الجمهورية الجزائرية الديمقراطية الشعبية
Algerian Democratic Republic and Popular
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research

University

LOGO

TRAINING COURSES
L.M.D.

ACADEMIC LICENCE

NATIONAL PROGRAMME
2018- 2019

Establishment	Faculty / Institute	Department

Domain	Channel	Speciality
Science and Technologies	***Automatic***	***Automatic***

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Ministry of Higher Education Domaine et de la Recherche Scientifique

اللجنة البيداغوجية الوطنية
التكنولوجيا و العلوم لميدان
Pedagogical Committee
Domaine National du Science and Technology

عرض تكوين
ل .م .د
ليسانس أكاديمية

برنامج وطني
2019 – 2018

المؤسسة	/الكلية المعهد	القسم

الميدان	الفرع	التخصص
علوم و تكنولوجيا	آلية	آلية

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Contents

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I - Bachelor's degree profile

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1 - Location of the course :

Faculty (or Institute) :

Department :

Licence authorisation order references (attach copy order)

2- External partners:

Other partner institutions :

Companies and other socio-economic partners :

International partners :

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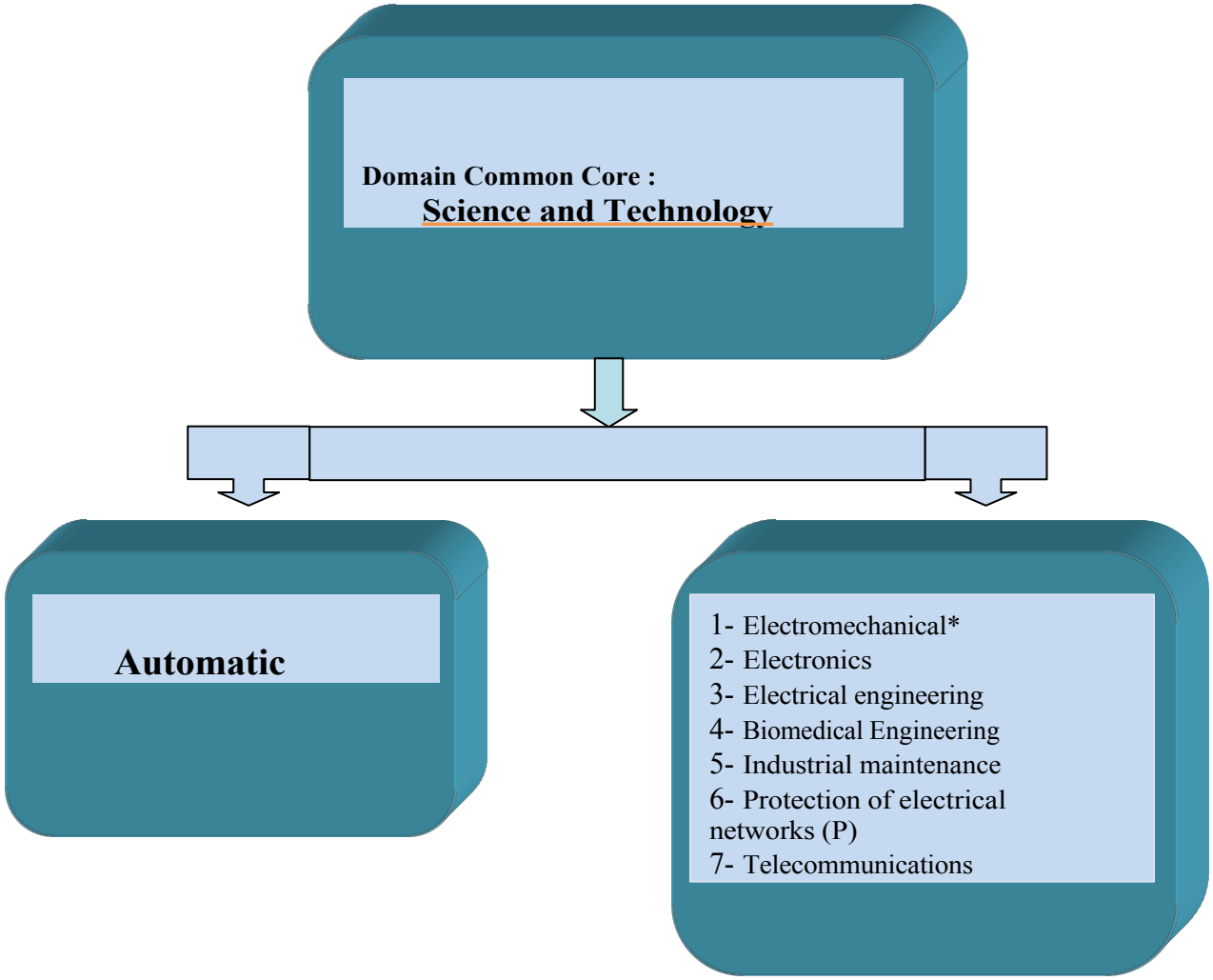
3 - Context and objectives of the course

A - General organisation of training: position of the project

In the following diagram, enter the licence which is the subject of this outline, as well as all the licences approved (functional or not) at the level of the institution and belonging to the same group of courses. Use an asterisk to indicate any other degree which is also supervised by a large number of the teachers involved in this degree. Use a double asterisk to indicate frozen licences. Also mark with a (P) any professionally-oriented degree.



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B - Training objectives:

Automation is defined as the science of analysing and controlling dynamic systems. It is a constantly evolving discipline at the frontier of many disciplines, which gives it great importance in terms of applications.

Modern industry is full of industrial automation systems that call on a wide range of technologies: pneumatics, electromechanics, electronics, electrical engineering, IT and others. That's why industrial companies are looking to universities to train specialists with a multi-disciplinary profile and a command of IT and industrial control tools, so that they can put their skills and know-how to good use in these sectors. They will then contribute to company's efficiency by providing the right information for the right decision.

In this respect, the aim of this course in Automation is to respond exactly to the concerns of our industrial partners. The programme is designed to provide students with a high-calibre diploma course that will enable them to integrate seamlessly into the professional sector.

This three-year course is academic in nature. It draws heavily on mathematics, physics, electronics, automation and computer science. It is divided into 6 semesters, the first two of which (common core) are reserved for basic subjects (mathematics, physics, chemistry and computer science). From the third semester onwards, courses become increasingly specialised. Students are provided with basic knowledge in the field of automation through mastery of the control and automation techniques most widely used in the various industrial sectors, can be summed up in three tasks: control and monitoring of production systems, maintenance of installations, automation of processes (digital control using programmable logic controllers).

C - Target profiles and skills:

The primary aim of the Bachelor's degree is to prepare students for longer studies (Master's, Doctorate). In addition, the proposed programme offers students who having difficulty pursuing a Master's degree the opportunity to enter the world of work quickly after completing the course.

They will then be able work in a wide variety of industrial fields as managerial technicians in the engineering and industrial maintenance departments of medium-sized and large companies.
The students trained will thus be capable of understanding a medium-sized automation system, modelling the control system, choosing the appropriate technologies and implementing conventional numerical control algorithms, in conjunction with (or possibly under the supervision) a designer working at a higher level of workshop or production unit management.

More specifically, the knowledge acquired by these young executives will enable them to :

- ✓ Integrate effectively into automation team,
- ✓ Design, install, operate and troubleshoot industrial facilities.
- ✓ Evaluate system performance.
- ✓ Propose and detail the solutions envisaged in collaboration with the engineers.
- ✓ Helping to define project specifications.
- ✓ Project management.
- ✓ Take account of the company's socio-economic environment, including safety and quality aspects.

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- ✓ Helping to identify the need to restructure the company's control and command processes

D - Regional and national employability potential:

The remarkable development of automated industries in recent years has led to an increased demand for automation managers. Skills in this field are in demand in all branches of industry, regardless of the specific technologies involved. These include

- ✓ Chemical and petrochemical industries.
- ✓ Steel and metallurgy industries.
- ✓ Mechanical engineering and automotive industries.
- ✓ Water and desalination industries.
- ✓ Processing, textile and manufacturing industries.
- ✓ Food industry.
- ✓ Pharmaceutical industry.
- ✓ Building materials industry.
- ✓ Production and distribution of electrical energy.
- ✓ Renewable energy sector.

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E - Gateways to other specialities:

Joint Semesters 1 and 2	
Channel	**Specialities**
Aerospace	Aerospace
Civil engineering	Civil engineering
Climate engineering	Climate engineering
Marine engineering	Naval Propulsion and Hydrodynamics
	Shipbuilding and naval architecture
Mechanical engineering	Energy
	Mechanical engineering
	Materials engineering
Hydraulics	Hydraulics
Transport engineering	Transport engineering
Metallurgy	Metallurgy
Optics and precision mechanics	Optics and photonics
	Precision mechanics
Public works	Public works
Automatic	Automatic
Electromechanical	Electromechanical
	Industrial maintenance
Electronics	Electronics
Electrical engineering	Electrical engineering
Biomedical engineering	Biomedical engineering
Industrial engineering	Industrial engineering
Telecommunications	Telecommunications
Process engineering	Process engineering
Mining engineering	Mining
	Developing mineral resources
Hydrocarbons	Hydrocarbons
Industrial health and safety	Industrial health and safety
Petrochemical industries	Refining and petrochemicals

Table of Science and Technology streams and specialities

Group A	Semester 3 common
Channel	**Specialities**
Automatic	Automatic
Electromechanics	Electromechanical Industrial maintenance
Electronics	Electronics
Electrical engineering	Electrical engineering
Biomedical engineering	Biomedical engineering
Industrial engineering	Industrial engineering
Telecommunications	Telecommunications

Group B	Joint Semester 3
Sector	**Specialities**
Aeronautics	Aeronautics
Civil engineering	Civil engineering
Climatic engineering	Climatic engineering
Engineering Maritime	Naval Propulsion and Hydrodynamics Shipbuilding and naval architecture
Mechanical engineering	Energy Mechanical engineering Materials engineering
Hydraulics	Hydraulics
Transport engineering	Transport engineering
Metallurgy	Metallurgy
Optics and precision mechanics	Optics and photonics Precision mechanics
Public works	Public works

Streams group C	Semester 3 common
Channel	**Speciality**
Process engineering	Process engineering
Engineering Mining	Mining Developing mineral resources
Hydrocarbons	Hydrocarbons
Industrial health and safety	Industrial health and safety
Petrochemical industries	Refining and petrochemicals

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

This degree offers multidisciplinary and cross-disciplinary teaching programmes:

Multidisciplinary, in the sense that the teaching in this specialisation is 100% identical for semesters 1 and 2 with all the specialisations in the Science and Technology field. In addition, the teaching in semester 3 for all the specialisations in the same group of fields is also 100% identical.

Semester	Group of sectors	Shared teaching
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 Licence offers students the choice of joining, if they so wish and depending on the number of teaching places available:

- All other specialities in the ST field at the end of semester 2.

- All specialities in the same stream group at the end of semester 3.

- All specialities from another group of streams at the end of semester 3 (subject to conditions of equivalence and the opinion of the training team).

- All specialities in the same group of streams at the end of semester 4 (subject equivalence and the opinion of the training team).

F - Performance indicators expected of the course:

All training must meet the quality requirements today and tomorrow. With this in mind, in order to better assess the expected performance of the proposed programme, on the one hand, and to take advantage of the flexibility and adaptability of the LMD system, on the other, a certain number of mechanisms are proposed, by way of example, for this degree to assess and monitor the progress of the teaching, the training programmes, the student/teacher and student/administration relations, the future of the graduates of this degree, as well as the assessments of the university's partners regarding the quality of the graduates recruited and/or the teaching provided. It is up to the programme team to add other criteria to this list according to its own resources and objectives.

Assessment procedures may take the form of surveys, on-site monitoring of students in training and surveys of graduates recruited and their employers. To this end, a report must be drawn up, archived and widely distributed.

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1. Evaluation of the course :

In addition to the regular meetings of the Teaching Committee, a meeting is organised at the end of each semester. This meeting brings together the teaching staff and students of the year discuss any problems that may have arisen and possible improvements to be made to teaching methods in particular and to the quality of the course in general.

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

Prior to the course :

- ✓ Trend in the number students choosing this degree (supply/demand ratio).
- ✓ Rate and quality of students choosing this degree.

During the course :

- ✓ Regular meetings of teaching committees.
- ✓ End-of-cycle project themes in line with the nature of the course.
- ✓ Quality of the relationship between students and the administration.
- ✓ Support for students in difficulty.
- ✓ Satisfaction satisfaction students with teaching and the teaching methods.

After the course :

- ✓ Student success rate by semester for this degree.
- ✓ Student attrition rates (failures and drop-outs).
- ✓ Identify the causes student failure.
- ✓ Students who are unsuccessful are offered alternative courses.
- ✓ Percentage of students graduating on .
- ✓ Percentage of students continuing their studies after the bachelor's degree.

2. Assessment of the teaching process:

The teaching in this pathway is subject to regular evaluation (once a year) by the training team, which will, on request, be made available to the various institutions: National Pedagogical Committee of the Science and Technology Domain, Regional Conferences, Vice-Rectorate in charge of pedagogy, Faculty, etc.

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

- ✓ Equipping teaching rooms and laboratories with the equipment and aids needed to improve teaching (projection systems (data shows), wifi connection, etc.).
- ✓ A communication and teaching platform where students can access lectures, tutorials and practical work and find solutions to their questions.
- ✓ Equipping teaching laboratories with materials and equipment appropriate to the course content.

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- ✓ Number of weeks actual teaching provided during a semester.
- ✓ Rate of completion of teaching programmes.
- ✓ Digitisation and conservation of end-of-studies and/or end-of-cycle dissertations.
- ✓ Number of practical exercises carried out and increase in the number of types of practical exercise per subject (diversity of practical exercises).
- ✓ Quality and accessibility of the institution's documentary resources relevant to the specialism.
- ✓ Support for training from the socio-economic sector (company visits, placements, lectures by professionals, etc.).

3. Integration of graduates :

A coordination committee has been set up, made up of those in charge of training and members of the Administration, which is mainly responsible for monitoring the integration of graduates from the sector into working life, compiling a database graduates from the sector, identifying and/or updating existing economic and industrial potential at regional and national level, anticipating and promoting new professions related to the sector in association with the Chamber of Commerce, the various employment support agencies, public and private operators, etc, to participate in any action concerning the professional integration of graduates (organisation of events with socio-economic operators).
In order to carry out these tasks, this committee is free to carry out or commission any study or survey on graduate employment and post-employment. Below is a list of indicators and methods that could be envisaged to evaluate and monitor this operation:

- ✓ Recruitment rate of graduates in the socio-economic sector in a position directly related to their training.
- ✓ Nature of jobs held by graduates.
- ✓ A wide range of career opportunities.
- ✓ Creation an alumni association.
- ✓ Creation of small businesses by graduates of the speciality.
- ✓ Degree of employer satisfaction.

G- Student assessment through continuous assessment and personal work :

G1- Continuous assessment :

The importance of continuous assessment in terms of students' learning outcomes is well established. In this respect, articles 20, 21 and 22 of order 712 of 03 November 2011 define and specify methods and organisation of continuous assessment of students according to their course of study. Continuous assessment averages (tutorials and practical work) are calculated on the basis of a weighting of all the elements that make up this assessment. These articles specify that this weighting is left to the discretion of the teaching staff.

A survey carried out by the CPND-ST among all the teachers in the various university establishments showed a heterogeneity in the implementation of the continuous assessment of students. This has led us to admit that there is a real deficit in the effective management of this teaching activity, which has required us to give serious thought to the matter, which, combined with proposals from several institutions, has resulted in the recommendations below.

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Analysis of the various proposals from these establishments has shown that Articles 21 and 22 Order 712 of 03 November 2011 are not sufficiently explicit and require further clarification. These articles could be enriched by taking into account the following points, which represent a summary of the proposals received.

1. Proposals for subjects with tutorials:

1.1. Preparation exercise series :

The teacher responsible for the subject should propose a series of exercises for each chapter of the course. This series should be exhaustive, with exercises for understanding the course and model exercises to be solved in the tutorial session.
These exercises must be prepared by the student before coming to the class. This preparation may be assessed. The method of assessment is left to the discretion of the teacher in charge of the tutorial.
Exercises not solved in class can be assigned as individual work in groups of 3 or 4 students, to be handed in for assessment (deadline: 1 week).

1.2. Written tests:

At the end of each series of exercises (*i.e.* at the end of each chapter) there will be a short written test. This examination must be organised in collaboration with the subject leader in order to ensure fair assessment for all students (especially when several teachers are involved in the tutorials).

1.3. Participation of students in tutorials:

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

1.4. Student attendance:

Student attendance is compulsory in tutorials and practical work. In lectures, it is difficult to monitor attendance for undergraduate students where the number of students is very high (lectures in lecture theatres). For masters courses where the number of students is smallattendance must be compulsory in both lectures and practical work.

2. Methodology units (practical work) :

Like the practical sessions, the practical work must be prepared by the student. A test check this preparation must be organised by the teacher before each experiment (in the form of short comprehension questions, MCQs, diagram of the experiment, etc.). A report (by work group) must be submitted at the end of the practical session. In this respect, the teacher must prepare a standard report (outline) to make the work easier for the students so that they can actually hand it in at the end of the practical session.
At the end of the semester, the teacher organises a practical test which summarises all the work carried out by the student.

3. About cross-curricular and discovery subjects that have no practical or laboratory sessions:

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

However, the teacher in charge of this subject may, if he/she wishes, let the students know that he/she may assess them (on a continuous basis) by offering them the opportunity to prepare presentations, write reports, research the course supplement or use free software,

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ask students to watch a popular science film related to the subject at home (after giving them either an electronic copy of the or an Internet link to it) and then ask them to submit a written report or give an oral presentation summarising the film, etc. It is up to the teacher and the course team to decide how best to take account of this personal work in the overall mark for the final exam.

Similarly, if the number of students in the subject is reasonable (20 to 30 students), which may be the case for many masters courses, the subject leader may consider continuous student assessment along lines of what is done in subjects with tutorials. The only requirement is that students should be informed of this procedure and it should be approved at the first Teaching Board meeting.

In any case, the teacher and teaching staff are free to include any type of assessment they deem appropriate to encourage students to take greater responsibility for their course and, at the same time, combat the phenomenon student absenteeism from lessons.

4. Harmonisation of continuous assessment :

The use of a common assessment grid would help to harmonise these practices from one teacher to another, from one department to another and from one institution to another. It would also provide a structuring and reassuring reference point for students. To this end, we propose below indicative assessment grid which presents the various continuous assessments used evaluate degree of acquisition of students' skills in terms of knowledge, analytical skills and ability to synthesise.
It should be noted that the aim of these assessments is not to 'trap' students by imposing very difficult continuous assessments. On the contrary, the aim is to "honestly" assess the degree to which students have assimilated the various skills and knowledge taught to , with complete objectivity. In the same spirit, we would gain by encouraging the contractualisation of learning assessment by specifying, for example, the success criteria and good practices that would lead to correct and precise answers to questions. In this way, the assessment would focus mainly on what has been learnt through training, by giving exercises linked to what has been prepared in lectures, without forgetting, however, to assess the students' ability to use their skills in more complex situations.

