الجمهورية الجزائرية الديمقراطية الشعبية وزارة Algerian People's and Democratic Republic

التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research

اللجنة البيداغوجية الوطنية لميدان العلوم و التكنولوجيا

National Pedagogical Committee of the Science and Technology field

HARMONIZATION OF ACADEMIC TRAINING OFFER

2016 - 2017

Domain	Spinneret	Speciality
Science and Technologies	***Electromechanics***	***Electromechanics***

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مواءمة

عرض تكوين
ماستر أكاديمي

2017-2016

الميدان	الفرع	التخصص
علوم و تكنولوجيا	كهروميكانيك	كهروميكانيك

I – Master's identity sheet

Conditions of access

(Indicate the bachelor's specialties that can give access to the Master's degree)

Spinneret	Harmonized Master's Degree	Master's Degree Licenses	Classification according to License compatibility	Coefficient assigned to the license
Electromechanics	Electromechanics	Electromechanics	**1**	**1.00**
		Industrial Maintenance	**2**	**0.80**
		Electrotechnical	**3**	**0.70**
		Electronic	**3**	**0.70**
		Mechanical engineering	**3**	**0.70**
		Energy	**3**	**0.70**
		Other ST Domain Licenses	**5**	**0.60**

II – Semester organisation sheets for the specialty's courses

Semester 1 Master's Degree: Electromechanics

Teaching unit	Materials	Credits	Coefficient	Hourly volume weekly			Semi-Annual Hourly Volume (15 weeks)	Complementary Work in Consultation (15 weeks)	Evaluation method	
	Entitled			**Course**	**TD**	**TP**			**Continuous assessment**	**Examination**
UE Fundamental Code: UEF 1.1.1 Credits: 10 Coefficients: 5	Modeling and Simulation of Electrical Machines	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
	Power Electronics advance	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
	Industrial Power Grids	2	1	1h30			10:30 p.m.	27:30		100%
UE Fundamental Code: UEF 1.1.2 Credits: 8 Coefficients: 4	Industrial mechanisms and power transmission	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
	Hydraulic Machinery and Tyres	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
UE Methodological Code: EMU 1.1 Credits: 9 Coefficients: 5	Lab Machine Modeling and Simulation Electrical	2	1			1h30	10:30 p.m.	27:30	100%	
	Advanced Power Electronics TP	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Industrial Power Grids	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Mechanisms Industrial and Power Transmission	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Hydraulic Machines and pneumatic	1	1			1h00	3:00 p.m.	10:00 a.m.	100%	
UE Discovery Code: UED 1.1 Credits: 2 Coefficients: 2	Renewable	1	1	1h30			10:30 p.m.	02:30 am		100%
	Refrigeration and air conditioning	1	1	1h30			10:30 p.m.	02:30 am		100%

UE Transversal Code: UET 1.1 Credits: 1 Coefficients: 1	Technical English and Terminology	1	1	1h30			10:30 p.m.	02:30 am		100%
Semester 1 total		**30**	**17**	**12:00 p.m.**	**6:00 pm**	**7:00 pm**	**375h00**	**375h00**		

Semester 2 Master's Degree: Electromechanics

Teaching unit	Materials	Credits	Coefficient	Hourly volume weekly			Semi-Annual Hourly Volume (15 weeks)	Complementary work in consultation (15 weeks)	Evaluation method	
	Entitled			**Course**	**TD**	**TP**			**Continuous assessment**	**Examination**
UE Fundamental Code: UEF 1.2.1 Credits: 8 Coefficients: 4	Machine control Electrical	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
	Hydraulic and pneumatic control	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
Core UE Code: UEF 1.2.2 Credits: 10 Coefficients: 5	Thermodynamics Applied	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
	Fluid Mechanics Applied	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
	Diagnosis and monitoring	2	1	1h30			10:30 p.m.	27:30		100%
Methodological UE Code: EMU 1.2 Credits: 9 Coefficients: 5	Practical work Controlling electrical machines	2	1			1h30	10:30 p.m.	27:30	100%	
	TP Order Hydraulic and pneumatic	2	1			1h30	10:30 p.m.	27:30	100%	
	Applied Thermodynamics Lab	2	1			1h30	10:30 p.m.	27:30	100%	
	Numerical methods applied	3	2	1h30		1h00	37:30 p.m.	37:30 p.m.	40%	60%

UE Discovery Code: UED 1.2 Credits: 2 Coefficients: 2	Special electrical machines	1	1	1h30			10:30 p.m.	02:30 am		100%
	Electromagnetic conversion	1	1	1h30			10:30 p.m.	02:30 am		100%
UE Transversal Code: UET 1.2 Credits: 1 Coefficients: 1	Ethics, Professional Conduct and Intellectual Property	1	1	1h30			10:30 p.m.	02:30 am		100%
Semester 2 total		**30**	**17**	**12:00 p.m.**	**6:00 pm**	**7:00 pm**	**375h00**	**375h00**		

