is recommended.

Material content:

Chapter 1. Evolution of internal combustion engines

Chapter 2. Internal combustion engine technology

Chapter 3. Theory of different thermodynamic cycles
Beau de Rochas, diesel and Sabathé.

Chapter 4. Carburization

Chapter 5. Injection

Chapter 6. Combustion

Chapter 7. Overeating

Evaluation method:

Review: 100%.

Bibliographic references:

1. R. Van Basshuysen, F. Schäfer, Internal Combustion Engine Handbook. Basics, Components, Systems, and Perspectives, SAE International, 2002.
2. CR Ferguson, Internal Combustion Engines. Applied Thermosciences, John Wiley & Sounds, 1986.
3. JB Heywood, Internal Combustion Engine Fundamentals, McGraw-Hill Book Company, 1988.
4. R. Stone, Introduction to International Combustion Engines, 4th Edition, Palgrave Macmillan, 2012.

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

Title of the License: Electromechanics

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