4-1 Tutorial :

Preparation for series of exercises and work personal (homework à presentations, etc.)	30%	06 points
Quizzes written (minimum 02 questions, including one proposed by the subject leader)	50%	10 points
Student participation in tutorials	20%	04 points
Total	**100%**	**20 points**

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4.2 Practical work :

Preparatory tests for practical work	20%	04 points
Report (must be returned to At the end of the practical session)	40%	08 points
TP test at the end of the semester on all the operations carried out by the student.	40%	08 points
Total	**100%**	**20 points**

G2- Students personal work :

Students' personal work is part of spirit of the LMD. A very substantial amount of time per week has been set aside for this: approximately 50% of the total time spent on the course (see the table entitled "Overall summary of the course" in this).

A survey carried out by the CPND-ST among the training teams in all the universities revealed that the time allocated to students' personal work could be used judiciously, under good supervision by the teacher, in a rational way and in different forms. The tasks carried out by volunteer students would be assessed and counted (as a bonus) towards their overall grade for continuous assessment. The rate of this bonus is left to the discretion of the teaching staff.

The various proposals can be summarised as follows:

1. *Homework*:

In order to enrich students' knowledge and reinforce their training, they will be asked to carry out additional homework under the guidance of their course or TD teachers. For example, this type of work could involve encouraging students to carry out research to answer specific and/or conflicting questions raised during the , solve a difficult exercise, go over demonstration of a theorem in detail, look for the complement to a lecture, use free software or a CAD-CAM tool to carry out applications and simulations linked to the lecture, etc. These activities can be assessed, marked and credited to the students who carry them out.

2. Mini course project:

The course mini-project (1 to 3 weeks) is an effective way of preparing students for the methodology of expression, writing and documentary research. It enables them to put into practice the techniques they have learnt in cross-curricular subjects. It also enables 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), culminating in a single report (10 pages maximum) and a short collective oral presentation (preferably with audio-visual support). A mark, common to the group, is awarded according to assessment grid (presentation of the document and use of bibliographical resources, oral presentation, adherence to time limits, answers to questions, etc.) and will then be counted, as a bonus, in the continuous assessment mark.

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3. Report on a visit, a field trip or a discovery and/or immersion :

Visits, educational outings, discovery and/or immersion placements are opportunities for students to gain a better understanding of the realities of the world of work and help them integrate more effectively into the world of work.

Administrators and teachers should encourage this very important aspect of training as much as possible and ensure educational visits and outings are organised throughout the course.

They should also help/encourage students to canvass economic institutions with a view to finding (in L3 and M1) one or two-week work placements in industry 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 assessed, marked and entered as a bonus for the student who carries it out. Students can be given *templates* to help them present their placement report properly.

4. Participation in scientific events:

In order to imbue students with a scientific mindset (especially for higher level students), they should be guided and encouraged to take part in round tables, laboratory seminars and conferences organised within their faculty and/or establishment. These students should even be encouraged to attend conferences, related to their speciality, outside their university at exhibitions, fairs and the like. This activity can be assessed, graded and entered as a bonus for the student who carries it out.

5. Use of New Information and Communication Technologies:

NICTs are very attractive to students. Teachers should encourage them to exploit these technologies to create spaces for exchange between them (promotion pages, discussion forum on a specific course issue, etc.). The teacher can also take part in the group as an online assessor. This activity can be assessed, marked and entered as a bonus for the students involved.

Conclusion:

Studentsautonomy, which is seen as a key to success, is based on the personal work they do, making the resources and tools available to them their own. All of this must, of course, be supervised and formalised as part of the pedagogical monitoring and support that must be provided jointly by the university lecturer and the administrative manager throughout the student's course.

This autonomy will enable them to develop their professional identity in line their aspirations, abilities and skills, and to build their academic career in the pursuit of higher education.

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4 - Available human resources :

A: Enrolment capacity (expressed as the number students that can be) :

Number students:

B: Internal teaching team mobilised for the specialisation: (To be completed and endorsed by the faculty or institute)

Full name	Graduation diploma	Specialised degree (Magister, doctorate)	Grade	Subjects to be taught	Registration

Department endorsement **Faculty or institute endorsement**

C: External teaching team involved in the speciality: (To be completed and signed by the faculty or institute)

First and last name	Home establishment	Graduation	Specialised degree (Magister, doctorate)	Grade	Subjects to be taught	Registration

Department endorsement

Faculty or institute endorsement

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D: Overall summary of human resources mobilised for the specialism (L3) :

Grade	Internal workforce	External workforce	Total
Teachers			
Senior lecturers (A)			
Senior lecturers (B)			
Senior assistant (A)			
Senior assistant (B)			
Other (*)			
Total			

(*) Technical and support staff

5 - Equipment specific to the speciality

A- Teaching laboratories and equipment: **List of existing teaching equipment for the practical work involved in the proposed course (1 list per laboratory).**

Laboratory name: Student capacity

:

N°	Equipment designation	Number	Comments

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B- Work placements and in-company training (see agreements/conventions)

Place of work placement	Number students	Length of course

C- Documentation available at the school specific to the proposed course (compulsory field) :

D- Personal workspaces and ICT available at department and faculty level **:**

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II - Semester organisation sheets for speciality courses

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Semester 1

Teaching unit	Materials	Credits	Coefficient	Hourly volume weekly			Semester (15 weeks)	Additional consultancy work (15 weeks)	Assessment method	
	Title			**Courses**	**TD**	**TP**			**Continuous assessment**	**Examination**
Foundation course Code : UEF 1.1 Credits: 18 Coefficients: 9	Mathematics 1	6	3	3h00	1h30		67h30	82h30	40%	60%
	Physics 1	6	3	3h00	1h30		67h30	82h30	40%	60%
	Structure of matter	6	3	3h00	1h30		67h30	82h30	40%	60%
Methodology course Code : UEM 1.1 Credits: 9 Coefficients: 5	TP Physics 1	2	1			1h30	22h30	27h30	100%	
	Chemistry practical work 1	2	1			1h30	22h30	27h30	100%	
	IT 1	4	2	1h30		1h30	45h00	55h00	40%	60%
	Methodology of the writing	1	1	1h00			15h00	10h00		100%
UE Discovery Code : UED 1.1 Credits: 1 Coefficients: 1	Careers in Science and Technology 1	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 1.1 Credits: 2 Coefficients: 2	Foreign language 1 (French and/or English)	2	2	3h00			45h00	05h00		100 %
Total semester 1		**30**	**17**	**16h00**	**4h30**	**4h30**	**375h00**	**375h00**		

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Semester 2

Teaching unit	Materials	Credits	Coefficient	Hourly volume weekly			Semester (15 weeks)	Additional consultancy work (15 weeks)	Assessment method	
	Title			**Courses**	**TD**	**TP**			**Continuous assessment**	**Examination**
Foundation course Code : UEF 1.2 Credits: 18 Coefficients: 9	Mathematics 2	6	3	3h00	1h30		67h30	82h30	40%	60%
	Physics 2	6	3	3h00	1h30		67h30	82h30	40%	60%
	Thermodynamics	6	3	3h00	1h30		67h30	82h30	40%	60%
Methodology course Code : UEM 1.2 Credits: 9 Coefficients: 5	TP Physics 2	2	1			1h30	22h30	27h30	100%	
	Chemistry 2 practical work	2	1			1h30	22h30	27h30	100%	
	IT 2	4	2	1h30		1h30	45h00	55h00	40%	60%
	Methodology of the presentation	1	1	1h00			15h00	10h00		100%
UE Discovery Code : UED 1.2 Credits: 1 Coefficients: 1	Careers in Science and Technology 2	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 1.2 Credits: 2 Coefficients: 2	Foreign language 2 (French and/or English)	2	2	3h00			45h00	05h00		100 %
Total semester 2		**30**	**17**	**16h00**	**4h30**	**4h30**	**375h00**	**375h00**		

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Semester 2

Teaching unit	Materials	Credits	Coefficient	Hourly volume weekly			Semester (15 weeks)	Additional consultancy work (15 weeks)	Assessment method	
	Title			**Courses**	**TD**	**TP**			**Continuous assessment**	**Examination**
Foundation course Code : UEF 2.1.1 Credits: 10 Coefficients: 5	Mathematics 3	6	3	3h00	1h30		67h30	82h30	40%	60%
	Waves and vibrations	4	2	1h30	1h30		45h00	55h00	40%	60%
Foundation course Code : UEF 2.1.2 Credits: 8 Coefficients: 4	Electronics fundamental 1	4	2	1h30	1h30		45h00	55h00	40%	60%
	Electrical engineering fundamental 1	4	2	1h30	1h30		45h00	55h00	40%	60%
Methodology course Code : UEM 2.1 Credits: 9 Coefficients: 5	Probability and statistics	4	2	1h30	1h30		45h00	55h00	40%	60%
	IT 3	2	1			1h30	22h30	27h30	100%	
	Electronics and electrical engineering practical training	2	1			1h30	22h30	27h30	100%	
	TP Waves and vibrations	1	1			1h00	15h00	10h00	100%	
UE Discovery Code : UED 2.1 Credits: 2 Coefficients: 2	State of the art in engineering electric	1	1	1h30			22h30	02h30		100%
	Energy and environment	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 2.1 Credits: 1 Coefficients: 1	Technical English	1	1	1h30			22h30	02h30		100%
Total semester 3		**30**	**17**	**13h30**	**7h30**	**4h00**	**375h00**	**375h00**		

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Semester 2

Teaching unit	Title	Credits	Coefficient	Hourly volume weekly			Semester (15 weeks)	Additional consultancy work (15 weeks)	Assessment method	
				Courses	**TD**	**TP**			**Continuous assessment**	**Examination**
Foundation course Code : UEF 2.2.1 Credits: 10 Coefficients: 5	Linear and continuous servo systems	6	3	3h00	1h30		67h30	82h30	40%	60%
	Combinatorial and sequential logic	4	2	1h30	1h30		45h00	55h00	40%	60%
Foundation course Code : UEF 2.2.2 Credits: 8 Coefficients: 4	Numerical methods	4	2	1h30	1h30		45h00	55h00	40%	60%
	Signal theory	4	2	1h30	1h30		45h00	55h00	40%	60%
Methodology course Code : UEM 2.2 Credits: 9 Coefficients: 5	Electrical and electronic measurements	3	2	1h30		1h00	37h30	37h30	40%	60%
	TP Servo Systems linear and continuous	2	1			1h30	22h30	27h30	100%	
	TP Combinatorial and sequential logic	2	1			1h30	22h30	27h30	100%	
	TP Numerical Methods	2	1			1h30	22h30	27h30	100%	
UE Discovery Code : UED 2.2 Credits: 2 Coefficients: 2	Architecture of Automated systems	1	1	1h30			22h30	02h30		100%
	Electrical safety	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 2.2 Credits: 1 Coefficients: 1	Expression and communication techniques	1	1	1h30			22h30	02h30		100%
Total semester 4		**30**	**17**	**13h30**	**6h00**	**5h30**	**375h00**	**375h00**		

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Semester 2

Teaching unit	Title	Credits	Coefficient	Hourly volume weekly			Semester (15 weeks)	Complementary work in consultation (15 weeks)	Assessment method	
				Courses	**TD**	**TP**			**Continuous assessment**	**Examination**
Foundation course Code : UEF 3.1.1 Credits: 10 Coefficients: 5	Controlling linear systems	4	2	1h30	1h30		45h00	55h00	40%	60%
	Power electronics	4	2	1h30	1h30		45h00	55h00	40%	60%
	Modelling and systems identification	2	1	1h30			22h30	27h30		100%
Foundation course Code : UEF 3.1.2 Credits: 8 Coefficients: 4	Microprocessors and microcontrollers	6	3	3h00	1h30		67h30	82h30	40%	60%
	Programming in C++	2	1	1h30			22h30	27h30		100%
Methodology course Code : UEM 3.1 Credits: 9 Coefficients: 5	TP Control of linear systems	2	1			1h30	22h30	27h30	100%	
	TP Power Electronics	2	1			1h30	22h30	27h30	100%	
	TP Systems modelling and identification	2	1			1h30	22h30	27h30	100%	
	TP Microprocessors and Microcontrollers	2	1			1h30	22h30	27h30	100%	
	TP Programming in C++	1	1			1h00	15h00	10h00	100%	
UE Discovery Code : UED 3.1 Credits: 2 Coefficients: 2	Standards and Certification	1	1	1h30			22h30	02h30		100%
	Renewable energies: Production and storage	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 3.1 Credits: 1 Coefficients: 1	English in Automation	1	1	1h30			22h30	02h30		100%
Total semester 5		**30**	**17**	**13h30**	**4h30**	**7h00**	**375h00**	**375h00**		

Semester 2

Teaching unit	Title	Credits	Coefficient	Number of hours per week			Semester (15 weeks)	Additional consultancy work (15 weeks)	Assessment method	
				Courses	**TD**	**TP**			**Continuous assessment**	**Examination**
Foundation course Code : UEF 3.2.1 Credits: 10 Coefficients: 5	Sampled servo systems	4	2	1h30	1h30		45h00	55h00	40%	60%
	Actuators	4	2	1h30	1h30		45h00	55h00	40%	60%
	Sensors and measure	2	1	1h30			22h30	27h30		100%
Foundation course Code : UEF 3.2.2 Credits: 8 Coefficients: 4	Programmable logic controllers	6	3	3h00	1h30		67h30	82h30	40%	60%
	Communication bus and Industrial networks	2	1	1h30			22h30	27h30		100%
Methodology course Code : UEM 3.2 Credits: 9 Coefficients: 5	End of Cycle Project	4	2			3h00	45h00	55h00	100%	
	TP Sensors and Actuators	2	1			1h30	22h30	27h30	100%	
	TP Programmable Logic Controllers	2	1			1h30	22h30	27h30	100%	
	TP Communication Buses and Industrial Networks	1	1			1h00	15h00	10h00	100%	
UE Discovery Code : UED 3.2 Credits: 2 Coefficients: 2	Automatic electrical installations	1	1	1h30			22h30	02h30		100%
	Maintenance and reliability	1	1	1h30			22h30	02h30		100%
Cross-curricular course Code : UET 3.2 Credits: 1 Coefficients: 1	Professional project and business management	1	1	1h30			22h30	02h30		100%
Total semester 6		**30**	**17**	**13h30**	**4h30**	**7h00**	**375h00**	**375h00**		

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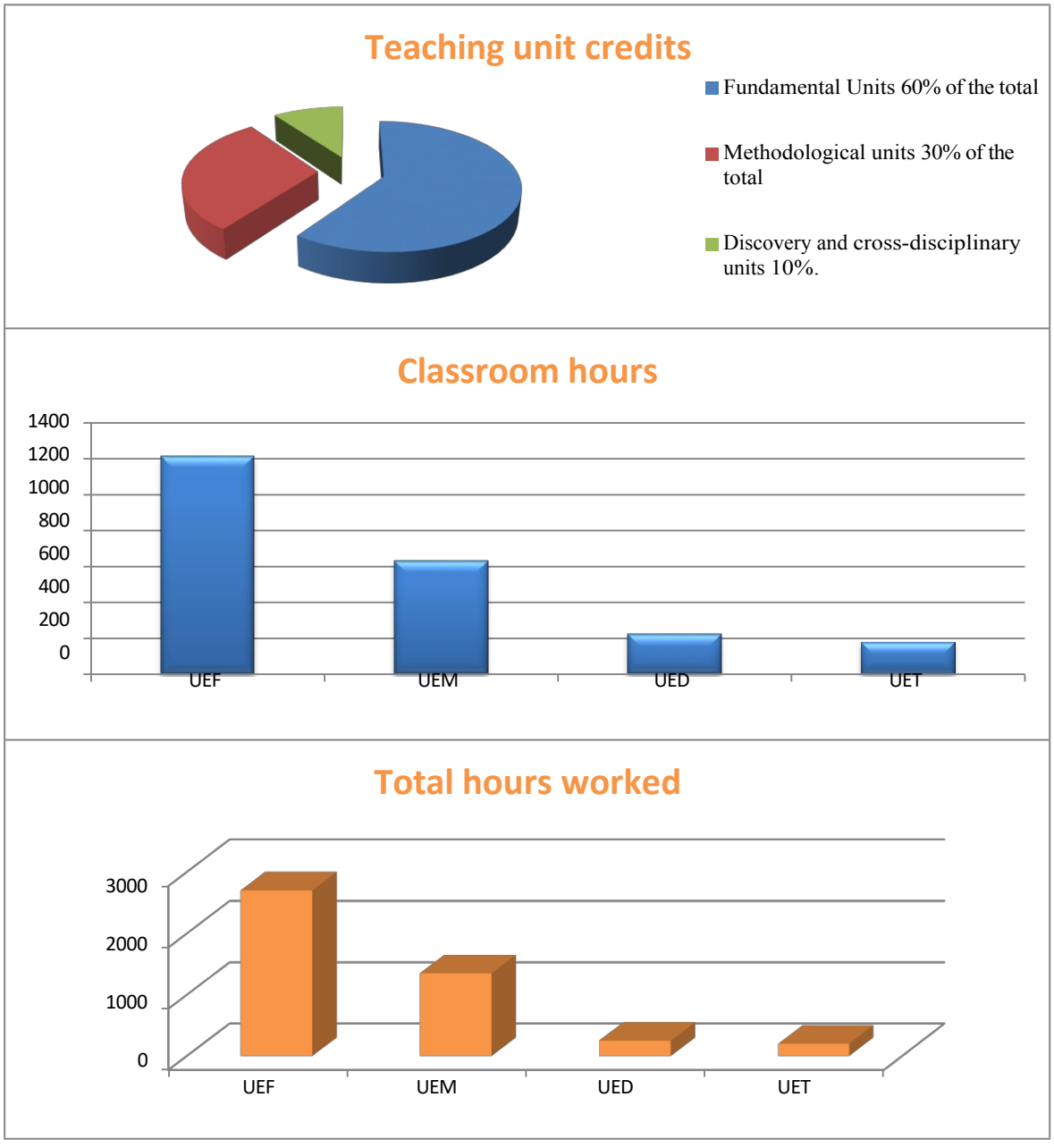
Overall summary of the course :

EU / VH	UEF	UEM	UED	UET	Total
Courses	720h00	120h00	225h00	180h00	1245h00
TD	495h00	22h30	—	—	517h30
TP	—	487h30	—	—	487h30
Personal work	1485h00	720h00	25h00	20h00	2250h00
Other (please specify)	—	—	—	—	—
Total	2700h00	1350h00	250h00	200h00	4500h00
Credits	108	54	10	8	180
% in credits for each EU	60 %	30 %	10 %		100 %



III - Detailed programme by subject

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Semester: 1
Teaching unit: UEF 1.1 Subject 1:
Mathematics 1
VHS: 67h30 (Classes: 3h00, Workshops: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives

This first mathematics subject is designed to level the playing field for students entering university. The first new elements are taught progressively, leading students on to more advanced mathematics. The concepts covered in this subject are fundamental and among the most widely used in the field of Science and Technology.