Semester 3 Master's Degree: Electromechanics

Teaching unit	Materials	Credits	Coefficient	Hourly volume weekly			Semi-Annual Hourly Volume (15 weeks)	Complementary Work in Consultation (15 weeks)	Evaluation method	
	Entitled			**Course**	**TD**	**TP**			**Continuous assessment**	**Examination**
UE Core Code: UEF 1.3.1 Credits: 10 Coefficients: 5	Modeling and simulation of the converter-machine association	6	3	3:00 pm	1h30		67h30	82:30 p.m.	40%	60%
	Advanced control technology and control	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
UE Core Code: UEF 1.3.2 Credits: 8 Coefficients: 4	Microprocessors and PLCs	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
	Organization and management of maintenance industrialist	4	2	1h30	1h30		45h00	55:00 pm	40%	60%
UE Methodological Code: EMU 1.3	TP Modeling and simulation of the association Machine converters	2	1			1h30	10:30 p.m.	27:30	100%	

Credits: 9 Coefficients: 5	TP Techniques Advanced control and regulation	2	1			1h30	10:30 p.m.	27:30	100%	

	TP Microprocessors and APIs	2	1			1h30	10:30 p.m.	27:30	100%	
	Computer-aided manufacturing design CAM	3	2	1h30		1h00	37:30 p.m.	37:30 p.m.	40%	60%
UE Discovery Code: UED 1.3 Credits: 2 Coefficients: 2	Basket of your choice	1	1	1h30			10:30 p.m.	02:30 am		100%
	Basket of your choice	1	1	1h30			10:30 p.m.	02:30 am		100%
UE Transversal Code: UET 1.3 Credits: 1 Coefficients: 1	Literature search and memory design	1	1	1h30			10:30 p.m.	02:30 am		100%
Semester 3 total		**30**	**17**	**12:00 p.m.**	**6:00 pm**	**7:00 pm**	**375h00**	**375h00**		

Discovery UE (S1, S2 and S3)

1- Sensors and instrumentation
2- Refrigeration and air conditioning
3- Exploitation of Renewable Energies
4- System reliability
5- Special electrical machines
6- Industrial Security and Authorization
7- Signal processing
8- Servo systems
9- Industry standards and legislation
10- Maintenance and dependability
11- Industrial IT
12- Other...

Semester 4

Internship in a company sanctioned by a thesis and a defense.

	VHS	Coeff	Credits
Personal work	550	09	18
Internship in a company	100	04	06
Seminars	50	02	03
Other (Framing)	50	02	03
Total Semester 4	750	17	30

This table is given for information purposes only

Evaluation of the Master's End of Cycle Project

- Scientific value (Jury's assessment) /6
- Writing of the Thesis (Jury's Assessment) /4
- Presentation and answer to questions (Jury's assessment) /4
- Supervisor's assessment /3
- Presentation of the internship report (Jury's assessment) /3

III - Detailed programme by subject of the S1 semester

Semester: 1
Teaching unit: UEF 1.1.1
Subject 1: Modeling and Simulation of VHS Electrical Machines:
45h00 (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

To establish the mathematical models necessary for the modelling and simulation of electrical machines. These models provide, for the machine under consideration, the instantaneous and steady-state equations, the performances and the control laws.

Recommended prior knowledge:

The student will have the following knowledge:

- Three-phase electrical circuits, magnetic circuits, single-phase and three-phase transformers.
- DC and AC Electric Machines

Material content:

Chapter 1.General Machine Modeling (03weeks)
Machine structures, representation of magnetic phenomena, equivalent diagram, magnetomotive force, permeances, induction distribution, winding flux, couplings, dispersion flux, case of sinusoidal distributions, torque calculation by the method of virtual works.

Chapter 2.Machine Modeling for Dynamic Regimes (03weeks)
Transformation matrices, PARK transformation, use of the method for transient regime calculations, choice of the coordinate system.

Chapter 3.Modeling and Simulation of Direct Current Machines (DCM) (03weeks)
Equations of DC machines, model of the DC machine on the d,q axes, consideration of the various types of excitation in an MCC, transient regimes.

Chapter 4.Modeling and Simulation of Synchronous Machines (03weeks)
Modeling and simulation of a synchronous machine with and without dampers, study of transient regimes, torque expressions, modeling and simulation of a permanent magnet synchronous machine, d,q diagrams, magnet motors, reluctance.

Chapter 5.Modeling and Simulation of Asynchronous Squirrel Cage Machines (03 weeks)
Modeling and simulation of an Asynchronous motor/generator with squirrel cage, wound rotor motor, study of transient regimes, torque expressions.

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

References:

1. P. Barret, "Régimes transitoires des machines tournantes électriques", Edition Eyrolles, 1997. ISBN10: 2-212-01574-7.
2. M. Kostenko, L. Piotroviski, "Electrical Machines, Volume 2: Alternating Current Machines", Moscow Edition.
3. J. P. Fanton, "Electrotechnique, Machines et réseaux, génie électrique",EditionEllipses, 2002. ISBN 10: 2729811133.
4. R Abdessemed, ''Modeling and simulation of electrical machines'', Edition Ellipses 2011. ISBN10: 2-7298-6495-4.

5. J. P. Caron, J.P. Hautier, "Modeling and control of the asynchronous machine", Technip Edition 1995. ISBN: 9782710806837.
6. J. Chatelain, ''Machines Electriques'', T1 & T2, Edition Dunod, 1989.
7. D. Hanselman, ''Brushless permenent magnet motor design'', Magna physics publishing 2006. ISBN: 1-881855-15-5.

Semester: 1
Teaching unit: UEF 1.1.1
Subject 1: Advanced Power Electronics VHS:
45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

To allow the student to deepen his knowledge of energy conversion and quality and to give him certain notions about modern converters and their control.

Recommended prior knowledge:

The student should possess a basic knowledge of power semiconductor components and knowledge of basic power converters.

Material content:

Chapter 1.The Choppers **(03 weeks)**
Non-reversible choppers (series chopper, parallel chopper), current reversible chopper, voltage reversible chopper, current and voltage reversible chopper.

Chapter 2.Techniques for controlling static converters **(03 weeks)** Full-wave control, triangular PWM, calculated modulation, vector modulation, hysteresis control...

Chapter 3.New Converter Topologies **(03 weeks)**
Multi-level converters, multi-cell converters, matrix converters...

Chapter 4.Power Quality of Static Converters **(03 weeks)**
Introduction to the problem of harmonic pollution of power grids, harmonic values and standards, harmonic disturbances, harmonic propagation, harmonic reduction.

Chapter 5. Applications of converters **(03 weeks)** Active filtering, reactive energy compensation, power factor correction, variable speed electric drives...

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

References:

1. G. Seguier, ''Les converters'' de l'électronique de pouvoir. Volume 1: The Alternative Conversion – Continuous'', Edition Lavoisier - Tec& Doc 1992.
2. C. Rombaut, G. Seguier, ''Les converters'' de l'électronique de pouvoir. Volume 2: The Alternative-Alternative Conversion'', Lavoisier Edition - Tec & Doc 1991.
3. R. Bausière. F. Labrique, G. Seguier, ''Les converters'' de l'électronique de pouvoir. Volume 3: The Continuous–Continuous Conversion'', Édition Lavoisier - Tec & Doc 1997.
4. F. Labrique, G. Seguier, R. Bausiere, ''Les converterseurs de l'électronique de pouvoir. Volume 4: The Continuous-Alternative Conversion'', Edition Lavoisier - Tec & Doc 1995.
5. H. Bühler, ''Converters statics'', Éditions Presses polytechniques et universitaires romandes 1991.

Semester: 1
Teaching unit: UEF 1.1.1
Subject 1: VHS Industrial Power Networks:
10:30 pm (Lecture: 1 hour 30 minutes)
Credits: 2
Coefficient: 1

Teaching objectives:

The objective of this subject is to give students first an overview of industrial electrical networks (architectures, diagrams and plans), then the information necessary to evaluate an electrical structure and the principles to be respected in order to work on a structure in complete safety.

Recommended prior knowledge:

Basic notions of electrical networks and equipment.

Material content:

Chapter 1. General **(01 week)**
Standardization, voltage domains, switchgear, diagram graphic symbols.

Chapter 2. Industrial Power Grids **(02 weeks)**
General structure of an industrial network, delivery stations, general switchboards and sub-switchboards, emergency power supply, uninterruptible power supply, Examples of industrial networks.

Chapter 3. Industrial electrical structures (Installations and switchboards) **(03 weeks)**
Fields of voltages, environment, structures and pipelines, electrical installations, lighting and special installations, general problems with installations (disturbances and energy quality).

Chapter 4. Grounding and safety in a system **(03 weeks)**
Origin of neutral regimes, usefulness of earthing, PE and PEN conductors, grounding of transformer substations.

Chapter 5. Facility calculations **(03 weeks)**
Minimum cross-section of a pipe, voltage drop, short-circuit currents, heating in electrical cabinets.

Chapter 6. Wiring and maintenance **(03 weeks)**
Techniques for holding wires (chutes, strands, combs), observations, measurements, control.

Evaluation method:

Review: 100%.

References:

1. J. M. Broust, ''Industrial electrical apparatus and installations: design, coordination, implementation and maintenance'', Dunod, Paris 2008.
2. C. Prévé and R. Jeannot, ''Guide de conception des réseaux électriques industriels'', Schneider Electric, n° 6883 427/A 1997.
3. D. Fedullo, T. Gallauziaux, ''Le grand livre de l'électricité'', Ed Broché, Eyrolles 2009.

Semester: 1
Teaching unit: UEF 1.1.2
Subject 1: Industrial Mechanisms and Power Transmission VHS: 45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

To develop in the student the concepts of designing and producing a means of transmitting the movement of certain mechanisms and machine components (bearings, reducers, etc.).

Recommended prior knowledge:

The student will have the following knowledge:

- Applied mechanics.
- Mechanical manufacturing.

Material content:

Chapter 1. General **(02 weeks)**
Standardization, kinematic links between mechanical parts.

Chapter 2. Making connections **(02 weeks)**
Functions to be performed and characterization of functions, removable assemblies, permanent assemblies.

Chapter 3. Rotational guidance **(03 weeks)**
Functions to be performed and characterization of functions, plain bearings, bearing interposition guidance, hydrostatic and hydrodynamic bearings.

Chapter 4. Translation guidance **(03 weeks)**
Function to be performed and characterization of functions, direct contact guidance, guidance by interposition of rolling elements, sealing function and protection of connections

Chapter 5. Motion and power transmission components **(05weeks)**
Couplings, clutches, brakes, gear transmission, belt transmission, design and sizing of industrial equipment (gearbox, winch, overhead crane).