Recommended prior knowledge

Basic mathematical concepts for the final year of secondary school (sets, functions, equations, etc.).

Subject content:

Chapter 1: Methods of mathematical reasoning (1 week)
1-1 Direct reasoning. 1-2 Reasoning by contraposition. 1-3 Reasoning by absurdity. 1-4 Reasoning by counter-example. 1-5 Reasoning by recurrence.

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

Chapter 3. Real functions with one real variable (3 weeks)
3-1 The limit and continuity of a function. 3-2 Derivative and differentiability of a function.

Chapter 4. Application to elementary functions (3 weeks)
4-1 Power function. 4-2 Logarithmic function. 4-3 Exponential function. 4-4 Hyperbolic function. 4-5 Trigonometric function. 4-6 Inverse function

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

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

Assessment method:

Continuous assessment: 40%; examination: 60%.

References :

1- K. Allab, Eléments d'analyse, Fonction d'une variable réelle, 1re & 2e années d'université, Office des Publications universitaires.
2- J. Rivaud, Algèbre : Classes préparatoires et Université Tome 1, Exercices avec solutions, Vuibert.
3- N. Faddeev, I. Sominski, Collection of exercises in higher algebra, Moscow edition
4- M. Balabne, M. Duflo, M. Frish, D. Guegan, Géométrie - 2e année du 1er cycle classes préparatoires, Vuibert Université.

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5- B. Calvo, J. Doyen, A. Calvo, F. Boshet, Exercices d'algèbre, 1er cycle scientifique préparation aux grandes écoles 2e année, Armand Colin - Collection U.
6- J. Quinet, Cours élémentaire de mathématiques supérieures 1- Algèbre, Dunod.
7- J. Quinet, Cours élémentaire de mathématiques supérieures 2- Fonctions usuelles, Dunod.
8- J. Quinet, Cours élémentaire de mathématiques supérieures 3- Calcul intégral et séries, Dunod.
9- J. Quinet, Cours élémentaire de mathématiques supérieures 4- Equations différentielles, Dunod.

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Semester: 1
Teaching unit: UEF 1.1 Subject 2: Physics 1
VHS: 67h30 (Classes: 3h00, Workshops: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives
Introduces students to the basics of Newtonian physics through three main sectionsKinematics, Dynamics and Work and Energy.

Recommended prior knowledge
Notions of mathematics and physics.

Subject content:

Mathematics reminder **(2 weeks)**
1- Dimensional equations
2- Vector calculus: scalar product (norm), vector product, multivariate functions, derivation. Vector analysis: gradient and rotational operators, etc.

Chapter 1: Kinematics **(5 weeks)**
1- Position vector in coordinate systems (Cartesian, cylindrical, spherical, curvilinear) - law of motion - trajectory. 2- Speed and acceleration in systems. 3- Applications: Motion of a material point in different coordinate systems. 4- Relative motion.

Chapter 2. Dynamics: **(4 weeks)**
1- General: Mass - Force - Moment of force - Absolute and Galilean reference frame. 2- Newton's laws. 3- Principle of conservation of momentum. 4- Differential equation of motion. 5- Kinetic momentum. 6- Applications of the fundamental law for forces (constant, time-dependent, velocity-dependent, central force, etc.).

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

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

References:
1. A. Gibaud, M. Henry; Cours de physique - Mécanique du point - Cours et exercices corrigés; Dunod, 2007.
2. P. Fishbane et al; Physics For Scientists and Engineers with Modern Physics, 3rd Ed; 2005.
3. P. A. Tipler, G. Mosca; Physics For Scientists and Engineers, 6th Ed, W. H. Freeman Company, 2008.

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Semester: 1
Teaching unit: UEF 1.1 Subject 3:
Structure of the subject VHS: 67h30
(Lecture: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives

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

Recommended prior knowledge

Basic knowledge of mathematics and general chemistry.

Contents:

Chapter 1: Fundamentals **(2 weeks)**
States and macroscopic characteristics of states of matter, changes in states of matter, concepts of atom, molecule, mole and Avogadro number, atomic mass unit, atomic and molecular molar mass, molar volume, Law of Weight: Conservation of Mass (Lavoisier), chemical reaction, Qualitative aspect of matter, Quantitative aspect of matter.

Chapter 2: Main constituents of matter **(3 weeks)**
Introduction: Faraday's experiment: relationship between matter and electricity**,** Identification of the constituents of matter and therefore of the atom**,** and some physical properties (mass and charge), Rutherford's planetary model, Presentation and characteristics of the atom (symbol, atomic number Z, mass number A, number of proton, neutrons and electron), Isotopy and relative abundance of different isotopes, Separation of isotopes and determination of the atomic mass and average mass of an atom: Mass spectrometry: Bainbridge spectrograph, Binding and cohesive energy of nuclei, Stability of nuclei.

Chapter 3: Radioactivity - Nuclear reactions **(2 Weeks)** Natural radioactivity (α, β andradiation), Artificial radioactivity and nuclear reactions, Kinetics of radioactive decay, Applications of radioactivity.

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

Chapter 5: Periodic classification of the elements **(3 weeks)** D.
Mendeleiev's periodic classification, modern periodic classification, evolution and periodicity of the elements' physico-chemical properties, calculation of radii (atomic and ionic), successive ionization energies, electronic affinity and electronegativity (Mulliken scale) using Slater's rules.

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

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Evaluation :

Continuous assessment: 40%; Exam: 60%.

References

1. Ouahes, Devallez, General Chemistry, OPU.
2. S.S. Zumdhal & al, Chimie Générale, De Boeck Université.
3. Y. Jean, Structure électronique des molécules: 1 de l'atome aux molécules simples, 3rd edition, Dunod, 2003.
4. F. Vassaux, La chimie en IUT et BTS.
5. A. Casalot & A. Durupthy, Chimie inorganique cours 2ème cycle, Hachette.
6. P. Arnaud, Cours de Chimie Physique, Ed. Dunod.
7. M. Guymont, Structure de la matière, Belin Coll, 2003.
8. G. Devore, Chimie générale: T1, étude des structures, Coll. Vuibert, 1980.
9. M. Karapetiantz, Constitution de la matière, Ed. Mir, 1980.

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Semester: 1
Teaching : UEM 1.1 Subject 1: TP
Physics 1
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives
Consolidate the theoretical knowledge acquired during the course with number of practical manipulations.

Recommended prior knowledge
Notions of mathematics and physics.

Contents:

5 manipulations minimum (3h00 / 15 days) :

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

Evaluation :
Continuous assessment: 100%.

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Semester: 1
Teaching : UEM 1.1 Subject 2:
Chemistry practical work 1
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives
Consolidate the theoretical knowledge acquired in the Structure of Matter course with a number of practical manipulations.

Recommended prior knowledge
Basic chemistry.

Contents:

1. Safety in the laboratory

2. Solution preparation

3. Notions on uncertainty applied to chemistry.

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

5. Acid-base determination by conductivity meter.

5. Redox

6. Determining water hardness

7. Determination of ions in water: determination of chloride ions using Mohr's method.

Evaluation :
Continuous assessment: 100%.

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Semester: 1
Teaching unit: UEM 1.1 Subject 3:
Computer Science 1
VHS: 45h00 (Class: 1h30, Practical: 1h30)
Credits: 4
Coefficient: 2

Objective and recommendations:
The aim of the subject is to enable students to learn to program in an advanced language (Fortran, Pascal or C). The choice of language is left to the discretion of each school. The notion algorithms should be implicitly taken into account when learning the language.

Recommended prior knowledge
Web technology basics.

Contents:

Part 1. Introduction computers (5 weeks)

1- Definition of IT
2- The evolution of computers
3- Information coding systems
4- How a computer works
5- Computer hardware
6- System part
Basic systems (operating systems (Windows, Linux, Mac OS, etc.) Programming languages, application

Part 2. Algorithm and program concepts (10 weeks)

1- Concept an algorithm
2- Flowchart representation
3- Program structure
4- Approach and analysis a problem
5- Data structure: Constants and variables, Data types
6- Operators: assignment , relational operators, logical operators, arithmetic operations, priorities in operations
7- Input/output operations
8- Control structures: Conditional control structures, Repetitive control structures

TP Informatique 1 :
Practical work is designed to illustrate the concepts taught during the course. They should begin with the course, according to the following schedule:
- Introduction to and familiarization with computer hardware and operating (exploration of different OS functions).
- Introduction to use a programming environment (Editing, Assembly, Compilation, etc.).
- Practical application of programming techniques learned in class.

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

References
1- John Paul Mueller and Luca Massaron, Algorithms for Dummies large format, 2017.

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2- Charles E. Leiserson, Clifford Stein and Thomas H. Cormen, Algorithms: course with 957 exercises and 158 problems, 2017.
3- Thomas H. Cormen, Algorithms: Fundamentals, 2013.

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Semester: 1
Teaching unit: UEM 1.1
Subject 4: Writing Methodology
VHS: 15h00 (Course: 1h00)
Credits: 1
Coefficient: 1

Teaching objectives

Familiarize and train students with current concepts in writing methodology in the Science and Technology profession. Skills to be acquired include: how to introduce oneself; how to write a CV and cover letter; how to position oneself in writing or orally in relation to an opinion or idea; how to master syntax and spelling in writing.

Recommended prior knowledge

Basic French. Basic principles of writing.

Contents:

Chapter 1. Basics and generalities of writing techniques (2 weeks)
- Definitions, standards
- Applications: summaries, letters and applications

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

Chapter 3 Writing techniques and procedures (3 Weeks)
- Basic principles of writing - Punctuation, Syntax, Sentences
- Sentence length
- Paragraph division
- Using a neutral style and writing in the third person
- Legibility
- Objectivity
- Intellectual rigor and Plagiarism

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

Chapter 5. Applications (3 Weeks)
Practical work report

Evaluation :

Control Exam: 100%.

References :

1. J.-L. Lebrun, Guide pratique de rédaction scientifique, EDP Sciences, 2007.
2. M. Fayet, Réussir ses comptes rendus, 3rd edition, Eyrolles, 2009.
3. M. Kalika, Mémoire de master - Piloter un mémoire, Rédiger un rapport, Préparer une soutenance, Dunod, 2016.
4. M. Greuter, Réussir son mémoire et son rapport de stage, l'Etudiant, 2014
5. F. Cartier, Communication écrite et orale, Edition GEP- Groupe Eyrolles, 2012.
6. M. Fayet, Méthodes de communication écrite et orale, 3rd edition, Dunod, 2008.

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7. E. Riondet, P. Lenormand, Le grand livre des modèles de lettres, Eyrolles, 2012.
8. R. Barrass, Scientist must write - A guide to better writing for scientists, engineers and students, 2d edition, Routledge, 2002.
9. G. Andreani, La pratique de la correspondance, Hachette, 1995.
10. Ph. Rubens, Science & Technical Writing, A Manual of Style, 2d edition, Routledge, 2001.
11. A. Wallwork, User Guides, Manuals, and Technical Writing - A Guide to Professional English, Springer, 2014.

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Semester: 1
Teaching : UED 1.1
Subject 1: Careers in Science and Technology 1 VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Aim of the subject:
Firstlyit introduces students to all the fields covered by the Science and Technology Domain, and secondly to the wide range of careers to which these fields lead. In the same context, this subject introduces the new challenges of sustainable development and the new professions that can result from it.

Recommended prior knowledge
None.

Contents :
1. What is engineering science? (2 weeks)
The engineering profession, history and challenges of the 21st century**,** Search for a profession/recruitment ad by keyword, draw up a simple job description (job title, company, main activities, skills required (knowledge, know-how, interpersonal skills, etc.)).

2. Electronics, Telecommunications, Biomedical Engineering, Electrical Engineering, Electromechanics, Optics & Precision Mechanics : (2 weeks)
- Definitions, fields of application (home automation, automotive applications, video surveillance, mobile telephony, fiber optics, advanced scientific instrumentation, medical imaging and instrumentation, giant mirrors, contact lenses, electrical power transmission and distribution, power generation plants, energy efficiency, industrial equipment maintenance, elevators, wind turbines, etc.).
- The role of the specialist in these areas.

3. Automation and Industrial Engineering : (1 week)
- Definitions, fields of application (industrial automation chains, machine tools, robotics, inventory management, goods traffic management, quality),
- The role of the specialist in these areas.

4. Process Engineering, Hydrocarbons and Petrochemical Industries : (2 weeks)
- Definitions, Pharmaceutical industry, Food industry, Leather and textile industry, Biotechnologies, Chemical and petrochemical industry, Plastics industry, Energy sector (oil, gas), ...
- The 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+ Vivable+ Equitable), SD actors (governments, citizens, socio-economic sector, international organizations, etc.), Global nature of SD challenges.

6. Sustainable engineering : (4 weeks)
Definition, Principles sustainable engineering (definitions of: sustainable energy/energy efficiency, sustainable mobility/ecomobility, resource recovery (water, metals and minerals, ...), production

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sustainable engineering), Relevance of sustainable engineering in ST sectors, Relationship between sustainability and engineering, Responsibility of engineers in the realization of sustainable projects, ...

Personal work for this subject:
The teacher in charge of this subject can let his students know that he can still assess them by suggesting that they prepare job descriptions. Ask students to watch a popular science film related to their chosen profession at home (giving them either the film in electronic format or the Internet link to the film), and then ask them submit a written report or give an oral presentation summarizing the film... etc. Whether or not these activities should be credited is left to the discretion of the teacher and the training team, who alone are able to determine the best way to take account of this personal work in the overall mark for the final exam.

Group work: Drawing up job descriptions for professions in each sector, based on de recrutement on the sites de demande d'emploi (e.g. **http : //www.onisep.fr/Decouvrir-les-metiers** , www.indeed.fr, www.pole-emploi.fr) (1 stream / group). Depending on the institution's capacity, it may be advisable to call on the institution's PhD students and former graduates in a tutoring/mentoring scheme, where each group can call on its tutor/mentor to draw up the job description and discover the various ST professions.

Assessment :
100% review

References :
1- What jobs for tomorrow? Publisher: ONISEP, 2016, Collection: Les Dossiers.
2- J. Douënel and I. Sédès, Choisir un métier selon son profil, Editions d'Organisation, Collection: Emploi & carrière, 2010.
3- V. Bertereau and E. Ratière, Pour quel métier êtes-vous fait? Publisher: L'Étudiant, 6th edition, Collection: Métiers, 2015.
4- Le grand livre des métiers, Publisher: L'Étudiant, Collection: Métiers, 2017.
5- Careers in industry, Collection: Parcours, Edition: ONISEP, 2017.
6- Les métiers de l'électronique et de la robotique, Collection: Parcours, Edition: ONISEP, 2015.
7- Les métiers de l'environnement et du développement durable, Collection: Parcours, Edition: ONISEP, 2015.
8- Les métiers du bâtiment et des travaux publics, Collection: Parcours, Edition: ONISEP, 2016.
9- Les métiers du transport et de la logistique, Collection : Parcours, Edition : ONISEP, 2016.
10- Les métiers de l'énergie, Collection: Parcours, Edition: ONISEP, 2016.
11- Les métiers de la mécanique, Collection: Parcours, Edition: ONISEP, 2014.
12- Les métiers de la chimie, Collection: Parcours, Edition: ONISEP, 2017.
13- Les métiers du Web, Collection: Parcours, Edition: ONISEP, 2015.
14- Les métiers de la biologie, Collection: Parcours, Edition: ONISEP, 2016.

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Semester: 1
Teaching : UET 1.1 Subject 1:
French language1 VHS: 22h30
(Course: 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 and written expression, through reading and study of texts.

Previous knowledge recommended:
Basic French.

Contents:
Below is a list of themes covering basic science, technology, economics, social issues, communication, sport, health and more. Teachers can choose texts from this list to develop during the lesson. Otherwise, he or she is free to tackle other themes of his or her choice. Texts can be borrowed from a variety of media: daily newspapers, sports and entertainment magazines, specialized and popular magazines, books, websites, audio and video recordings, etc.
For each text, the teacher helps the student to develop his her language skills: listening, comprehension, oral and written expression. They must also use the text to identify the grammatical structures they will develop during the same class session. Here, by way of illustration, we list a number of grammatical structures that can be developed as examples. Of course, you don't have to develop them all or in the same way. Some can be recalled, while others can be explained in detail.

Examples of themes	Grammatical structures
Climate change Pollution Electric cars Robots Artificial intelligence The Nobel Prize Olympic Games Sport at school The Sahara The currency Assembly line work Ecology Nanotechnology Fiber optics Engineering Power plants Energy efficiency Intelligent buildings Wind power Solar power	Punctuation. Proper nouns, Articles. Grammatical functions: nouns, verbs, pronouns, adjectives, adverbs. The complement pronoun "le, la, les, lui, leur, y, en, me, te, ..." Agreements. The negative sentence. Ne ... pas, Ne ... pas encore, Ne ... plus, Ne ... jamais, Ne ... point, ... The interrogative sentence. Question with "Who, What, What", Question with "When, Where, How, Why, Which, Which". The exclamatory sentence. Pronominal verbs. Impersonal verbs. Indicative tenses, Present, Future, Past Compound, Past Simple, Imperfect. ...

Evaluation :
Review: 100%.

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References:

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

CPNDST University

Semester: 1
Teaching Unit: UET 1.1 Subject 1: English Language1 VHS: 22h30 (Course: 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 technical matters in English for further understanding. Therefore, each text will be defined by a set 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. Besides, the activity at the end of each session must include a translation of long statements which are selected from the texts.

Examples for some lectures:	Examples of Word Study: Patterns
Iron and Steel	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

Evaluation mode:
Exam: 100%.

References:

1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office des Publications Universitaires, 1994.
2. A.J. Herbert, The Structure of Technical English, Longman, 1972.
3. S. Berland-Delepine, Grammaire méthodique de l'anglais moderne avec exercices, Ophrys, 1982.
4. Test of English as a Foreign Language - Preparation Guide, Cliffs, 1991.
5. R. Fowler, The Little, Brown Handbook, Little, Brown Company, 1980.
6. Cambridge - First Certificate in English, Cambridge books, 2008.
7. K. Wilson, Th. Healy, First Choice, Oxford, 2007.

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8. M. Mann, S. Tayore-Knowles, Destination: Grammar & Vocabulary with Answer Key, MacMillan, 2006.
9. E. Hamby, Ph. Bedford Robinson, Special English Computer Applications, Cassell, 1980.
10. P. Charles Brown, Norma D. Mullen, English for Computer Science, Oxford University Press, 1989.
11. Graeme Kennedy, Structure and Meaning in English: A Guide for Teachers, Pearson, 2004.
12. Anne M. Hanson, Brain-Friendly Strategies for Developing Student Writing Skills, 2nd Edition, Corwin Press, 2008.
13. Ann Bridges, How to Pass Higher English, Hodder Gibson-Hachette, 2009.
14. Claude Renucci, Anglais : 1000 Mots et expressions de la presse : Vocabulaire et expressions du monde économique, social et politique, Fernand Nathan, 2006.

CPNDST University

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

Teaching objectives

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

Recommended prior knowledge

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

Contents:

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, transition matrix.

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

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

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 second-order ordinary differential equations with constant coefficient.

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

Evaluation :

Continuous assessment: 40%; Exam: 60%.

References:

1- F. Ayres Jr, Theory and Applications of Differential and Integral Calculus - 1175 corrected exercises, McGraw-Hill.
2- F. Ayres Jr, Theory and Applications of Differential Equations - 560 corrected exercises, McGraw-Hill.
3- J. Lelong-Ferrand, J.M. Arnaudiès, Cours de Mathématiques - Equations différentielles, Intégrales multiples, Tome 4, Dunod Université.
4- M. Krasnov, Collection of Problems on Ordinary Differential Equations, Moscow Edition

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5- N. Piskounov, Differential and Integral Calculus, Volume 1, Moscow Edition
6- J. Quinet, Cours élémentaire de mathématiques supérieures 3- Calcul intégral et séries, Dunod.
7- J. Quinet, Cours élémentaire de mathématiques supérieures 4- Equations différentielles, Dunod.
8- J. Quinet, Cours élémentaire de mathématiques supérieures 2- Fonctions usuelles, Dunod.
9- J. Quinet, Cours élémentaire de mathématiques supérieures 1- Algèbre, Dunod.
10- J. Rivaud, Algebra: Classes préparatoires et Université Tome 1, Exercices avec solutions, Vuibert.
11- N. Faddeev, I. Sominski, Collection of exercises in higher algebra, Moscow Edition.

CPNDST University

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

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

Recommended prior knowledge
Mathematics 1, Physics 1.

Contents:
Mathematics reminder : (1 Week)
1- Elements of length, surface and volume in Cartesian, cylindrical and spherical coordinate systems. Solid angles, operators (gradient, rotational, Nabla, Laplacian and divergence).
2- Multiple derivatives and integrals.

Chapter I. Electrostatics : (6 weeks)
1- Electrostatic charges and fields. Electrostatic interaction forces-Coulomb's law.
2-Electrostatic potential. 3- Electric dipole. 4- Electric field flow. 5- Gauss's theorem. 6- Conductors in equilibrium. 7- Electrostatic pressure. 8- Capacitance of a conductor and a capacitor.

Chapter II. Electro-kinetics : (4 weeks)
1- Electrical conductor. 2- Ohm's law. 3- Joule's Law. 4- Electrical circuits. 5- Application of Ohm's Law to networks. 6- Kirchhoff's Laws. Thevenin's theorem.

Chapter III. Electromagnetism : (4 weeks)
1- Magnetic field: Definition of a magnetic field, Biot and Savart's Law, Ampère's Theorem, Calculation of magnetic fields created by permanent currents.
2- Induction phenomena: Induction phenomena (circuit in a variable magnetic field and moving circuit in a permanent magnetic field), Lorentz's force, Laplace's force, Faraday's law, Lenz's law, Application to coupled circuits.

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

References:

1. J.-P. Perez, R. Carles, R. Fleckinger; Electromagnetisme Fondements et Applications, Ed. Dunod, 2011.
2. H. Djelouah ; Electromagnetisme ; Office des Publications Universitaires, 2011.
3. P. Fishbane et al; Physics For Scientists and Engineers with Modern Physics, 3rd ed; 2005.
4. P. A. Tipler, G. Mosca; Physics For Scientists and Engineers, 6th ed, W. H. Freeman Company, 2008.

CPNDST University

Semester: 2
Teaching : UEF 1.2 Subject 3:
Thermodynamics
VHS: 67h30 (Lecture: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives

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

Recommended prior knowledge

Basic knowledge of mathematics and general chemistry.

Contents:

Chapter 1: General thermodynamics (3 weeks)

1-Fundamental properties of state functions. 2- Definitions of thermodynamic systems and the external environment. 3- Description of a thermodynamic system. 4- Evolution and thermodynamic equilibrium states of a system. 5- Possible transfers between the system and the external environment. 6- Transformations in the state of a system (operation, evolution). 7- Recall the laws of perfect gases.

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

1. Work, heat, internal energy, conservation of energy. 2. 1st principle of thermodynamics: statement, notion of internal energy of a system, application to perfect gas, enthalpy function, heat capacity, reversible transformations (isochore, isobaric, isothermal, adiabatic).

Chapter 3: Applying the first principle of thermodynamics to thermochemistry (3 weeks)

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

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

1- The 2nd principle for a closed system. 2. statement of the 2nd principle: entropy of an isolated closed system. 3. calculation of entropy change: 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 equilibria

Evaluation :

Continuous assessment: 40%; Exam: 60%.

References:

1. C. Coulon, S. Le Boiteux S. and P. Segonds, Thermodynamique Physique - Cours et exercices avec solutions, Edition Dunod.

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2. H.B. Callen, Thermodynamics, Cours, Edition John Wiley and Sons, 1960
3. R. Clerac, C. Coulon, P. Goyer, S. Le Boiteux & C. Rivenc, Thermodynamics, Cours et travaux dirigés de thermodynamique, Université Bordeaux 1, 2003
4. O. Perrot, Cours de Thermodynamique I.U.T. de Saint-Omer Dunkerque, 2011
5. C. L. Huillier, J. Rous, Introduction to thermodynamics, Dunod Edition.

CPNDST University

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

Teaching objectives
Consolidate the theoretical concepts covered in Physics 2 through hands-on sessions.

Recommended prior knowledge
Mathematics 1, Physics 1.

Contents:

5 manipulations minimum (3h00 / 15 days)

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

Evaluation :
Continuous assessment: 100%.

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Semester: 2
Teaching : UEM 1.2 Subject 2:
Chemistry 2 practical work
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives

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

Recommended prior knowledge

Thermodynamics.

Contents:

1. Laws of perfect gases.
2. Calorimeter water value.
3. Mass heat: mass heat of liquids and solids.
4. Latent heat : Latent heat of fusion of ice
5. Heat of reaction: Determining the energy released by a chemical reaction (HCl/NaOH)
6. Hess's law
7. Vapor pressure of a solution.

Evaluation :

Continuous assessment: 100%.

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Semester: 2
Teaching unit: UEM 1.2 Subject 3:
IT 2
VHS: 45h00 (Class: 1h30, Practical: 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 degree of autonomy; Designing algorithms from the simplest to the most complex.

Recommended prior knowledge

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

Contents:

Chapter 1: Indicator variables (4 Weeks)
1- One-dimensional arrays: Memory representation, Array operations
2- Two-dimensional arrays: Memory representation, Operations on two-dimensional arrays

Chapter 2: Functions and procedures (6 weeks)
1- Functions : Function types, declaring functions, calling functions
2- Procedures: notions of global and local variables, simple procedure, procedure with arguments

Chapter 3: Records and files (5 weeks)
1- Heterogeneous data structure
2- Record structure (notion of fields)
3- Handling record structures
4- Notion of file
5- File access
6- Reading and writing to a file

TP Informatique 2 :

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

Evaluation :

Continuous assessment: 40%; Exam: 60%.

References:

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

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

Teaching objectives

To provide the basic skills needed for a successful oral presentation. Skills include: preparing a presentation; delivering a presentation; capturing the audience's attention; plagiarism pitfalls and intellectual property regulations.

Recommended prior knowledge

Expression and communication and writing methodology.

Contents:

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

Chapter 2: 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, penalties for plagiarism, how to borrow the work of other authors, quotations, illustrations, how to be sure of avoiding plagiarism?
2- Writing a bibliography: definition, objectives, how to present a bibliography, writing a bibliography

Chapter 4: Presenting written work **(6 Weeks)**
- Presenting written work. Applications: oral presentation.

Evaluation :

Review: 100%.

References :

1. M. Fayet, Méthodes de communication écrite et orale, 3rd edition, Dunod, 2008.
2. M. Kalika, Mémoire de master - Piloter un mémoire, Rédiger un rapport, Préparer une soutenance, Dunod, 2016.
3. M. Greuter, Réussir son mémoire et son rapport de stage, l'Etudiant, 2014
4. B. Grange, Réussir une présentation. Preparing powerful slides and communicating well in public. Eyrolles, 2009.
5. H. Biju-Duval, C. Delhay, Tous orateurs, Eyrolles, 2011.
6. C. Eberhardt, Practical work with PowerPoint. Creating and formatting slides, Dunod, 2014.
7. F. Cartier, Communication écrite et orale, Edition GEP- Groupe Eyrolles, 2012.
8. L. Levasseur, 50 exercices pour prendre la parole en public, Eyrolles, 2009.
9. S. Goodlad, Speaking technically - A Handbook for Scientists, Engineers, and Physicians on How to Improve Technical Presentations, Imperial College Press, 2000.
10. M. Markel, Technical communication, eleventh edition, Bedford/St Martin's, 2015.

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

Aim of the subject:
Firstlyit introduces students to all the fields covered by the Science and Technology Domain, and secondly to the wide range of careers that these fields can lead to. In the same context, this subject introduces students to the new challenges of sustainable development and the new professions that can arise from it.

Recommended prior knowledge
None.

Contents :
1. Industrial Hygiene and Safety (IHS) and Mining Engineering : **(2 weeks)**
- Definitions and fields of application (safety of goods and people, environmental problems, exploration and exploitation of mineral resources, etc.)
- The role of the specialist in these areas.

2. Climate Engineering and Transport Engineering : (2 weeks)
- Definitions, fields application (air conditioning, intelligent buildings, transport safety, traffic management and road, air and sea transport, etc.)
- The role of the specialist in these areas.

3. Civil Engineering, Hydraulics and Public Works : (2 weeks)
- Definitions and fields of application (construction materials, major road and rail infrastructures, bridges, airports, dams, drinking water supply and sanitation, water runoff, water resource management, public works and regional planning, smart cities, etc.)
- The role of the specialist in these areas.

4. Aeronautics, Mechanical Engineering, Marine Engineering and Metallurgy: (2 weeks)
- Definitions and fields of application (Aeronautics, Avionics, Automotive industry, Ports, Dykes...), Production of industrial equipment, Iron and steel industry, Metal processing, ...)
- The role of the specialist in these areas.

5. Approaches to sustainable production : (2 weeks)
Industrial ecology, Remanufacturing, Ecodesign.

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

7. Sustainable development and business : (3 weeks)
Definition of the company as an economic entity (notions of profit, costs, performance) and a social entity (notion of corporate social responsibility), Impact of economic activities on the environment (examples), Stakes/benefits of SD for the company, Means of commitment to an SD approach (ex. ISO 14001 certification, labeling (e.g. energy labeling, Ecolabel, Label Bio/ AB, Label FSC, ...), SD strategic plan, Global Reporting Initiative (GRI)...), Worldwide rankings of the most sustainable companies (Dow Jones Sustainable Index, Global 100, ...), Studies of

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

Personal work by the student for this subject:

- **Group work:** Read articles on sustainable development and/or reports from successful, sustainable companies and draw up summaries of the main actions undertaken in the field of SD.

Examples of documents for reading and synthesis :

- Cas de l'ONA et l'ENIEM : Kadri, Mouloud, 2009, Le développement durable, l'entreprise et la certification ISO 14001, Marché et organisations vol. 1 (N° 8), p. 201- 215 (free online access: http://www.cairn.info/revue-marche-et-organisations-2009-1-page-201.htm)
- Mireille Chiroleu-Assouline. Les stratégies de développement durable des entreprises. Idées, La revue des sciences économiques et sociales, CNDP, 2006, p 32-39 (free online access: http://halshs.archives-ouvertes.fr/hal-00306217/document)
- Page Web sur les engagements environnementaux et sociétaux de TOTAL : https://www.total.com/fr/engagement
- Innovations mobility sustainable from group PSA : http://www.rapportannuel.groupe- psa.com/report-2015/engagements/dessolutions-innovantes-pour-des-transports-durables/

Evaluation :

100% review

References :

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

CPNDST University

Semester: 2
Teaching : UET 1.2 Subject 1:
French language 2 VHS: 22h30
(Course: 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 and written expression, through reading and study of texts.

Previous knowledge recommended:
Basic French.

Contents:
Below is a list of themes covering basic science, technology, economics, social issues, communication, sport, health and more. Teachers can choose texts from this list to develop during the lesson. Alternatively, he or she is free to tackle other themes of his or her choice. Texts can be borrowed from a variety of media: daily newspapers, sports or entertainment magazines, specialist or popular magazines, books, websites, audio and video recordings, etc.
For each text, the teacher helps the student to develop his her language skills: listening, comprehension, oral and written expression. They must also use the text to identify the grammatical structures they will develop during the same class session. Here, by way of illustration, we list a number of grammatical structures that can be developed as examples. Of course, you don't have to develop them all or in the same way. Some can be recalled, while others can be explained in detail.

Examples of themes	Grammatical structures
Pharmaceutical industry Food industry National employment agency ANEM Sustainable development Renewable energies Biotechnology Stem cells Road safety Dams Water - Water resources Avionics Automotive electronics Electronic newspapers Carbon-14 dating Stadium violence Drugs: a social scourge Smoking School failure The Algerian war Social networks China, an economic powerhouse Superconductivity Cryptocurrency Advertising Autism	The subjunctive. The conditional. The imperative. Past participle. The passive form. Possessive adjectives, Possessive pronouns. Demonstratives, Demonstrative pronouns. Expressing quantity (several, some, enough, a lot, more, less, as much, etc.). Numbers and measurements. Pronouns "who, what, where, whose". Subordinate preposition of time. Cause and consequence. Purpose, opposition, condition. Comparatives, superlatives. ...

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Evaluation :
Review: 100%.

References:

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

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Semester: 2
Teaching Unit: UET 1.2 Subject 1: English Language 2 VHS: 22h30 (1h30 lecture)
Credits: 1
Coefficient: 1

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

Recommended prior Knowledge:
Basic English.

Contents:
The English syllabus consists of a set of texts containing scientific and technical parts. The chosen texts must be used to study scientific and technical English and Grammar acquisition.
The texts must be selected according to the vocabulary built up, familiarization with both scientific and technical matters in English for further understanding. Therefore, each text will be defined by a set 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. Besides, the activity at the end of each session must include a translation of long statements which are selected from the texts.

Examples for some lectures:	Examples of Word Study: Patterns
Radioactivity.	Explanation of Cause
Chain Reaction.	Result
Reactor Cooling System.	Conditions (if), Conditions (Restrictive)
Conductor and Conductivity.	Eventuality
Induction Motors.	Manner
Electrolysis.	When, Once, If, etc. + Past Participle
Liquid Flow and Metering.	It is + Adjective+ to
Liquid Pumps.	As
Petroleum.	It is+ Adjective or Verb + that...
Road Foundations.	Similarity, Difference
Rigid Pavements.	In Spite of, Although
Piles for Foundations.	Formation of Adjectives
Bridges suspension.	Phrasal Verbs

Evaluation mode:
Exam: 100%.

References:

1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office des Publications Universitaires, 1994.
2. A.J. Herbert, The Structure of Technical English, Longman, 1972.
3. S. Berland-Delepine, Grammaire méthodique de l'anglais moderne avec exercices, Ophrys, 1982.
4. Test of English as a Foreign Language - Preparation Guide, Cliffs, 1991.
5. R. Fowler, The Little, Brown Handbook, Little, Brown Company, 1980.
6. Cambridge - First Certificate in English, Cambridge books, 2008.
7. K. Wilson, Th. Healy, First Choice, Oxford, 2007.
8. M. Mann, S. Tayore-Knowles, Destination: Grammar & Vocabulary with Answer Key, MacMillan, 2006.
9. E. Hamby, Ph. Bedford Robinson, Special English Computer Applications, Cassell, 1980.

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10. P. Charles Brown, Norma D. Mullen, English for Computer Science, Oxford University Press, 1989.
11. Graeme Kennedy, Structure and Meaning in English: A Guide for Teachers, Pearson, 2004.
12. Anne M. Hanson, Brain-Friendly Strategies for Developing Student Writing Skills, 2nd Edition, Corwin Press, 2008.
13. Ann Bridges, How to Pass Higher English, Hodder Gibson-Hachette, 2009.
Claude Renucci, Anglais : 1000 Mots et expressions de la presse : Vocabulaire et expressions du monde économique, social et politique, Fernand Nathan, 2006.

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Semester: 3
Teaching unit: UEF 2.1.1 Subject 1:
Mathematics 3
VHS: 67h30 (Lecture: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

At the end of this coursestudents should be able to understand 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

Contents

Chapter 1: Simple and multiple integrals **3 weeks**
1.1 Recall the Riemann integral and the calculation of primitives. 1.2 Double and triple integrals.
1.3 Application to the calculation of areas, volumes, ..

Chapter 2: Improper integrals **2 weeks**
2.1 Integrals of functions defined on an unbounded interval. 2.2 Integrals of functions defined on a bounded interval, infinite one end.

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 Suites and series of functions. 4.3 Integer series, Fourrier series.

Chapter 5: Fourier transform **3 weeks**
5.1 Definition and properties. 5.2 Application solving differential equations.

Chapter 6: Laplace transform **2 weeks**
6.1 Definition and properties. 6.2 Application to solving differential equations.

Assessment :

Continuous assessment: 40%; Final exam: .

References:

1- F. Ayres Jr, Theory and Applications of Differential and Integral Calculus - 1175 corrected exercises, McGraw-Hill.
2- F. Ayres Jr, Theory and Applications of Differential Equations - 560 corrected exercises, McGraw-Hill.
3- J. Lelong-Ferrand, J.M. Arnaudiès, Cours de Mathématiques - Equations différentielles, Intégrales multiples, Tome 4, Dunod Université.
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, Cours élémentaire de mathématiques supérieures 3- Calcul intégral et séries, Dunod.

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7- J. Quinet, Cours élémentaire de mathématiques supérieures 4- Equations différentielles, Dunod.
8- M. R. Spiegel, Laplace Transforms, Courses and Problems, 450 Corrected Exercises, McGraw-Hill.

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

Teaching objectives

Introduce students to mechanical vibration phenomena restricted to low-amplitude oscillations for 1 or 2 degrees of freedom, to the study of mechanical wave propagation.