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

References:

1. E. Francis, ''Mechanical Construction: Power Transmission'', Volume 1, ISBN: 2-10-049125-12006.
2. E. Francis, ''Construction mécanique: transmission de pouvoir'', Volume 2, ISBN: 2-10-049750-2 2006.
3. E. Francis, ''Mechanical Construction: Power Transmission'', Volume 3, ISBN: 2-10-049749-32006.

Semester: 1
Teaching unit: UEF 1.1.2
Subject 1:VHS Hydraulic and Pneumatic Machines:
45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The objective of the program is to familiarize the student with the different types of hydraulic and pneumatic machines. The notions of aerodynamics and thermodynamics are applied in order to establish the modeling and understanding of flow in a turbomachinery and to develop basic elements for the design and selection of these machines.

Recommended prior knowledge:

The student will have the following knowledge:

- Fluid Mechanics,
- Applied thermodynamics

Material content:

Chapter 1. Introduction (03 weeks)
General classification of hydraulic and pneumatic machines according to the direction of flow, historical aspects, machines operating with incompressible flows and machines operating with compressible flows, configuration of hydraulic and pneumatic machines, axial, radial and mixed turbomachinery, hydraulic machines and thermal machines.

Chapter 2. One-dimensional theory of hydraulic and pneumatic machines (05 weeks)
Calculation hypothesis, revision of basic concepts of dynamics and energy transfer of a moving fluid, momentum (principle of action and reaction), work of a wheel (Euler's equation, application to hydraulic and pneumatic machines that operate with compressible and incompressible fluids), transformation of kinetic energy into mechanical work, Transformation of thermal energy into kinetic energy (Application to thermal machines of the fundamental laws of thermodynamics), efficiency definitions.

Chapter 3. Axial and radial hydraulic and pneumatic machines (04 weeks)
Velocity triangle, normal triangle, characterization of velocity triangles (load coefficient, flow coefficient, degree of reaction), radial hydraulic and pneumatic machines (energy transfer), slip factor, blade inclination, compressors and centrifugal pumps, dimensionless numbers (similarity of operating regimes, characteristic curves, specific speed and specific diameter).

Chapter 4. Water turbines (03 weeks)
Pelton, Francis and Kaplan turbines.

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

References:

1. J. Faisandeur, "Hydrauliques et pneumatiques", Dunod 2006.
2. ''Industrial hydraulic Systems, an introduction'', Englwood cliffs (new jersy), Prentice hall 1988.
3. R. Affouard, J. Diez, ''Les installations hydrauliques conception et réalisation pratique'', Paris, entreprise moderne d'édition 1972.

4. S. L. Dixon, ''Fluid Mechanics and Thermodynamics of Turbomachinery'', Fourth edition, Butterworth-Heinemann, Woburn, MA, USA 1998, ISBN 0-7506-7059-2.
5. H.Cohen, , G.F.C.Rogers, H.I.H.Saravanamuttoo, ''Gas Turbine Theory'', Fourth edition, Longman group, Harlow, UK 1996, ISBN 0-582-23632-0.

Semester: 1
Teaching unit: UEM1.1
Subject 1:Practical work Modeling and simulation of VHS electrical machines: 10:30 pm (Practical work: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

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

Recommended prior knowledge:

Good command of computer tools and MATLAB-SIMULINK software.

Material content:

TP1. Getting Started with MATLAB-SIMULINK Software

TP2. Modeling and Simulation of Direct Current Machines (DCM)
Modeling and simulation of a separately excited/shunt DC machine.

TP3. Modeling and simulation of synchronous machines
Modeling and simulation of a synchronous machine with and without shock absorbers.

TP 4.Modeling and simulation of a permanent magnet synchronous machine TP5. Modeling and

Simulation of Asynchronous Squirrel Cage Machines
Modeling and simulation of an asynchronous squirrel cage motor.

Evaluation method:

Continuous assessment: 100 % .

References:

Lecture notes and laboratory brochures.

Semester: 1
Teaching unit: UEM1.1
Subject 1:TP Advanced Power Electronics VHS:
10:30 pm (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

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

Recommended prior knowledge:

Power semiconductor components and basic power converters.

Content of the material:

TP 1. 1 quadrant and 4 quadrant chopper

TP 2. Triangulo-sinusoidal PWM of a voltage inverter TP

3. Vector PWM of a voltage inverter

TP 4. Simulation of a TP 5 multilevel converter.

Simulation of a TP6 multi-cell converter. Simulating

a Matrix Converter

TP7. Power factor correction

Method of evaluation:

Continuous assessment: 100%

Bibliographical references:

Lecture notes and laboratory brochures.

Semester: 1
Teaching unit: UEM1.1
Subject 1:TP Industrial Electrical Networks
VHS: 10:30 pm (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

The objective of this subject is to help students to know the main indicators of energy quality in an industrial installation, and to be able to evaluate this quality.

Recommended prior knowledge:

Basic notions of networks, machines, signals.

Material content:

TP 1. Receivers and their power constraints
Disturbances in an industrial network (origins and evaluations), effects of disturbances on engines, effects on lighting (evaluations).

TP 2.Reactive Energy Compensation
Interest of compensation, determination of compensation power, location and choice of compensation equipment.

TP 3.Harmonics in an industrial network
Sources of harmonics, effects on equipment and receivers, means of protecting against their effects (filtering, confinement, low-impedance source,...).

TP 4.Sizing of an industrial plant

Evaluation method:

Continuous assessment: 100 % .

References:

Lecture notes and laboratory brochures.

Semester: 1
Teaching unit: UEM1.1
Material 1:TP Industrial Mechanisms and Power Transmission
VHS: 10:30 pm (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

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

Recommended prior knowledge:

Applied mechanics and mechanical manufacturing.

Material content:

TP 1.Gearbox recessed connections TP

2.Coupling alignments TP 3.Bearing

adjustments

TP 4.Geometric rotor control

Evaluation method:

Continuous assessment: 100 % .

References:

Lecture notes and laboratory brochures.

Semester: 1
Teaching unit: UEM1.1
Material 1:TP Hydraulic and Pneumatic Machines VHS:
15:00 (TP: 1h00)
Credits: 1
Coefficient: 1

Teaching objectives:

The objective is to develop in the student the means that will allow him to analyze hydraulic and pneumatic circuits.

Recommended prior knowledge:

Thermodynamics and MDF.

Material content:

TP 1. Study of a venturi

TP 2. Testing of a centrifugal pump and Cavitation phenomenon

TP 3. Hydro turbines

TP 4. Testing a Compressible Fluid Machine

Evaluation method:

Continuous assessment: 100 % .

References:

Lecture notes and laboratory brochures.

Semester: 1
Teaching unit: UET 1.1
Subject: Technical English and VHS terminology: 10:30 pm (course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Introduce the student to technical vocabulary. Strengthen your knowledge of the language. Help them understand and synthesize a technical document. To enable him to understand a conversation in English held in a scientific setting.

Recommended prior knowledge:

Basic English vocabulary and grammar

Material content:

- Reading comprehension : Reading and analysis of texts related to the specialty.

- Oral comprehension : From authentic video documents of scientific popularization, note-taking, summary and presentation of the document.

- Oral expression : Presentation of a scientific or technical subject, development and exchange of oral messages (ideas and data), Telephone communication, Gestural expression.

- Written expression : Extracting ideas from a scientific document, writing a scientific message, exchanging information in writing, writing CVs, letters requesting internships or jobs.

Recommendation: It is strongly recommended that the subject person present and explain at the end of each session (at most) about ten technical words of the specialty in the three languages (if possible) English, French and Arabic.

Evaluation method:

Review: 100%.

References:

1. P.T. Danison, Practical Guide to Writing in English: Uses and Rules, Practical Advice, Editions d'Organisation 2007
2. A. Chamberlain, R. Steele, Practical Guide to Communication: English, Didier 1992
3. R. Ernst, Dictionnaire des techniques et sciences appliquées: français-anglais, Dunod 2002.
4. J. Comfort, S. Hick, and A. Savage, Basic Technical English, Oxford University Press, 1980
5. E. H. Glendinning and N. Glendinning, Oxford English for Electrical and Mechanical Engineering, Oxford University Press 1995
6. T. N. Huckin, and A. L. Olsen, Technical writing and professional communication for nonnative speakers of English, Mc Graw-Hill 1991
7. J. Orasanu, Reading Comprehension from Research to Practice, Erlbaum Associates 1986

III - Detailed programme by subject of the S2 semester

Semester: 2
Teaching unit: UEF 1.2.1
Subject 1:VHS Electrical Machine Control: 45h00
(Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

To enable the student to acquire knowledge in the field of electronic power supply and control of the most widely used electrical machines.

Recommended prior knowledge:

Notions of servo control and regulation; Electric machines and static converters.

Material content:

Chapter 1.Introduction (02weeks)
- Electromechanical Properties of Electrical Machines
- Variable speed benefits
- Variable speed drives and their structures (for DC and AC machines)

Chapter 2. Control of DC machines (02weeks)
- Mathematical description of direct current machines (different excitation modes)
- Natural and Artificial Characteristics of Direct Current Machines
- Speed control of DC motors (armature voltage control, magnetic flux variation control)
- Braking of DC machines

Chapter 3.Controlling Asynchronous Machines (07weeks)
- Modeling of the asynchronous machine for control (torque-speed characteristic, variable frequency and voltage operation, dynamic models of the machine in the two-phase coordinate system)
- Principles, interest and methods of speed adjustment of asynchronous machines:
  - Electronic control and power supply by static converters of asynchronous machines
  - Scalar control (principle, model and control law)
  - FOC vector control (vector control principle, rotor or stator flow orientation, command expression)
  - DTC direct torque control (control strategy, torque control, power control)

Chapter 4.Synchronous Machine Control (04weeks)
- Types, structure and operation of synchronous machines
- Synchronous machine start-up and auto-control
- Mathematical modeling for the control of a synchronous machine (permanent magnet synchronous machine or others)
- Machine-converter combination and vector control

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

References:

1. Course Notes
2. Variable speed electric drives; Jean Bonal, Guy Séguier, 1998
3. Electronic control of electric motors; Michel Pinard; Dunod, 2004

4. Electrical system controls; Loron Luc, Lavoisier, 2004
5. Modeling and control of the asynchronous machine, J.P.Hautier and J.P.Caron, Technip, 1995
6. Electrical Engineering Theodore WILDI De BEOCK UNIVERSITY.