Recommended prior knowledge

Mathematics 2, Physics 1 and Physics 2

Contents :

***Preamble**: This subject is divided into two parts, Waves and Vibrations, which can be taken independently of each other. In view of the consistency of this subject in terms of content, it is advisable to approach it in this order: Waves and then Vibrations for students in Electrical Engineering courses (Group A). For students in Groups B and C (Civil Engineering, Mechanical Engineering and Process Engineering), it makes sense to start with Vibrations. In any case, the teacher is called upon to do his best to cover both parts. Remember that this subject is intended for engineering in the Science and field. The teacher therefore asked to skim over any parts of the course that require demonstrations or theoretical developments, and to focus only on the application aspects. In any case, demonstrations can be the subject of auxiliary work to be requested from students as part of their personal work. In this respect, please refer to the paragraph entitled "G- Student assessment through continuous assessment and personal work" in this course syllabus.*

Part A: Vibrations

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

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

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

2.1 Undamped oscillations
2.2 Free oscillations of damped systems

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

3.1 Differential equation
3.2 mass-spring-damper system
3.3 Solution of 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

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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 information and basic definitions
1.2 Propagation equation
1.3 Solution of propagation equation
1.4 Progressive sinusoidal wave
1.5 Superposition of two progressive sinusoidal waves

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

Chapter 3: Acoustic waves in fluids 1 week
3.1 Wave equation
3.2 Speed of sound
3.3 Progressive sinusoidal wave
3.4 Reflection-Transmission

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

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

References:

1. H. Djelouah ; Vibrations et Ondes Mécaniques - Cours & Exercices (USTHB University website: perso.usthb.dz/~hdjelouah/Coursvom.html)
2. T. Becherrawy ; Vibrations, waves and optics ; Hermes science Lavoisier, 2010
3. J. Brac ; Propagation d'ondes acoustiques et élastiques ; Hermès science Publ. Lavoisier, 2003.
4. R. Lefort ; Ondes et Vibrations ; Dunod, 2017
5. J. Bruneaux ; Vibrations, ondes ; Ellipses, 2008.
6. J.-P. Perez, R. Carles, R. Fleckinger; Electromagnetisme Fondements et Applications, Ed. Dunod, 2011.
7. H. Djelouah ; Electromagnetisme ; Office des Publications Universitaires, 2011.

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Semester: 3
Teaching unit: UEF 2.1.2 Subject 1:
Fundamental Electronics 1 VHS:
45h00 (Class: 1h30, Practical
exercises: 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

materials physics and electricity.

Contents

The number of weeks shown are indicative. Obviously, the course leader is not obliged to adhere strictly to these dimensions or to the layout of the chapters.

Chapter 1: Continuous operation 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, Thevenin, Norton, Millmann, Kennelly, Equivalence between Thevenin and Norton, Maximum power transfer theorem.

Chapter 2: Passive quadrupoles **3 weeks**
Representation of a networkpassiveby a quadrupole. Quantities characterizing the behavior of a quadripole in a circuit (input and output impedance, voltage and current gain), application matching. Passive filters (low-pass, high-pass, etc.), gain curve, phase curve, cutoff frequency, passband.

Chapter 3. Diodes **3 weeks**
Basic reminder of semiconductor physics: definition of a semiconductor, crystalline Si, doping concepts, N and P semiconductors, PN junction, constitution and operation of a diode, forward and reverse biasing, current-voltage characteristics, static and variable regime, equivalent schematic. Diode applications: full and half-wave rectification. Voltage stabilization with the Zener diode. Clipping, Other diode types: Varicap, LED, Photodiode.

Chapter 4: Bipolar transistors **3 weeks** Bipolar transistors: Transistor effect, modes of operation (blocking, saturation, ...), Static characteristics network, Polarizations, Load line, Rest point, ... Study of three fundamental circuits: EC, BC, CC, equivalent diagram, voltage gain, decibel gain, bandwidth, current gain, input and output impedances. Study multi-stage LF amplifiers in static and dynamic modes, link capacitors, decoupling capacitors. Other transistor applications: Darlington circuit, switching transistor, etc.

Chapter 5 - Operational amplifiers : **3 weeks** Principle, Equivalent diagram, Ideal op-amp, Feedback, Characteristics of the op-amp, Basic operational amplifier setups: Inverter, Non-inverter, Summer, Subtractor, Comparator, Follower, Derivator, Integrator, Logarithmic, Experimental, ...

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Assessment :

Continuous assessment: 40%; Final exam: .

References:

1. A. Malvino, Principe d'Electronique, 6th Edition Dunod, 2002.
2. T. Floyd, Electronique Composants et Systèmes d'Application, 5th Edition, Dunod, 2000.
3. F. Milsant, Cours d'électronique (et problèmes), Tomes 1 à 5, Eyrolles.
4. M. Kaufman, Electronics: Components, Volume 1, McGraw-Hill, 1982.
5. P. Horowitz, Traité de l'électronique Analogique et Numérique, Tomes 1 et 2, Publitronic-Elektor, 1996.
6. M. Ouhrouche, Electrical Circuits, Presses internationale 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, Toute l'Electronique en Exercices, Vuibert, 2000.

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Semester: 3
Teaching : UEF 2.1.2
Subject 2:Fundamental Electrical Engineering 1
VHS: 45h00 (Class: 1h30, Practical exercises: 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:

Fundamental electricity.

Contents :

Chapter 1: Mathematical review of complex numbers (NC) (1 week)
Cartesian form, conjugate NC, modulus, arithmetic operations on NC (addition, ...), geometric representation, trigonometric form, Moivre's formula, root of NC, exponential representation of NC, trigonometric application of Euler's formulas, application of NC to electricity.

Chapter 2: Basic laws of electricity (2 weeks)
Continuous operation: electric dipole, combination of R, C, L dipoles.
Harmonic regime: representation of sinusoidal quantities, mean and rms values, Fresnel representation, complex notation, impedances, power in sinusoidal regime (instantaneous, active, apparent, reactive), Boucherot's Theorem.
Transient operation: RL circuit, RC circuit, RLC circuit, charging and discharging a capacitor.

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

Chapter 4: Magnetic circuits (3 weeks) Magnetic circuits in sinusoidal AC. Self and mutual inductances. Magnetic electric analogy.

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

Chapter 6: Introduction to Electrical Machines (3 weeks) General information on electrical machines. Generator and motor operating principles. Power balance and efficiency.

Assessment :

Continuous assessment: 40%; Final exam: .

References :

(Depending on the availability of documentation at the establishment, Internet sites, etc.).

1. J.P Perez, Electromagnetisme Fondements et Applications, 3rd Edition, 1997.
2. A. Fouillé, Electrotechnique à l'Usage des Ingénieurs, 10th edition, Dunod, 1980.
3. C. François, Electrical Engineering, Ellipses, 2004

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4. L. Lasne, Electrotechnique, Dunod, 2008
5. J. Edminister, Theory and Applications of Electrical Circuits, McGraw Hill, 1972
6. D. Hong, Circuits et mesures électriques, Dunod, 2009
7. M. Kostenko, Electrical Machines - Volume 1, Volume 2, MIR Publishing, Moscow, 1979.
8. M. Jufer, Electromechanics, Presses polytechniques et universitaires romandes- Lausanne, 2004.
9. A. Fitzgerald, Electric Machinery, McGraw-Hill Higher Education, 2003.
10. J. Lesenne, Introduction à l'électrotechnique approfondie. Technique et Documentation, 1981.
11. P. Maye, Industrial electric motors, Dunod, 2005.
12. S. Nassar, Electrical Circuits, Maxi Schaum.

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Semester: 3
Teaching unit: UEM2.1 Subject 1:
Probability and Statistics VHS: 45h00
(Class: 1h30, Practical exercises:
1h30)
Credits: 4
Coefficient: 2

Objectives of the subject

This module introduces students to the essential concepts of probability and statistics: univariate and bivariate statistical series, probability over a finite universe and random variables.

Recommended prior knowledge

Mathematics 1 and Mathematics 2

Contents:

Part A: Statistics

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

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

Chapter 2: Univariate statistical series **(3 weeks)**

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

Chapter 3: Bivariate statistical series **(3 weeks)**

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

Part B: Probability

Chapter 1: Combinatorial analysis **(1 week)**

B.1.1 Arrangements
B.1.2 Combinations
B.1.3 Permutations.

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

B.2.1 Event algebra
B.2.2 Definitions
B.2.3 Probabilized spaces
B.2.4 General probability theorems

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

B.3.1 Packaging,
B.3.2 Independence,

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B.3.3 Bayes formula.

Chapter 4: Random variables **(1 week)**

B.4.1 Definitions and properties,
B.4.2 Distribution function,
B.4.3 Mathematical expectation,
B.4.4 Covariance and moments.

Chapter 5: Usual discrete and continuous laws of probability **(3 weeks)**

Bernoulli, binomial, Poisson, ... ; Uniform, normal, exponential, …

Assessment :

Continuous assessment: 40%; Final exam: .

References:

1. D. Dacunha-Castelle and M. Duflo. Probabilités et statistiques : Problèmes à temps fixe. Masson, 1982.
2. J.-F. Delmas. Introduction to probability calculus and statistics. ENSTA handbook, 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. Cours de statistique mathématique. Economica, 1988.
7. A. Montfort. Introduction to Statistics. Ecole Polytechnique, 1991

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Semester: 3
Teaching : UEM2.1 Subject 2:
Computer Science 3 VHS:
22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Subject objectives :

Teach students how to program using easy-to-use software (mainly Matlab, Scilab, Mapple, etc.). This subject will be a tool for carrying out numerical methods practical work in S4.

Recommended prior knowledge:

Programming basics acquired in Computer Science 1 and 2.

Contents :

Practical exercise 1: Introduction to a scientific programming environment (1 week)

(Matlab , Scilab, ... etc.)

TP 2: Script files and Data and variable types (2 weeks)

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

TP 4: Vectors and matrices (2 weeks)

TP 5: Control instructions (for and while loops, if and switch instructions)(2 weeks) TP 6: Function files (2 weeks)

TP 7: Graphics (graphic window management, plot) (2 weeks)

TP 8: Using toolboxes (2 weeks)

Assessment :

Continuous assessment: .

References :

1. Jean-Pierre Grenier, Débuter en algorithmique avec MATLAB et 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, Informatique : Programmation et calcul scientifique en Python et Scilab classes préparatoires scientifiques 1er et 2e années, Ellipses, 2010.

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Semester: 3
Teaching unit: UEM 2.1
Subject 3: Electronics and Electrical Engineering
Practical Work VHS: 22h30 (Practical Work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

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

Recommended prior knowledge

Fundamental electronics. Fundamental electrical engineering.

Contents

The practical teacher is required to carry a minimum of 3 electronics practical exercises and 3 electrical engineering practical exercises from the list below:

TP d'Electronique 1
TP 1: Fundamental theorems
TP 2: Passive filter characteristics
TP 3: Diode characteristics / rectification
TP 4: Stabilized power supply with Zener diode
TP 5: Transistor characteristics and operating point
TP 6: Operational amplifiers.

Electrical Engineering 1
Practical exercise 1: Measuring single-phase voltages and currents
Practical exercise 2: Measuring three-phase voltages and currents
Practical exercise 3: Three-phase active and reactive power measurement
TP 4: Magnetic circuits (hysteresis cycle)
TP 5: Transformer testing
TP 6: Electrical machines (demonstration).

Assessment :

Continuous assessment: 100

References:

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Semester: 3
Teaching unit: UEM 2.1 Subject 4:
Practical work Waves and vibrations
VHS: 15h00 (Practical work: 1h00)
Credits: 1
Coefficient: 1

Teaching objectives

The objectives of this program are to enable students to put into practice their knowledge of mechanical vibration phenomena 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.

Contents :

TP1: Mass - spring **TP2:**
Simple pendulum **TP3:**
Torsion pendulum
TP4: Free-running and forced-running oscillating circuits
TP5: Coupled pendulums
TP6: Transverse oscillations in vibrating strings
TP7: Hoffmann throat pulley
TP8: Electromechanical systems (The electrodynamic loudspeaker)
TP9: The Pohl pendulum
TP10: Longitudinal wave propagation in a fluid.

Note: We recommend that you choose at least 5 of the 10 practical exercises.

Assessment :

Continuous assessment: .

References:

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Semester: 3
Teaching : UED 2.1
Subject 1: State of the art in electrical engineering VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives
To give the student a general overview of the various fields of electrical engineering while emphasizing the impact of electricity in improving people's daily lives.

Recommended prior knowledge
No

Contents :

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

2- **Impact of Electrical Engineering on the development of society**: advances in microelectronics, automation and supervision, robotics, telecommunications development, instrumentation in healthcare development, etc.

Evaluation : Final exam: .

References:
(Depending on the availability of documentation at the establishment, Internet sites, etc.).

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Semester: 3
Teaching : UED 2.1 Subject 2: Energy and environment VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives :

Introduce students to the different types of energy available, their sources and the impact of their use on the environment.

Recommended prior knowledge:

Notions energy and environment.

Contents :

Chapter 1: Energy resources

Chapter 2: Energy storage

Chapter 3: Consumption, reserves and trends in energy resources

Chapter 4: Different types of pollution

Chapter 5: Detection and treatment of pollutants and waste

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

Assessment :

Final exam: .

References :

1-Jenkins et al, Electrotechnique des énergies renouvelables et de la cogénération, Dunod, 2008
2-Pinard, Les énergies renouvelables pour la production d'électricité, Dunod, 2009
3- Crastan, Centrales électriques et production alternative d'électricité, Lavoisier, 2009
4-Labouret et Villoz, Energie solaire photovoltaïque, 4e éd., Dunod, 2009-10.

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Semester: 3
Teaching : UET 2.1 Subject 1:
Technical English VHS: 22:30
(Class: 1:30)
Credits: 1
Coefficient: 1

Teaching objectives

The aim of this course is to enable students to acquire a sufficiently high level of language skills to enable them to use a scientific document and talk about their speciality and field of study in English, at least, with a certain degree of ease and clarity.

Recommended prior knowledge:

English 1 and English 2

Contents :

- comprehension and expression, acquisition of vocabulary, grammar, etc.
- Nouns and adjectives, comparatives, following and giving instructions, identifying things.
- Use numbers, symbols, equations.
- Measurements: length, area, volume, power, etc.
- Describe scientific experiments.
- Characteristics of scientific texts.

Assessment :

Final exam: .

References :

1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office des Publications Universitaires, 1994.
2. A.J. Herbert, The Structure of Technical English, Longman, 1972.
3. 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.

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Semester: 4
Teaching unit: UEF 2.2.1
Subject 1: Linear and continuous servo systems VHS:
67h30 (Lectures: 3h00, TD: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

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

Recommended prior knowledge

- Mathematics (algebra, analysis, in particular handling complex values, etc.)
- Fundamentals of basic electronics (linear circuits) and physics.

Contents

Chapter 1: General information on servo systems (2 weeks)
Overview on history of systems of systems, Terminology of (disturbance, setpoint, control, output, measurement noise, deviation, tracking, control, corrector, ...), Functions (monitoring/safety, servo-control/regulation), Open-loop/closed-loop control, Structure and components of a control system.

Chapter 2: Laplace transforms and representation of servo systems (3 Weeks)
Laplace transform of common functions (definitions, properties, initial and final value theorem, ...), Inverse Laplace transform (definitions, properties, ...), Mathematical model of a system, Representation by differential equations, Representation of servo systems by transfer functions (definition of static gain, poles, zeros of a transfer function), Block diagrams and simplification rules: series, parallel, unitary and non-unitary feedback systems, ...

Chapter 3: Time-domain analysis (2 weeks)
Transient regime, steady state and notions of stability, speed and static accuracy, Notion of impulse response, Response of first- and second-order systems for typical signals, Case of higher-order systems, Identification of first- and second-order systems from time response.

Chapter 4: System analysis in the frequency domain (3 weeks)
Introduction, Graphical representation of transfer functions (Bode diagrams, Nyquist locus, Black-Nichols diagrams), Analysis and stability criteria (Bode/Nyquist plane reversal criterion, Nyquist criterion, Evans locus, Routh criterion)

Chapter 5: System synthesis (3 weeks)
Introduction, Synthesis specifications (stability, speed, precision), Different structures

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of controllers (phase advance/delay, PID, RST), Choice of controller according to imposed specifications, Sizing of controllers: Synthesis by empirical methods (Ziegler-Nichols, flat, symmetrical, ...), Synthesis by graphical methods (Evans, Bode, Black, Nyquist, ...).

Chapter 6: State representation of a continuous system (2 weeks)

Passage: transfer function - state of a continuous system (companion form, diagonal of the evolution matrix), Solving the equation of state, Studying the observability, controllability and stability of a continuous system from its state representation.

Assessment :

Continuous assessment: ; Final exam: .

References:

1- Y. Granjon, Automatique - systèmes linéaires et continus, Dunod 2003.
2- S. Le Ballois and P. Cordon, Automatique - systèmes linéaires et continus, Dunod 2006.
3- K. Ogata, Modern Control Engineering, Prentice Hall, 2010.
4- B. Kuo et al, Automatic Control Systems, John Wiley and Sons, 2008.

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Semester: 4
Teaching unit: UEF 2.2.1
Subject 2: Combinatorial and sequential logic
VHS: 45h00 (Class: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Know the usual combinatorial circuits. 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.

Contents

The number of weeks shown are indicative. Obviously, the course leader is not obliged to adhere strictly to these dimensions or to the layout of the chapters.

Chapter 1: Boolean algebra and simplification of logic functions **2 weeks** Logical variables and functions (OR, AND, NOR, NAND, XOR). Laws of Boolean algebra. De Morgan's theorem. Complete and incomplete logic functions. Representation of logic functions: truth tables, Karnaugh tables. Logic function simplification: algebraic method, Karnaugh method.

Chapter 2: Numbering systems and information coding **2 weeks**
Representation of a number by codes (binary, hexadecimal, DCB, signed and unsigned binary, etc.), change of base or conversion, unweighted codes (Gray's code, error detection and correction codes, ascii code, etc.), arithmetic operations in binary code.

Chapter 3: Combinatorial transcoder circuits **2 weeks**
Definitions, decoders, priority encoders, transcoders, cascading, applications, decoder IC datasheet analysis, list of decoder ICs.

Chapter 4: Switching combinational circuits **2 weeks**
Definitions, multiplexers, demultiplexers, cascading, applications, analysis of a switcher IC datasheet, list of ICs.

Chapter 5: Combinatorial comparison circuits **2 weeks**
Definitions, 1-bit, 2-bit and 4-bit comparison circuits, Cascading, Applications, Analysis of a comparison IC datasheet, List of integrated circuits.

Chapter 6: Scales **2 weeks**
Introduction to sequential circuits. RS flip-flop, RST flip-flop, D flip-flop, master-slave flip-flop, T flip-flop, JK flip-flop. Examples of flip-flop applications: frequency divider by n, pulse train generator, etc. For each flip-flop, it's a good idea to present the truth table, sample chronograms, as well as limitations and imperfections.