Semester: 2
Teaching unit: UEF 1.2.1
Subject 1:VHS hydraulic and pneumatic control:
45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

To enable the student to acquire knowledge on the design, operation and calculation of the elements involved in industrial automated systems based on hydraulic and pneumatic energy.

Recommended prior knowledge:

Logic circuits, fluid mechanics, hydraulic and pneumatic machines.

Material content:

Chapter 1. Hydraulic and pneumatic energies in the functional chain of a system **(02weeks)**

- Definitions of hydraulic and pneumatic energy
- Energy storage and supply: power systems, storage systems, conditioning systems (filters, dehydrators, lubricators), safety systems (flow controller), measuring systems
- Types of energy converters (types of cylinders, pumps, etc.)
- Energy distributors (modulators) (presentation, types and designation of distributors)
- Conventional schematics of hydraulic and pneumatic elements

Chapter 2.Industrial Hydraulics Circuits **(05weeks)**

- General Description
- Hydraulic circuit diagramming
- Hydropower plant (Constitution)
- Positive displacement pumps and their associated quantities (calculations of displacement, flow rates, power, efficiency and drive torque, 'example of calculation')
- Hydraulic receivers: Cylinders (dimensioning, pressure, cross-section, speed, efficiency and power), Hydraulic motors (definition, types and calculations, 'example of calculation')
- Protection and regulation devices (valves, pressure and flow reducers and reducers, valves, etc.)
- Oils, characteristics and choices

Chapter 3.Pneumatic automation circuits **(04weeks)**

- Description
- Creation and diagramming of a compressed air system (compressed air production elements, pneumatic cylinders, connections, compressed air conditioning modules)
- Pneumatic symbols
-Examples of circuits

Chapter 4. Automated Production Systems (SAP) **(04weeks)**

- Definition and example of an automated system.
- Description of an automated system:
  - Operative parts: constitution, examples of sensors, examples of actuators (electrical, hydraulic and pneumatic)
  - Control parts: constitution, direct control mode (closed loop), control mode with execution report (or closed loop)

- Human/machine interface

- The programmable logic controller (PLC): principles, PLC periphery, modular PLC design (TOR modules, communication modules)
- Representation tools: by GRAFCET (definition, GRAFCET standards and basic graphic elements, examples) or by programming flowchart.

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

References:

1. J. Faisandeur, ''Hydraulic and pneumatic mechanisms'', Dunod 2006.
2. S. Moreno, "Pneumatics in automated systems", Eyrolle 2001.
3. ''Industrial hydraulic Systems, an introduction'', Englwood cliffs (new jersy), Prentice hall 1988.
4. R. Affouard, J. Diez, ''Les installations hydrauliques conception et réalisation pratique'', Paris, entreprise moderne d'édition 1972.

Semester: 2
Teaching unit: UEF 1.2.2 Subject 1:
Applied Thermodynamics VHS: 10:30 pm (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

Remind the student of the fundamental concepts of thermodynamics, physical interpretation of the fundamental notions of thermodynamics in order to understand thermodynamic cycles as an energy conversion system.

Recommended prior knowledge:

General laws of basic thermodynamics and fluid mechanics acquired during the bachelor's degree course.

Material content:

Chapter 1. Principles of thermodynamics (02 weeks)
- The First Principle and Definition of Internal Energy in a Closed System
- The second principle and the notion of performance in a cycle
- Ideal Gases (The Equation of State of Ideal Gases, Coefficients of Expansion and Compressibility, Analytical Determination of Entropy and Enthalpy)
- Phase change

Chapter 2.Real Cycles of Steam Thermal Engines (03 weeks)
- Cycle de Carnot
- Cycle de Rankine
- Resuperheat Cycle
- Regeneration cycle (racking)
- Mixing and surface heaters
- Two-Fluid Thermal Power Plant
- Ideal Fluid for a Steam Thermal Power Plant

Chapter 3. Theoretical cycles of internal combustion engines (03 weeks)
- Cycle de Carnot
- Otto's cycle
- Cycle de Diesel
- Combined
- Real Cycles

Chapter 4.Theoretical cycles of gas turbines (04 weeks)
- Cycle de Brayton o Cycle de Stirling
- Ericsson cycle
- Gas turbine cycle with regenerator
- Stepped compression with intercooling
- Staggered expansion with intermediate reheating
- Theoretical cycle of jet, ramjet and turbojet propulsion
- Reverse Brayton Cycle, Refrigeration Cycle

Chapter 5. Heat exchangers (03 weeks)
- Classification of Heat Exchangers
- Design Method of Heat Exchangers
- Heat exchanger design

- Correlations of Forced Convection in Heat Exchangers
- Pumping power and pressure drop in heat exchangers
- Condensers and evaporators

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

Bibliographical references:

1. Thermodynamics and Energetics, Lucien BOREL
2. Energy Systems, Renaud GICQUEL
3. Thermodynamics applied to Energetics, Francis-Emile MEUNIER
4. Applied Thermodynamics, Van-Wylen

Semester: 2
Teaching unit: UEF 1.2.2
Subject 1: Applied Fluid Mechanics VHS:
45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

The objectives of the course are to provide an operational understanding of the essential concepts of fluid mechanics and to master the theory behind the different flows in order to solve problems on case studies of practical interest.