Chapter 7: Meters **2 weeks**
Definition, classification of counters (synchronous, regular, irregular, asynchronous, complete and incomplete cycles). Realization of complete and incomplete synchronous binary counters, JK, D and RS flip-flop excitation tables, Realization of asynchronous binary counters modulo (n) :

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complete, incomplete, regular and irregular. Programmable counters (start from any state).

Chapter 8. Registers **1 Week**

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

Assessment :

Continuous assessment: 40%; Final exam: .

References:

1- J. Letocha, Introduction to logic circuits, McGraw Edition.
2- J.C. Lafont, Cours et problèmes d'électronique numérique, 124 exercises with solutions, Ellipses.
3- R. Delsol, Electronique numérique, Tomes 1 et 2, Edition Berti
4- P. Cabanis, Electronique digitale, Edition Dunod.
5- M. Gindre, Logique combinatoire, 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, Logique combinatoire et séquentielle, Ellipses, 2002.
10- J-P. Ginisti, La logique combinatoire, Paris, PUF (coll. "Que sais-je?" n°3205), 1997.
11- J-L. Krivine, Lambda-calcul, types et modèles, Masson, 1990, chap. Logique combinatoire, English translation available on the author's website.

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Semester: 4
Teaching unit: UEF 2.2.2 Subject 1:
Numerical Methods VHS: 45h00
(Class: 1h30, Practical exercises:
1h30)
Credits: 4
Coefficient: 2

Teaching objectives :

Familiarization with numerical methods and their applications in mathematical calculations.

Recommended prior knowledge:

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

Contents :

Chapter 1: Solving nonlinear equations f(x)=0 **(3 weeks)**

1. Introduction to calculation errors and approximations, 2. Introduction to methods for solving non-linear equations, 3. Bisection method, 4. Successive approximation method (fixed point), 5. Newton-Raphson method.

Chapter 2: Polynomial interpolation **(2 weeks)**

1. General introduction, 2. Lagrange polynomials, 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: Numerical integration **(2 weeks)**

1. General introduction, 2. trapezoidal method, 3. Simpson's method, 4. quadrature formulae.

Chapter 5: Solving ordinary differential equations
(Initial condition or Cauchy problem) **(2 weeks)**

1. General introduction, 2. Euler method, 3. Improved Euler method, 4. Runge-Kutta method.

Chapter 6. Direct solution of systems linear equations **(2 weeks)**

1. Introduction and definitions, 2. Gauss method and pivotation, 3. LU factorization method, 4. Choeleski MM^t factorization method, 5. Thomas algorithm (TDMA) for tridiagonal systems.

Chapter 7. Approximate method for solving systems linear equations
(2 Weeks)

1. Introduction and definitions, 2. Jacobi method, 3. Gauss-Seidel method, 4. Use of relaxation.

Assessment :

Continuous assessment: ; Final exam: .

References :

1. C. Brezinski, Introduction à la pratique du calcul numérique, Dunod, Paris 1988.
2. G. Allaire and S.M. Kaber, Numerical Linear Algebra, Ellipses, 2002.

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3. G. Allaire and S.M. Kaber, Introduction to Scilab. Corrected practical exercises d'algèbre linéaire, Ellipses, 2002.
4. G. Christol, A. Cot and C.-M. Marle, Calcul différentiel, Ellipses, 1996.
5. M. Crouzeix and A.-L. Mignot, Analyse numérique des équations différentielles, Masson, 1983.
6. S. Delabrière and M. Postel, Approximation methods. Équations différentielles. Applications Scilab, Ellipses, 2004.
7. J.-P. Demailly, Numerical analysis and differential equations. Presses Universitaires de Grenoble, 1996.
8. E. Hairer, S. P. Norsett and G. Wanner, Solving Ordinary Differential Equations, Springer, 1993.
9. P. G. Ciarlet, Introduction à l'analyse numérique matricielle et à l'optimisation, Masson, Paris, 1982.

CPNDST University

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

Teaching objectives :
Acquire a basic understanding of the mathematical tools used in signal processing.

Recommended prior knowledge:
Basic mathematics courses.

Contents :

Chapter 1: General information on signals **(3 weeks)**
Signal processing objectives. Areas of use. Signal classification (morphological, spectral, etc.). Deterministic signals (periodic and non-periodic) and random signals (stationary and non-stationary). Causality. Notions of power and energy. Basic signal processing functions (measurement, filtering, smoothing, modulation, detection, etc.). Examples of basic signals (rectangular pulse, triangular pulse, ramp, step, sign, Dirac, etc.).

Chapter 2. Fourier analysis **(4 weeks)**
Introduction, mathematical reminders (scalar product, Euclidean distance, linear combination, orthogonal basis, etc.). Approximation of signals by a linear combination of orthogonal functions. Fourier series, Fourier transform, properties. Parseval's theorem. Fourier spectrum of periodic (discrete spectrum) and non-periodic (continuous spectrum) signals.

Chapter 3: Laplace Transform **(3 Weeks)** Definition.
Properties of the Laplace Transform. Signal/system relationship. Application to linear and translation-invariant systems or SLIT (Time and Frequency Analysis).

Chapter 4. Convolution product **(2 Weeks)**
Formulation of the convolution product, Properties of the convolution product, Convolution product and Dirac impulse.

Chapter 5: Signal correlation **(3 weeks)** Signals with finite total energy. Signals with finite total average power. Intercorrelation between signals, Autocorrelation, Properties of the correlation function. Energy spectral and power spectral density. Wiener-Khintchine theorem. Case of periodic signals.

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

References:
1. S. Haykin, "Signals and systems", John Wiley & Sons, 2nd ed. 2003.
2. A.V. Oppenheim, "Signals and systems", Prentice-Hall, 2004.
3. F. de Coulon, "Théorie et traitement des signaux", Edition PPUR.
4. F. Cottet, "Traitement des signaux et acquisition de données, Cours et exercices résolus", Dunod.
5. B. Picinbono, "Théorie des signaux et des systèmes avec problèmes résolus", Edition Bordas.
6. M. Benidir, "Théorie et Traitement du signal, tome 1 : Représentation des signaux et des systèmes - Cours et exercices corrigés", Dunod, 2004.
7. M. Benidir, "Théorie et Traitement du signal, tome 2 : Méthodes de base pour l'analyse et le traitement du signal - Cours et exercices corrigés", Dunod, 2004.
8. J. Max, Signal processing

CPNDST University

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

Teaching objectives:

Introduce students to measurement techniques for electrical and electronic quantities. Familiarize students with the use of analog and digital measuring equipment.

Recommended prior knowledge

General Electricity, Fundamental Laws of Physics.

Contents

The number of weeks shown are indicative. Obviously, the course leader is not obliged to adhere strictly to these dimensions or to the layout of the chapters.

Chapter 1: Measurements, quantities and uncertainties 5 weeks

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

Chapter 2: Measurement methods 6 weeks

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

Chapter 3. The s Measuring devices 4 weeks

Introduction

Analog measuring instruments: Classification of deflection instruments, The moving-frame galvanometer, Structure of the magnetoelectric ammeter, Structure of the magnetoelectric voltmeter, Operation of the electrodynamic AC wattmeter

Digital measuring devices: Analog-to-digital converters (ADCs), Principle of operation of a digital measuring device, Examples of digital measuring devices (Multimeter, Oscilloscope, ...).

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TP Electrical and electronic measurements :

TP N° 1 : Resistance measurement :

Measure resistances using the following 5 methods: voltammetric, ohmmeter, Wheatstone bridge, comparison and substitution.
Compare these methods with each other and calculate their errors.

TP N° 2 : Inductance measurement :

Measure inductances by the following 3 methods: voltammetric, Maxwell bridge, resonance.
Compare these methods with each other and calculate their errors.

TP N° 3 : Capacity measurement :

Measure capacitances by the following 3 methods: voltammetric, Sauty bridge, resonance.
Compare these methods with each other and calculate their errors.

TP N° 4 : Phase shift measurement :

Measure resistances using the following 2 methods: Phase meter and oscilloscope.

TP N° 5 : Single-phase power measurement:

Measure resistances using the following 5 methods: wattmeter, Cosφmeter, three voltmeters, three ammeters, power sensor.
Compare these methods with each other and calculate their errors.

TP N° 6 : Three-phase power measurement:

Measure resistances using the following methods: Star and delta , balanced and unbalanced.

Assessment :

Continuous assessment: 40%; Final exam: .

References:

1- M. Cerr, Instrumentation industrielle : T.1, Edition Tec et Doc.
2- M. Cerr, Instrumentation industrielle : T.2, Edition Tec et Doc.
3- P. Oguic, Mesures et PC, Edition ETSF.
4- D. Hong, Circuits et mesures électriques, Dunod, 2009.
5- W. Bolton, Electrical and Electronic Measurement and Testing, 1992.
6- A. Fabre, Electrical and electronic measurements, OPU, 1996.
7- G. Asch, Les capteurs en instrumentation industrielle, Dunod, 2010.
8- L. Thompson, Electrical Measurements and Calibration: Fundamentals and Applications, Instrument Society of America, 1994.
9- J. P. Bentley, Principles of Measurement Systems, Pearson Education, 2005.
10- J. Niard, Mesures électriques, Nathan, 1981.
11- P. Beauvilain, Electrical and Electronic Measurements.
12- M. Abati, Mesures électroniques appliquées, Collection Techniques et Normalisation Delagrave.
13- P. Jacobs, Electrical measurements, Dunod Edition.
14- A. Leconte, Mesures en électrotechnique (Document D 1 501), Les techniques de l'ingénieur.

Internet sources :

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

CPNDST University

Semester: 4
Teaching : UEM 2.2
Subject 2: Linear and Continuous Servo Systems VHS:
22h30 (Practical: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

Introduce students to the practical application of their knowledge of control system theory. Teach students to use tools to model, analyze and design simple controllers for automated systems.

Previous knowledge recommended:

Linear and continuous servo systems. Fundamentals of electronics and physics

Contents

Practical exercises can be organized into three parts: modeling/simulation, analysis and synthesis. The content of this module and the number of practical tests to be carried out can be adjusted according to the equipment available in the laboratory. Simulations can be used to reinforce practical tests or to make up for lack of equipment.

Part 01: PC simulation practice (theoretical part)

TP N°1: Solving differential equations representing the dynamics of systems (electrical, mechanical and electromechanical) using Matlab software Use of Matlab software commands such : *ode45*, *ode123*, *Rang-Kutta* of order4, ... etc.

Practical exercise #2: Determining a system's transfer function and plotting time and frequency responses

Use of commands*: Ident, Step, Impulse, Lsim, Ltiview, Bode, Nyquist,* etc.

Practical exercise 3: Improving the performance of a looped system - Introduction to Simulink software

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

Part 02: Practical validation

Practical exercise 1: Model and identify an R-L-C electrical circuit using a first/second-order model (random excitation by a voltage generator and measurement of output voltage by a voltmeter). The same applies to the NTC and PT100 temperature sensors.

Practical exercise #2: Study a PID corrector using operational amplifiers.

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TP N°3: Temperature control with an ALL or NOTHING.

TP N°4: Control a first-order system using a P and PI controller.

TP N°5: Control a second-order system using a P, PI and PID controller.

TP N°6: Setting the speed a DC motor.

Assessment :
Continuous assessment: .

References:
1-S. Le Ballois, P. Codron, Automatique : Systèmes linéaires et continus, Dunod 2006.
2- P. Prouvost, Automatique - Contrôle et régulation Cours, exercices et problèmes corrigés, Dunod 2010.
3- E. Godoy, Régulation industrielle Outils de modélisation, méthodes et architectures de commande, Dunod.

CPNDST University

Semester: 4
Teaching unit: UEM 2.2
Subject 3: Practical work in combinatorial and sequential logic VHS: 22h30 (Practical work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

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

Recommended prior knowledge

Combinatorial and Sequential Logic.

Contents

From this list, the teacher chooses between 4 and 6 tests to be carried out on the two types logic circuits (combinatorial and sequential).

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

TP2: Practical simplification of logic equations
Discover the rules for simplifying equations in Boolean algebra through practice

Practical exercise 3: Design and implementation of standard combinatorial logic functions
Example: routing circuits (MUX, DMUX), coding and decoding circuits, etc.

TP4: Designing and building an arithmetic combinatorial circuit
an adder and/or subtractor circuit for 2 binary numbers.

TP5: Designing and building a combinatorial logic circuit
Realization of a logic function using logic gates. Example: a 7-segment display and/or a generator of the 2's complement of a 4-bit number and/or a generator of Gray's 4-bit code, ...

TP6: Designing and building a combinatorial logic circuit
Complete study (truth table, simplification, flow chart, practical assembly and testing) of a combinatorial circuit based on a specification.

TP7: Designing and meter circuits
Incomplete asynchronous counter circuits using flip-flops, Irregular-cycle synchronous counter circuits using flip-flops

TP8: Design and production of registers

Assessment :

Continuous assessment: 100

References:

1. J. Letocha, Introduction to logic circuits, Mc-Graw Hill Edition.
2. J.C. Lafont, Cours et problèmes d'électronique numérique, 124 exercises with solutions, Edition Ellipses.

CPNDST University

Semester: 4
Teaching unit: UEM 2.2 Subject 4:
Numerical Methods Practical work
VHS: 22h30 (Practical work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

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

Recommended prior knowledge

Numerical method, Computing 2 and Computing 3.

Contents

Chapter 1: Solving non-linear 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: Numerical integrations **3 weeks**
1. Rectangle method, 2. Trapezes method, 3. Simpson method

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

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

Assessment :

Continuous assessment: .

References:

1. José Ouin, Algorithmique et calcul numérique : Travaux pratiques résolus et programmation avec les logiciels Scilab et Python, Ellipses, 2013.
2. Bouchaib Radi, Abdelkhalak El Hami, Mathématiques avec Scilab : guide de calcul programmation représentations graphiques ; conforme au nouveau programme MPSI, Ellipses, 2015.
3. Jean-Philippe Grivet, Méthodes numériques appliquées : pour le scientifique et l'ingénieur , EDP sciences, 2009.

CPNDST University

Semester: 4
Teaching : UED 2.2
Subject 1: Architecture of Automated Systems VHS:
22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

Introduce students to industrial automated systems (AS) and their architecture. Learn about the components and operating principles of these systems. This program is an introduction to various subjects in semesters five and six, where they will be described in detail.

Previous knowledge recommended:

Contents

Chapter 1: Introduction **(2 weeks)**
Global approach to a production system, Objectives of production automation, Profitability of automation, Application example.

Chapter 2: Structure of a production system **(3 weeks)**
Decomposition OPERATING PART and CONTROL PART (OP - PC), Components of OP and PC, Actuator, Actuator (electric motor, pneumatic cylinder, ...), Pre-Actuator (contactors, relays, distributors pneumatic distributors), Sensor (sensors SENSORS, analog sensors, transmitters), Processing (PLC, industrial PC...), Dialogue (HMI, SCADA...).

Chapter 3: Control part **(2 weeks)** PC type, Architecture, Programming

Chapter 4: Production system architecture **(3 weeks)** Stand-alone machines, Associated machines in line, Centrally controlled production cell, Decentralized and coordinated control cell, Flexible cell with distributed and hierarchical control.

Chapter 5: Network concepts **(2 weeks)**
Industrial local area networks, Computer networks.

Chapter 6: Presentation and case study **(3 weeks)**
Electrical distribution, Petrochemical process control, Thermal, furnaces, …

Note:
Give preference to animated presentations using slides and videos,
Plan and organize a visit to an industrial site, if possible.

Evaluation : Final exam: .

References:
1- Process control architectures Engineering AG3510

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2- Automatisme et procédés industriels agroalimentaires Technique de l'ingénieur F1290
3- Programmable Logic Controllers Engineering S8015
4- Jean-Pierre THOMESSE, Réseaux locaux industriels - Concepts, typologie, caractéristiques Technique del ingénieurRéf.S7574v1

CPNDST University

Semester: 4
Teaching unit: UED 2.2 Subject 2: Electrical safety VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

The aim of the course is to inform future graduates about the nature of electrical accidents, rescue methods for those who have suffered an electrical accident, and to provide them with sufficient knowledge to enable them to design the best possible protective devices for equipment and personnel working in industry and other areas where such equipment is used.

Previous knowledge recommended:

Notions electricity.

Contents:

Chapter 1: Electrical hazards (2 weeks)

Definition and purpose of occupational safety, Legend and history of electrical hazards, Standards organization, Electrical accident statistics.

Chapter 2: The nature of electrical accidents and the dangers of electric current (3 weeks)

Classification (direct and indirect action 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 persons, Regulations, Safety measures, Non-voltage work, Work in the vicinity of electrical installations, Individual and collective protection, Protection against direct and indirect currents, Safety voltage, Earth connection diagram (ECS), Effects of electric and magnetic fields, Protection of equipment, Protective devices (types and reliability of devices), Low-voltage, medium-voltage and high-voltage indoor installations, Low-voltage mobile equipment, Checks and inspections.

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

Fires, Nuisance materials, Explosions, Noise and vibrations (Definition, standards and noise abatement techniques).

Chapter 5: First aid and treatment (2 weeks)

Attitude to electrical accidents, First aid, Assisted ventilation (mouth-to-mouth and Sylvester methods), External cardiac massage, Burn care.

Assessment :

Final exam: .

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References:

1-V. Semeneko, Prescriptions Générale de Sécurité Technique dans une Entreprise, University of Annaba, 1979.
2- A.Novikov, Cahier de Cours de Protection de Travail, University of Annaba, 1983.
3- Edgar Gillon, Cours d'Electrotechnique, Dunod, Paris 1966.
4- Encyclopédie des Sciences industrielles, Quillet, Paris, 1983.
5- L.G. Hewitson, Guide de la protection des équipements électriques, Dunod, 2007.

CPNDST University

Semester: 4
Teaching : UET 2.2
Subject 1: Expression and communication VHS: 22h30
(Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

This course aims to develop students' personal and professional skills in communication and expression techniques.

Previous knowledge recommended:

Languages (Arabic; French; English)

Contents:

Chapter 1: Researching, analyzing and organizing information **3 weeks**
Identify and use documentary resources, understand and analyze documents, compile and update documentation.

Chapter 2: Improving expression skills **3 weeks**
Take into account the communication situation, Produce a written message, Communicate orally, Produce a visual and audiovisual message.

Chapter 3: Improving communication skills in interactive situations
3 weeks Analyze the inter-personal communication process, Improve face-to-face communication skills, Improve group communication skills.

Chapter 4: Developing autonomy, organization and communication skills as part of a project approach **6 weeks**
Situate yourself in a project and communication approach, Anticipate action, Implement a project: Presentation of a report on a practical project (homework).

Evaluation :

Final exam: 100%.

References:

(*Books and handouts, websites, etc.)*

1- Jean-Denis Commeignes, 12 methods of written and oral communication - 4th edition, Michelle Fayet and Dunod 2013.
2- Denis Baril, Sirey, Techniques de l'expression écrite et orale, 2008.
3- Matthieu Dubost, Améliorer son expression écrite et orale toutes les clés, Edition Ellipses 2014.