Recommended prior knowledge:

- Rational mechanics
- The principles of thermodynamics

Material content:

Chapter 1. Reminders **(01 week)**

- Fluid viscosity
- Newtonian and non-Newtonian fluids
- The equation of state of ideal gases

Chapter 2. Fluid kinematics **(04 weeks)**

- Speed fields
- The different types of flow at 1D, 2D and 3D
- The trajectory and the lines and the current tubes
- Equation of Streamlines
- Acceleration and the notion of substantial derivative

Chapter 3. Fluid Dynamics **(04 weeks)**

- Study of a flow according to Lagrange
- Flow study according to Euler
- Reynolds' theorem
- Deduction of conservation equations:
    - Conservation of mass (Equation of continuity)
    - Conservation of momentum (Navier's Stocked Equation)
    - Conservation of energy (First Law of Thermodynamics)

Chapter 4. Application of the three Conservation Equations **(03 weeks)**

- Bernoulli equation for perfect and real fluids
- Application of Bernoulli's equation

Chapter 5.Energy balances **(03 weeks)**

- One-dimensional flows. Mechanical energy balance.
- Estimation of regular and singular pressure losses.
- Application example

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

Bibliographical references:

1. Course notes.
2. R. Benhamouda, ''Notions de Mécanique des Fluides''.
3. S. Amirouche, J. Luc Battaglia, ''Mécanique des Fluides Cours et Exercices correctes''.
5. Handouts, "Solved Exercises with Course in Fluid Mechanics".

Semester: 2
Teaching unit: UEF 1.2.2 Subject 1:VHS
diagnosis and surveillance: 10:30 pm
(Course: 1 hour 30 minutes)
Credits: 2
Coefficient: 1

Teaching objectives:

To impart to the student the basic concepts of fault diagnosis, monitoring of installations and electromechanical systems.

Recommended prior knowledge:

Knowledge in the following subjects: electrical diagrams and switchgear, maintenance of electromechanical systems, reliability and operational safety, electrical machines.

Material content:

Part 1: Monitoring **(07 weeks)**

Chapter 1. Failure Mode Analysis
Functional analysis; Qualitative analysis; Quantitative analysis.

Chapter 2. Surveillance techniques
Systematic; Conditional; Forecast; Vibration monitoring.

Chapter 3. Monitoring the operating status of a machine
Fault recognition; Setting alarms; Monitoring of machine faults (bearings, bearings, pulleys, gears,...).

Part 2. Diagnostic **(08 weeks)**

Chapter 1. General
Identification of the failure; Failure to be found.

Chapter 2. System Analysis Tools
SADT and FAST functional analysis (block diagrams, functional chain, logical equations, chronogram).

Chapter 3. Global approach to locating a fault
Phases of identification of the failing chain; Identification of the faulty element; Self-diagnostic questionnaire.

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

References:

1. J. Loui Feron, "Diagnostic maintenance, availability of rotating machines", Edition Masson, 1995.
2. J. Morel, ''Vibration des machines et diagnostic de leur état mécanique'', Edition Eyrolles, 1991.
3. G. Zwingelstein, ''Diagnosis of failures: theory and practice for industrial systems'', Traité des Nouvelles Technologies de la série Diagnostic et Maintenance, Editions Hermes, Paris 1995.

4. R. Isermann, ''Fault Diagnosis of Machines via Parameter Estimation and Knowledge Processing'', Tutorial Paper, Automatica, Vol. 29, No. 4, pp. 815-835, 1993.
5. J. N. Chatain, ''Diagnostic par systèmes experts'', Editions Hermès, Paris 1993.
6. R. Toscano, ''Command and Diagnosis of Dynamic Systems'', Technosup Series, Editions Ellipses, Paris 2005.

Semester: 2
Teaching unit: UEM1.2
Material 1:TP Electrical machine control VHS:
10:30 pm (Practical work: 1:30 am)
Credits: 2
Coefficient: 1

Teaching objectives:
Know how to model and apply the control techniques studied on electrical machines. Verify the dynamic behavior of controlled systems (machines with control loops). Implementation and calculation of PID controllers.

Recommended prior knowledge:
Notions of servo control and regulation; Modeling and control theories of electrical machines.

Material content:

TP1. Controlling a DC machine (01 session) TP2. Scalar control (voltage/frequency) of the asynchronous machine (02 sessions)

TP3. Vector Control (FOC) of the Asynchronous Machine (03 sessions) TP4. Direct torque control (DTC) of the asynchronous machine (03 sessions)

TP5. Vector Commands of a Synchronous Machine (Exp: MSAP) (03 sessions)

Evaluation method:
Continuous assessment: 100 %.

References:
Lecture notes and laboratory brochures.

Semester: 2
Teaching unit: UEM1.2
Material 1:TP Hydraulic and pneumatic control VHS: 22:30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

Knowing how to choose and size elements involved in hydraulic or pneumatic industrial circuits in order to create simple diagrams with manual or automatic controls.

Recommended prior knowledge:

Hydraulic and pneumatic control.

Material content:

TP1. Realization of a manual control (push button) of a single-acting cylinder (pneumatic or hydraulic) (02 sessions)

TP2. Realization of a manual control (push button) of a double-acting cylinder (pneumatic or hydraulic) (02 sessions)

TP3. Realization of an automatic control (repeated cycle) of a double-acting cylinder (pneumatic or hydraulic) using an end-of-course sensor (03 sessions)

TP4. Realization of an automatic control (programmed cycle on the PLC) of a double-acting cylinder (pneumatic or hydraulic) using an end-of-course sensor (03 sessions)

Evaluation method:

Continuous assessment: 100 %.