CPNDST University

Semester: 5
Teaching : UEF 3.1.1
Subject 1: Control of linear systems VHS:
45h00 (Class: 1h30, Practical exercises: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

This module consolidates the knowledge acquired in the second year and enables you to master the representation of dynamic systems and their properties in state space, as well as acquiring the main methods for analyzing and synthesizing control systems.

Previous knowledge recommended:

Basic mathematics. Continuous and sampled linear systems.

Contents

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

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

Chapter 3. Systems analysis in state space (3 weeks)
Resolution of state equations and transition matrix, Methods of calculating the transition matrix, Modal analysis (diagonalization), Stability, Notions of controllability and observability (definitions and test methods).

Chapter 4: State control (3 weeks)
Formulation of the state feedback pole placement problem, Computational methods for monovariable systems, Case of multivariable systems, Implementation.

Chapter 5. Synthesis of state observers (3 Weeks)
Introduction, Deterministic observers (Luenberger) and computational methods, Reduced observers, Stochastic observers (Kalman filter).

Evaluation :

Continuous assessment: 40%; Exam: 60%.

References:

1. Philippe de Larminat, "Automatique : Commande des systèmes linéaires", Hermès Lavoisier, 1996.
2. Hubert Egon, "Asservissement linéaires échantillonnés et représentation d'état", Méthodes, 2001.
3. Luc Jaulin, "Représentation d'état pour la modélisation et la commande des systèmes", Lavoisier, 2005.
4. Robert L. Williams, Douglas A, "Lawrence, Linear State-Space Control Systems", Edition John Wiley & Sons, 2007.
5. R. Longchamp, "Commande numérique de systèmes dynamiques", Presses Polytechniques et Universitaires Romandes, 1995.

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6. G. F. Franklin, J. D. Powell, L. M. Workman, "Digital control of dynamic systems", Addison-Wesley Series in Electrical and Computer Engineering: Control Engineering, 1990.
7. K. J. Aström, B. Wittenmark, "Computer controlled systems: theory and design", Prentice-Hall, 1984.
8. R. H. Middleton, G. C. Goodwin, "Digital control and estimation: a unified approach", Prentice Hall, 1990.

CPNDST University

Semester: 5
Teaching unit: UEF 3.1.1 Subject 2:
Power Electronics VHS: 45h00 (Class:
1h30, Practical exercises: 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 to make a technical choice according to the field of application of a power converter.

Recommended prior knowledge

Fundamental electronics1, Fundamental electrical engineering1.

Contents

The number of weeks shown are indicative. Obviously, the course leader is not obliged to adhere strictly to these dimensions or to the layout of the chapters.

Chapter 1: Introduction Power Electronics **3 weeks**

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

Chapter 2: AC-DC converters **3 weeks**

Power elements (diodes and thyristors), Single-phase rectifiers, load types R, RL, RLE, Three-phase rectifiers, load types R, RL, RLE. Analysis of switching phenomena in uncontrolled and controlled static rectifier converters.

Chapter 3: AC-AC converters **3 weeks**

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

Chapter 4: DC-DC converters **3 weeks**

Power elements (GTO thyristor, bipolar transistor, MOSFET transistor, IGBT transistor), step-down and step-up chopper, with R, RL and RLE load..,

Chapter 5: DC - AC converters **3 weeks**

Single-phase inverter, half-bridge and bridge circuit with R and RL loads.

Assessment :

Continuous assessment: 40%; Final exam: .

References:

1. L. Lasne, "Electronique de puissance : Cours, études de cas et exercices corrigés", Dunod, 2011.
2. P. Agati et al. Aide-mémoire: Électricité-Électronique de commande et de puissance-Électro-technique", Dunod, 2006.
3. J. Laroche, "Électronique de puissance - Convertisseurs : Cours et exercices corrigés", Dunod, 2005.

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4. G. Séguier et al, "Électronique de puissance : Cours et exercices corrigés", 8th edition; Dunod, 2004.
5. D. Jacob, "Electronique de puissance - Principe de fonctionnement, dimensionnement", Ellipses Marketing, 2008.
6. G. Séguier, "L'électronique de puissance, les fonctions de base et leurs principales applications", Tech et Doc.
7. H. Buhler, "Electronique de puissance", Dunod
8. C.W. Lander, "Power Electronics", McGraw-Hill, 1981
9. H. Buhler, "Electronique de Réglage et de commande; Traité d'électricité".
10. F. Mazda, "Power Electronics Handbook: Components, Circuits and Application", 3rd Edition, Newness, 1997.
11. R. Chauprade, "Commandes des moteurs à courant alternatif (Electronique de puissance)", 1987.
12. R. Chauprade, "Commandes des moteurs à courant direct Electronique de puissance)", 1984.

CPNDST University

Semester: 5
Teaching : UEF 3.1.1
Subject 3: Systems modeling and identification
VHS: 22h30 (1h30 lecture)
Credits: 2
Coefficient: 1

Teaching objectives:

The aim of this course is to present the fundamental concepts and basic methods that enable automation engineers to develop representation models describing the input-output behavior of a process to be controlled, with the aim of developing a high-performance controller.

Previous knowledge recommended:

Basics of mathematics and servo systems.

Contents

Chapter 1: Modeling **(3 weeks)**
Representation model, Knowledge model (modeling mechanical, electrical, fluidic, thermal systems, ...).

Chapter 2: Reminder of basic automatic control methods **(4 Weeks)** Time response of a system, Direct identification from time response, Frequency approach.

Chapter 3. Model fitting principle **(4 Weeks)**
Linear model with respect to parameters, Minimization of the fitting criterion and calculation of the optimal solution, Matrix writing of the least-squares method.

Chapter 4. Least Squares Analysis **(3 Weeks)**
Estimation , Estimation variance, Maximum likelihood estimator, Outlier rejection.

Chapter 5: Recursive least squares **(1 Week)**
Principle of recursive calculation, implementation of the recursive method, weighting factor, forgetting factor.

Evaluation :

Review: 100%.

References:

1. Jean-François Massieu, Philippe Dorléans, "Modélisation et analyse des systèmes linéaires", Ellipses, 1998.
2. Pierre Borne, Geneviève Dauphin-Tanguy, Jean-Pierre Richard, "Modélisation et identification des processus", Technip, 1992.
3. Ioan D. Landau, "Identification des systèmes", Hermès, 1998.
4. E. Duflos, Ph. Vanheeghe, "Estimation Prediction", Technip, 2000.
5. R. Ben Abdenour, P. Borne, M. Ksouri, M. Sahli, "Identification et commande numérique des procédés industriels", Technip, 2001.

CPNDST University

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

Teaching objectives:

This course enables students to understand the operation of microprocessors, their peripherals and their interfacing. It also familiarizes them with the different types of ECUs used in industrial installations.

Previous knowledge recommended:

Combinatorial and sequential logic, programming concepts.

Contents:

Chapter 1. Microprocessor architecture **(2 weeks)**

Introduction to microprocessor-based systems, External architecture of a microprocessor, Internal architecture of a microprocessor.

Chapter 2: Introduction to instruction and interrupts **(4 weeks)**

Instruction , Mnemonic code, Addressing modes, Interrupts.

Chapter 3. Memories **(2 Weeks)**

Introduction, Memory technology: ROM, RAM, Refresh techniques, Memory characteristics, Addressing modes.

Chapter 4. Interfaces **(2 weeks)**

Serial interface, Parallel interface.

Chapter 5. The microcontroller **(5 weeks)**

Microcontroller basics, Microcontroller architecture, Peripherals, Interrupts, Microcontroller programming, Practical application.

Evaluation :

Continuous assessment: 40%; Exam: 60%.

References:

1. A. Farouki, T. Laroussi, T. Benhabiles, "Microprocessors 8086", Univ. Constantine.
2. J. Y. Haggège, "Microprocesseur : Support de cours", INSET, 2003.
3. Lilen, "Cours fondamental des microprocesseurs", Dunod, 1993.
4. Alain-Bernard Fontaine, "The Microprocessor 16 bits-8086-8088", 2nd edition, Manuels informatiques", Masson, 1997.
5. Michel Aumiaux, "16-bit microprocessors", 1997.
6. J. Crisp," Introduction to microprocessors and microcontrollers", Elsevier, 2nd edit 2004.
7. Christian Tavernier, "Microcontrôleurs PIC 10, 12, 16, Description et mise en œuvre", Dunod, 2007.
8. Pascal Mayeux, "Apprendre la programmation des PIC Mid-Range par l'expérimentation et la simulation", Dunod, 2010.

CPNDST University

Semester: 5
Teaching : UEF 3.1.2 Subject 2: Programming in C++ VHS: 22h30 (Course: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

This course will familiarize students with programming languages, particularly C++.

Previous knowledge recommended:

Basic mathematics, Algorithms, Numerical methods, Binary logic.

Contents:

Chapter 1: Introduction to the C++ language **(1 week)**
History, C++ development (object , compilation, debugging, execution, etc.).

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

Chapter 3: Conditional Structures and Loops **(2 Weeks)**
If/else, Switch/case, Loop for, Loop while, Loop do/while.

Chapter 4: Inputs/Outputs **(2 weeks)**
Output stream for display, keyboard input stream, case of strings of characters, files.

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

Chapter 6. Functions **(2 Weeks)**
Prototype a function, Define a function, Call a function, Pass arguments to a function, Overload a function, Files.

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

Evaluation :

Review: 100%.

References:

1. Bjarne Stroustrup, Marie-Cécile Baland, Emmanuelle Burr, Christine Eberhardt, "Programming: Principles and Practice with C++", Edition Pearson, 2012.
2. Jean-Cédric Chappelier, Florian Seydoux, "C++ par la pratique. Recueil d'exercices corrigés et aide-mémoire", PPUR Edition: 3rd edition, 2012.
3. Jean-Michel Léry, Frédéric Jacquenot, "Algorithmique, applications aux langages C, C++ en Java", Edition Pearson, 2013.
4. Frédéric DROUILLON, "Du C au C++ - De la programmation procédurale à l'objet", Eni; Edition: 2nd edition, 2014.
5. Claude Delannoy, "Programmer en langage C++", Edition Eyrolles, 2000.

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6. Kris Jamsa, Lars Klander, "C++ La bible du Programur", Edition Eyrolles, 2000.
7. Bjarne Stroustrup, "The C++ Language", Addison-Wesley Edition, 2000.

CPNDST University

Semester: 5
Teaching unit: UEM 3.1.1
Subject 1: TP Control of linear systems VHS: 22h30
(TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

Consolidate the knowledge acquired during the corresponding theory course through practical work.

Previous knowledge recommended:

Continuous servo systems, Study of systems in frequency domain and state space.

Contents

Practical 1: Introduction to MATLAB/Simulink

Practical exercise 2: Study and synthesis of frequency-domain

controllers Practical exercise 3: State representation in canonical form

TP4: Study and analysis of state-space systems

TP5: Study and synthesis of pole placement controllers TP6: Study

and synthesis of state observers

Evaluation :

Continuous assessment: 100%.

CPNDST University

Semester: 5
Teaching unit: UEM 3.1.1 Subject 2:
Power Electronics Practical work VHS:
22h30 (Practical work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

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

Previous knowledge recommended:

Contents of the power electronics course.

Contents:

TP N° 1. Uncontrolled rectifiers: single-phase and three-phase
Analyze the evolution of voltage and current at the converter output with resistive and inductive loads, Analyze the evolution of semiconductor currents and voltages with resistive and inductive loads, Determine the form factor and ripple ratio.

PRACTICAL EXERCISE 2. Single-phase and three-phase controlled rectifiers
Analyze the evolution of voltage and current at the converter output with resistive and inductive loads, Analyze the evolution of semiconductor currents and voltages with resistive and inductive loads, Determine the form factor and ripple ratio.

TP N° 3. Choppers, serial chopper, parallel chopper
Study the behavior of a series chopper on the inductive load and, in particular, determine the trend of the current absorbed by the load during transient and steady-state operation. Understand the operation by observing the characteristic signals of the circuit and comparing them with the results of the TD on the parallel chopper.

TP N° 4. Single-phase inverters
Study the operation of single-phase voltage inverters and the filtering of the resulting waveforms. Both "active" and "passive" filtering solutions will be discussed.

TP N° 5. Single-phase and three-phase dimmers
Study the operation of a dimmer delivering different types of loads (R and R-L) and compare the different results obtained theoretically in class with the practical results (formulas and chronograms).

Evaluation :

Continuous assessment: 100%.

CPNDST University

Semester: 5
Teaching unit: UEM 3.1.1
Subject 3: Practical work Modelling and identifying systems VHS: 22h30 (Practical work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

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

Previous knowledge recommended:

Students must have a good command of computer tools, in particular simulation using MATLAB's Simulink toolbox, system modeling and identification course.

Contents:

TP1: Introduction to MATLAB/Simulink

Practical exercise 2: Simulation of a system described by the equation of state and transfer function

(Simulink) Practical exercise 3: Non-parametric identification using the deconvolution

method

TP4: Non-parametric identification using the correlation method TP5:

Parametric identification using the Broïda method

TP6: Least squares method

Evaluation :

Continuous assessment: 100%.

CPNDST University

Semester: 5
Teaching unit: UEM 3.1.2
Subject 1: Microprocessor and Microcontroller
Practical Work VHS: 22h30 (Practical Work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

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

Previous knowledge recommended:

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

Contents:

TP1: Getting to grips with the 6809/8086 emulator

TP2: Arithmetic and logic operations on the microprocessor TP3:

Application of different addressing modes

TP4: Interruptions

TP5: Learning to program with a PIC 16F84 TP6:

Controlling a display (7-segment, LCD)

Evaluation :

Continuous assessment: 100%.

CPNDST University

Semester: 5
Teaching unit: UEM 3.1 Subject 2:
Practical exercises in C++ programming
VHS: 15h00 (Practical exercises: 1h00)
Credits: 1
Coefficient: 1

Teaching objectives:

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

Previous knowledge recommended:

C++ programming module

Contents:

TP 1: Getting to know the C++ language
(Development environment, compilation, debugging, execution, etc.) **TP**

2: Basic syntax, variable and operator declaration TP 3: Conditional

structures and loops

TP 4: Arrays and pointers

TP 5: Functions

TP 6: Files

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

Evaluation :

Continuous assessment: 100%.

CPNDST University

Semester: 5
Teaching : UED 3.1 Subject 1:
Standards and Certification VHS:
22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

The aim of this course is to provide students with a basic understanding of industrial standards and certification, explaining the differences, levels and types of certification and the institutions that can issue such certificates.

Previous knowledge recommended:

None.

Contents:

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

Chapter 2: Standardization objectives and benefits **(1Week)**
- A reminder of the history of quality: craftsmanship to the digital industry
-Quality and quality assurance
-The role of standardization
-Advantages of a quality system (e.g. ISO 9000)

Chapter 3. Commercial legislation **(1 week)**
- Law, decree, circular etc. regulatory text and standard
-Standardization and economic players
ExamplesPC versus Apple, ibm PC versus compatible PC
-Quality control and compliance laboratories
-Border control: health, product quality, sanitary impact, economic techniques, politics (protectionism)

Chapter 4: Types of standards and organization of standardization work **(2 weeks)**
-Voluntary standards
-Internal or local organizations: European and American organizations, Algerian organizations
- International organizations: CGPM and the SI system, ISO, EN standards, specific electrical and telecommunications standards

Chapter 5: Standards development, standardization and safety **(3 weeks)**
-Standards production: case of Afnor and Ianor, organization and operation of Algerian standardization, Algerian standards development .
- Main legal texts relating to standardization in Algeria
-Standardization and safety
-Applications to domestic electrical safety:
- Installation a compliant domestic electrical system (example of nfc18510 standard): distribution of circuits (according to their use), choice of wire cross-sections and line circuit-breakers.
- Earthing according to standards

Chapter 6. Certification **(4 Weeks)**
-Accreditation

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

Chapter 7. ISO 9000 standards **(2 weeks)**
-Description
-The iso 9000 family
- Scope of the various iso 9000 standards
- Important notes ISO 9001:2015 and ISO 9004:2015

Evaluation :

Review: 100%.

Bibliographic reference:

1. Robert Obert, "Pratique des normes IFRS, Comparaison avec les règles françaises et les US GAAP", Dunod, 2004.
2. Daniel Boeri, Maîtriser la qualité: tout sur la certification et la qualité totale, Editions Maxima, 2003, p. 26 (ISBN 2840013134)
3. ISO 9000:2015 "Quality management systems - Fundamentals and vocabulary".
4. Standard, ISO 9001: 2015 "Quality management system - Requirements https://fr.wikipedia.org/wiki/S%C3%A9rie_des_normes_ISO_9000
5. Appendix D: empowerment, retraining, reference ED6127: general scheme for empowerment training and retraining in the nfc18510_inrs_habilitation standard.
6. 2014 catalog of Algerian standards pdf document 447 pages (free download) http://www.ianor.dz/Site_IANOR/Catalogue.php?id=8
7. List of Algerac accredited organizations: certification, inspection, testing, etc. (màj 14/09/2017)

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Semester: 5
Teaching : UED 3.1
Subject 2: Renewable energies: generation and storage
VHS: 10:30 p.m. (1:30 a.m. class)
Credits: 1
Coefficient: 1

Teaching objectives:

This course enables students to understand the principles of electricity production from renewable energies, so that they can propose renewable alternatives for the production of electrical energy.

Previous knowledge recommended:

Energy and environment courses

Contents:

Chapter 1: Energy in general **(3 weeks)**
Definition, measurement, power and energy.

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

Chapter 3. Main sources of electrical power generation **(3 weeks)**
Fossils and renewables.

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

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

Evaluation :

Review: 100%.

References:

1. Jean-Christian Lhomme, Alain Liébard, "Les énergies renouvelables", Delachaux & Niestlé, 2nd edition, 2004.
2. Leon Freris and David Infield, "Renewable energies for power generation", Dunod, 2013.
3. Philippe Terneyre, "Energies renouvelables : Contrats d'implantation : Implantation des unités de production, clauses supensives, modèles de contrats", Sa Lamy, April 2010.
4. Michel Lavabre and Fabrice Baudoin, "Exercices et problèmes de conversion d'énergie : Tome 5, Energies renouvelables (1) : aérogénérateurs, gestion et stockage d'énergie", Casteilla, 2010.

CPNDST University

Semester: 5
Teaching unit: UET 3.1 Subject 1:
English in Automatics VHS: 22h30
(Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Describe automatic equipment, how it works and its applications, Express yourself on the subject of automation in general, Use appropriate technology and grammatical structures, Deepen your general knowledge, Understand a document of general interest.

Previous knowledge recommended:

English 1 and 2.

Contents:

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

Chapter 2: Terminology used in field of Automation **(3 weeks)**
Terminology used in field of automationUse technical tutorials.

Chapter 3: Study of technical texts **(3 weeks)**
Study of technical texts in the field of automatic control, reading of scientific or general articles.

Chapter 4. Working with a variety of technology media **(2 Weeks)**

Chapter 5: Presentation techniques for reports and dissertations (4 weeks) Design a presentation on theme of Automation. This activity enables learners to construct a presentation and deliver it in English in front of their peers. This activity includes a
condition: it must be developed in pairs. This means working together. It enables
also to initiate a class debate on the theme presented.

Evaluation :

Review: 100%.

CPNDST University

Semester: 6
Teaching : UEF 3.2.1
Subject 1: Sampled Servo Systems VHS:
45h00 (Class: 1h30, Practical exercises:
1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

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

Previous knowledge recommended:

Linear and continuous servo systems, basic mathematics (algebra, analysis, etc.).

Contents:

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

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

Chapter 3: Representation of sampled systems (3 Weeks)
Definitions, Difference equation representation, Advance/delay operators, Impulse response representation, Z-transform, Z-transmittance and block/diagram simplification, Pole/zero transformation by sampling.

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

Chapter 5. Synthesis of sampled systems (4 weeks)
Introduction, Speed, Static accuracy, Standard PID controllers, P-plane synthesis and digitization, Z-plane synthesis, Practical implementation of controllers.

Chapter 6. RST controller (1 week)

Evaluation :

Continuous assessment: 40%; Exam: 60%.

References:

1. J.R. Ragazzini, G. F. Franklin, "Les systèmes asservis échantillonnés", Dunod, 1962.
2. Daniel Viault, Yves Quenec'hdu, "Systèmes asservis échantillonnés", ESE, 1977.
3. Christophe Sueur, Philippe Vanheeeghe, Pierre Borne, "Automatique des systèmes échantillonnés : éléments de cours et exercices résolus", Technip, December 5, 2000.
4. P. Borne. G.D.Tanguv. J. P. Richard. F. Rotella, I. Zambetalcis, "Analyse et régulation de processus industriels-régulation numérique", Tome 2-Editions Technip, 1993.
5. Emmanuel Godoy, Eric Ostertag, "Commande numérique des systèmes : Approches fréquentielle et polynomiale", Ellipses Marketing ,2004.

CPNDST University

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

Teaching objectives:

The aim of this course is to provide learners with the knowledge they need to select components for pneumatic, hydraulic, electrical and thermal operating parts. It will also enable them to understand the challenges and solutions available in the field of industrial automation actuators.

Previous knowledge recommended:

Power electronics, Fundamental electronics1, Fundamental electrical engineering1.

Contents

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

Reminders: Operating and control parts of an automated system, Structure of an automated system in pneumatic, electrical and electronic technologies
Interfaces: Interfaces modifying the parameters of a signal; Interfaces modifying the nature of a signal

Chapter 2- Pneumatic actuator: The cylinder **(2 weeks)**

1-Description. 2-Sizing. 3-Limit switches. 4-Different cylinder types. 5-Application example.

Chapter 3- Precautions for pneumatic actuators: The directional control valve(2 weeks)

1-Control or command means. 2-Standardized symbols. 3-Electro distributors. 4-Distribution auxiliaries. 5-Application examples.

Chapter 4- Electric actuator: The motor **(3 weeks)**

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

Chapter 5- Precautionary devices for electric actuators **(2 weeks)**

1-Manually-operated switchgear: circuit-breaker and motor circuit-breaker. 2-Automatically controlled switchgear: contactor. 3-Electronically controlled switchgear: electronic drive.

Chapter 6- Reminders: the motor in an electrical installation **(1 week)**

1-Single-phase and three-phase power supply network. 2-Functional structure of an electrical installation (power and control sections and the various functions). 3-Installation disconnection or isolation (the disconnector). 4-Power circuit protection (against short circuits, overcurrents, overloads). 5-Switching function. 6-Control circuit protection.

Chapter 7 - Three-phase motor control **(3 weeks)**

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

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Evaluation :

Continuous assessment: 40%; Exam: 60%.

References:

1. Guy Clerc, Guy Grellet, "Actionneurs électriques, Modèles, Commande", Eyrolles, 1999.
2. Gérard Lacroux, "Electric actuators for robotics and servo control", 1994.
3. Pierre Mayé, Industrial Electric Motors, Dunod, 2011.
4. J. Faisandier, "Mécanismes hydrauliques et pneumatiques", Dunod 1999.
5. R. LABONVILLE, "Conception des circuits hydrauliques, une approche énergétique", Editions de l'Ecole Poly technique de Montréal 1991.
6. P. MAYE, "Moteurs électriques pour la robotique", Dunod Paris 2000.
7. José RoldanViloria, Aide-mémoire de pneumatique industrielle, Dunod, 2015.

CPNDST University

Semester: 6
Teaching : UEF 3.2.1
Subject 3: Sensors and measuring chains
VHS: 22h30 (1h30 lecture)
Credits: 2
Coefficient: 1

Teaching objectives:

After acquiring this unit, the student is expected to master the various components a measurement chain, the basic operating principle of a transducer and the metrological characteristics to be taken into account using and selecting a transducer.

Previous knowledge recommended:

General Electricity, Electrical and Electronic Measurements.

Contents

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

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

Chapter 3: Sensor conditioning circuit: (3 weeks)
Basic operational amplifier setups (inverting, non-inverting, differential, summing), ...). Instrumentation amplifier, Isolation . Bridge conditioners. Linearization of sensor static characteristics.

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

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

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

Chapter 7. Displacement and speed measurement : (2 weeks)
Optical encoders, Incremental encoders, Variable reluctance sensors.

Evaluation :

Review: 100%.

References:

1. George Asch et Coll, "Sensors in industrial instrumentation", 6th edition Dunod, 2006.
2. Pascal Dassonvalle, "Les capteurs : 50 exercices et problèmes corrigés", 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 aux capteurs en instrumentation industrielle", Centre de Publication Universitaire 2006.

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5. J. P. Bentley, "Principles of measurement systems", Pearson education 2005.
6. J. Niard et al, "Mesures électriques", Nathan, 1981.

CPNDST University

Semester: 6
Teaching : UEF 3.2.2
Subject 1: Programmable Logic Controllers
VHS: 67h30 (Class: 3h00, Practical exercises: 1h30)
Credits: 6
Coefficient: 3

Teaching objectives:

Identify the technological elements needed to control and monitor the operation of an automated production system. Use industrial automation specification tools to forecast cycle times or production rates.

Previous knowledge recommended:

Basic knowledge of the calculator and programming.

Contents:

Chapter 1: General information on automated systems (2 weeks)
Description of the different parts, Different types of control, Fields of application of automated systems.

Chapter 3. Grafcet (3 weeks)
Grafcet description, Grafcet evolution rules, Basic structures, Run and stop modes.

Chapter 4. API architecture (3 weeks)
PLC technology, PLC environment, External appearance, Internal structure, PLC criteria and selection, Wiring the PLC to the various I/Os and interfaces of an SAP (Automated Production System).

Chapter 5. PLC programming (7weeks)
PLC program processing and execution cycles, different programming languages (ladder or contact, Boolean or logic or List Mode, graphic or logigram, SFC or grafcet), single-sequence grafcet programming, multi-sequence grafcet programming.

Assessment :

Continuous assessment: 40%; Exam: 60%.

References:

1. Hamdi Hocine, "Automatismes logiques : modélisation et commande", volumes 1 and 2, éditions de L'UMC, 2006.
2. William Bolton, "Les automates programmables industriels", Dunod, 2010.
3. J.C. Humblot, "Automates programmables industriels", Hermes Science Publications, 1993.
4. Simon Moreno, Edmond Peulot, "Le GRAFCET : conception, implantation dans les automates programmables industriels", Delagrave, 2009.
5. Kevin Collins, "PLC Programming", Meadow Books, 2007.
6. G. Michel, "Les A.P. I: architecture et applications des automates programmables industriels", Dunod, 1988.

CPNDST University

Semester: 6
Teaching : UEF 3.2.2
Subject 2: Communication Buses and Industrial Networks
VHS: 10:30 p.m. (Class: 1:30 a.m.)
Credits: 2
Coefficient: 1

Teaching objectives:

The aim of this course is to familiarize students with the concepts of digital data transmission, and more specifically with the different types of networks that exist in the industrial world. Emphasis will be placed on understanding the different topologies with their advantages and disadvantages relation to a given industrial installation.

Previous knowledge recommended:

Basic notions of Boolean logic.

Contents:

Chapter 1. Network architecture **(2 weeks)**

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

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

- Industrial local area networks
- Fieldbus objectives
- Fieldbus classification

Chapter 3. Controller Area Network (CAN) bus **(3 weeks)**

- CAN bus classification.
- CAN communication protocols
- CAN frame representation

Chapter 4: Actuator Sensor Interface (AS-I) **(3 weeks)**

- AS-I fieldbus architecture
- AS-I communication protocols

Chapter 5: ProfiBus field networks **(4 weeks)**

- ProFiBus network classification
- Profibus and OSI model (communication protocols)
- Bus access in a profibus network

Evaluation :

Review: 100%.

References:

1. Pascal Vrignat, "Réseaux locaux industriels - Cours et travaux pratiques", 1999.

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2. Jean-François Hérold, Olivier Guillotin, Patrick Anaya, "Informatique industrielle et réseaux", Dunod 2010.
3. Eric DECKE, "Module de cours, Réseaux Locaux Industriels et Bus de Terrain", mimeo.
4. Tanenbaum, Andrew, "Réseaux", Dunod 4th edition 2003.
5. Stéphane Lohier, Dominique Présent, "Transmissions et réseaux", Éditions DUNOD
6. Francis Lepage et al, "Les réseaux locaux industriels", Hermes 1991.
7. Fred Halsal, "Mutimedia Communications: Applications, Networks, Protocols and Standards", AddisonWesley, 2001.
8. http://lysjack.free.fr/jack/RLI.htm.

CPNDST University

Semester: S6
Teaching unit: UEM3.2 Subject 1:
project VHS: 45h00 (TP: 3h00)
Credits: 4
Coefficient: 2

Teaching objectives:

Assimilate knowledge from different subjects in a comprehensive and complementary way. To put into practice in a concrete way the concepts inculcated during training. Encourage students' sense of autonomy and initiative. To teach them to work in a collaborative environment, while fostering intellectual curiosity.

Previous knowledge recommended:

The entire Bachelor's program.

Contents:

The theme of the End-of-Cycle must be chosen jointly by the teacher-tutor and a student (or a group of students: binomial or trinomial). The subject matter must be in line with the course objectives and the student's real aptitudes (Bachelor's level). It is also preferable for the topic to take 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.

Note:
During the weeks when students are working on their project's purpose and feasibility (bibliographical research, research into software or hardware needed to carry out the project, revision and consolidation of teaching directly related to the subject, etc.), the subject leader should use this face-to-face time to remind students of the essential content of the two subjects "Methodology of writing" and "Methodology of presentation" covered during the first two semesters of the core curriculum.

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

- A detailed presentation of the topic of study, emphasizing its relevance to the socio-economic environment.
- Resources used: methodological tools, bibliographical references, contacts with professionals, etc.
- Analysis of results and comparison with initial objectives.
- Critique of deviations and presentation of any additional details.
- Identify the difficulties encountered, highlighting the limits of the work carried out and the next steps to be taken.

Finally, the student or group of students present their work (either in the form of a short oral presentation or on a poster) to their teacher tutor and a teacher examiner, who can ask questions and thus assess the technical and presentation aspects of work.

Evaluation :

Continuous assessment: 100%.

CPNDST University

Semester: 6
Teaching unit: UEM 3.2 Subject 2:
Practical work on sensors and actuators VHS : 22h30 (Practical work : 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

These practical exercises enable students to apply and master the theoretical concepts studied in class. Teachers are asked to choose four practical exercises suitable for each subject.

Previous knowledge recommended:

Sensors and measuring chains, Actuators.

Contents:

TP Sensors

TP1: Sensor conditioning TP2:

Temperature measurement

TP3: Pressure measurement

TP4: Level and Flow Measurement

TP5: Photometric Measurement

TP6: Measuring rotational speed

TP Actuators

TP1: Setting up a pneumatic system TP2: Control valve

TP3: Stepper motor

TP4: AC and DC motors TP5: Three-phase motors

Evaluation :

Continuous assessment: 100%.

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Semester: 6
Teaching unit: UEM 3.2.1
Subject 3: Practical work on programmable logic controllers VHS: 22h30 (Practical work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

Once they have acquired this knowledge, students will be to understand and implement a automated system. Thanks to various manipulations, they will be able to program a PLC to intelligently manage and coordinate the actions provided for in the specifications presented to them.

Previous knowledge recommended:

Programmable Controller course.

Contents:

Plan some practical work with the PLCs available.

Evaluation :

Continuous assessment: 100%.

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Semester: 6
Teaching unit: UEM 3.2.1
Subject 4: Practical work on communication buses and industrial networks VHS: 15h00 (Practical work: 1h00)
Credits: 1
Coefficient: 1

Teaching objectives:

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

Previous knowledge recommended:

Communications bus and industrial networks course.

Contents:

Depending on the resources available, some practical work will be carried out on industrial networks.

Evaluation :

Continuous assessment: 100%.

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Semester: 6
Teaching : UED 3.2
Subject 1: Electrical installations in automation
VHS: 22h30 (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

To give the graduate an idea of the choice of power supplies installed, depending on the type environment, and how to connect them to the process and other elements of control and command system.

Previous knowledge recommended:

General electricity, continuous servo systems, fundamental electrical engineering1.

Contents:

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

Chapter 2. Standardized switchgear and wiring diagrams **(6 weeks)**

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

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

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

Evaluation :

Review: 100%.

References:

Michel Grout and Patrick Salaun, "Instrumentation industrielle", 3rd edition, DUNOD, 2012.

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Semester: 6
Teaching unit: UED 3.2 Subject 2 :
Maintenance and reliability VHS:
22h30 (Class: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

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

Previous knowledge recommended:

Sensors and measurement chains, actuators.

Contents:

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

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

Chapter 3. Quantitative maintenance analysis **(4 Weeks)**
ABC analysis, Noiret's Abacus, decision tree, criticality matrix, correlation relationships.

Chapter 4. Diagnosis **(4 weeks)**
Definition and methodology, diagnostic procedures, diagnostic tools (cause-effect table, fault tree, diagnostic digram, etc.), comparative study of tools.

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

Evaluation :

Review: 100%.

References:

1. Jean HENG, "Pratique de la maintenance préventive", Dunod, 2002.
2. Renaud CUIGNET, "Management de la maintenance", Dunod, 2002.
3. Introduction to TPM, USINOR, Institut Qualité et Management, 1997.
4. "Pratique de la maintenance autonome", USINOR, Institut Qualité et Management 1997.
5. F. MONCHY, Maintenance: methods and organization, Dunod, 2000.
6. J. M. BLEUX, J. L. FANCHON, Maintenance : systèmes automatisés de production, Collection Etapes, Nathan, 1997.

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Semester: 6
Teaching : UET 3.2
Subject: Professional project and business management VHS: 22h30 (1h30 lecture)
Credits: 1
Coefficient: 1

Teaching objectives:

Prepare for and master the methodological tools needed enter the job market at the end of your studies, and prepare for the job search. Develop an awareness of entrepreneurship by presenting an overview of the management skills needed to set up a business and implement a project.

Contents :

Chapter 1Business and society (3 weeks)

The company: definition and objectives. Different types company, company structure, staff and partners. partners.
Different types company (VSE, SME, SMI, ETI, GE)
The company: definition and objectives
Different types company (SARL, EURL, SPA, SNC, etc.)
Difference between business and company.

Chapter 2: Company operations and organization (2 weeks)

How the company is organized and operates
Main company functions (production, service, etc.) Company structure (definition and characteristics)
Different types of structure (functional, divisional, multidivisional, staff-and-line).
Ancillary company activities (partnerships, subcontracting, etc.).

Chapter 3: How to get into a company (3 weeks)

Personnel requirements and quality (, managers, technicians, workers, etc.)
Where to find a job offer (ANEM, section, internet, etc.) How to go about it (application, CV)
The different types of job interviews and how to go about them. Types of employment contracts (permanent and fixed-term)
Salary (how to calculate a pay slip).

Chapter 4: How to start your own business (3 weeks)

The entrepreneur's path (the idea, capital, financial aid, etc.) How to find a good idea?
Financial aid schemes investment (ANSEJ, CNAC, ANDI, ANGEM, PNR)

Chapter 5: Study a business creation project (4 weeks)

study of a business creation project requires the promoter to plan and write down in detail the phases and steps he will have to take to get his business off the ground.
Market (sales, marketing, etc.).

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Technical study (location, equipment and machine requirements, production capacity, etc.).
Financial study (sales, payroll costs, expenses and consumption, taxes, etc.).
Mini project the study of a business creation project.

Evaluation : 100% examination

References :

1. -Antoine Melo "Gestion d'entreprise" Melo France 2016 edition
2. -Thomas Durand " Management d'entreprise " Paperback edition 2016
3. -Philippe Guillermic " La gestion d'entreprise pas à pas " Poche edition 2015
4. -Guy Raimbault "Outils de gestion" édition Chihab Alger 1994
5. -Institut de technologie financière " Initiation comptable "OPU Alger 1993
6. -Christian Bultez "Guide et mode d'emploi des démarches" published by Nathan Paris 1993

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IV- Agreements / Conventions

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STANDARD LETTER OF INTENT

(For licenses co-sponsored by another university)

(Official paper on the letterhead of the university concerned)

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

The university (or university center) hereby hereby declares that it will co-sponsor the above-mentioned license for the duration of the license's accreditation period.

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

- Providing input into the development and updating of teaching programs,
- Participating in seminars organized for this ,
- By taking part in defense juries,
- By pooling human and material resources.

SIGNATURE of legally authorized person:

FUNCTION :

Date :

CPNDST University

STANDARD LETTER OF INTENT

(If licensed in collaboration with a user company)

(Official letterhead)

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

Dispensed at :

The company hereby declares its willingness to participate in this training course as a potential user of the product.

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

- Provide input into the development and updating of teaching programs,
- Participate in seminars organized for this ,
- Participate in defense juries,
- As far as possible, we encourage internships, either as part of end-of-study dissertations or tutored projects.

We will provide the material and human resources needed to carry out the tasks required to achieve these objectives.

Mr (or Mrs)*..... has been appointed as external coordinator for this project.

SIGNATURE of legally authorized person :

FUNCTION :

Date :

OFFICIAL STAMP or COMPANY SEAL

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V - Opinions and visas of administrative and consultative bodies

Licence title: Automatic control

Department manager+ Domain team manager
Date and visa: Date and visa:
Dean of Faculty (or Institute)
Date and visa :
Head of university
Date and visa:

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VI - Opinions and approval of the Regional Conference

VII - Opinions and approval of the Comité pédagogique National de Domaine

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