References:

Lecture notes and laboratory brochures.

Semester: 2
Teaching unit: UEM1.2
Subject 1:Applied Thermodynamics Lab VHS:
10:30 pm (Practical work: 1 hour 30 minutes)
Credits: 2
Coefficient: 1

Teaching objectives:

To complete, consolidate and verify the knowledge already acquired in the course of the subject of Applied Thermodynamics.

Recommended prior knowledge:

Good mastery of materials: Thermodynamics, Heat transfer.

Material content:

TP1. Determination of the polytropic compression index "n"

TP2. Determination of the overall efficiency of the TP3 compressor plant.

Change of state of a pure body

TP4. Determination of the adiabatic index of the air

TP5. Changing the State of a Binary System

TP6. Verification of the equation of state of ideal gases

TP7. Measurement of the saturating vapor pressure of

water

Evaluation method:

Continuous assessment: 100 %.

References:

Lecture notes and laboratory brochures.

Semester: 2
Teaching unit: UEM1.2
Subject 1: Applied Digital Methods VHS:
37h30 (Lecture: 1h00, TP: 1h00)
Credits: 3
Coefficient: 2

Teaching objectives:

The subject of applied numerical methods aims to give the basic knowledge necessary for the understanding and implementation of the most commonly used algorithms for the resolution of problems encountered during the processing of industrial systems.

Recommended prior knowledge:

Mathematics, basic notions of numerical analysis, mastery of the MATLAB environment.

Material content:

Chapter I. Reminders of some numerical methods (04 weeks)

- Solving systems of linear and nonlinear equations by iterative methods (Jacobi method, Gauss-Seidel method, Newton Raphson method)
- Interpolation and approximation (Lagrange method, Divided difference method)
- Numerical integration (Trapezius Method, Simpson's Method, Composite Trapezius Method, Simpson's Composite Method)
- Solving ordinary differential equations (Euler's method, Runge-Kutta method, Adams' method)

Chapter II. Solving Partial Differential Equations (06 weeks)

- Classifications of partial differential equations and boundary conditions
- Finite difference method
- Finite element method

Chapter III. Optimization techniques (05 weeks)

- Definition and Formulation
- Types of optimization
- Optimization algorithms
- Unconstrained optimization (Deterministic Methods, Stochastic Methods)
- Stress processing (Transformation methods, Direct methods)

Practical work:

- Getting Started with the MATLAB Environment
- Calculates integrals by the methods: Trapezoid, Simpson and General
- Solving ordinary differential equations by the methods: Euler, Runge-Kutta
- Interpolation and approximation by the Lagrange method
- Solving systems of linear and nonlinear equations by the methods: Jacobi; Gauss-Seidel; Newton-Raphson
- Solving Partial Differential Equations by the Finite Difference Method
- Solving Partial Differential Equations by the Finite Element Method
- Minimization of a multivariate function without constraint by the methods: Gradient, Conjugate Gradient, Quasi-Newton
- Minimization of a multivariate function with constraints by the methods: Projected Gradient and Lagrange-Newton

Note: The first 3 sessions can be done as personal work

Evaluation method:

Continuous control: 40%; Examination: 60%.

Bibliographical references:

1. A. Quarteroni, R. Sacco, F. Saleri, "Méthodes Numériques, Algorithmes, analyse et applications", Ouvrage de l'édition Springer-Verlag, 2007.
2. S. Nicaise, "Analyse numérique et équations aux dérivées partis: Cours et problèmes résolus", Ouvrage de l'édition Dunod, 2000.
3. J. L. Merrien, "Analyse numérique avec Matlab: Exercices et problèmes ", Edition Dunod, 2007.
4. G. Allaire, "Analyse Numérique et Optimisation", Edition de l'école polytechnique, 2012.
5. S. S. Rao, "Optimization: Theory and Applications", Wiley-Eastern Limited, 1984.

Semester: 2
Teaching unit: UET 1.2
Subject: Ethics, deontology and intellectual property VHS:
10:30 pm (Lecture: 1h30)
Credit: 1
Coefficient: 1

Teaching objectives:

Develop student awareness of ethical principles. To introduce them to the rules that govern life at the university (their rights and obligations vis-à-vis the university community) and in the world of work. Raise awareness of respect for and appreciation of intellectual property. Explain to them the risks of moral ills such as corruption and how to combat them.

Recommended prior knowledge:

No

Content of the material:

A- Ethics and deontology

I. Notions of Ethics and Professional Conduct (3 weeks)

1. Introduction
   1. Definitions: Moral, Ethics, Deontology
   2. Distinction between ethics and professional conduct
2. MESRS Charter of Ethics and Professional Conduct: Integrity and Honesty. Academic freedom. Mutual respect. Requirement of scientific truth, Objectivity and critical spirit. Equity. Rights and obligations of the student, teacher, administrative and technical staff.
3. Ethics and professional conduct in the world of work
   Legal confidentiality in business. Loyalty to the company. Corporate Accountability, Conflicts of Interest. Integrity (corruption in the workplace, its forms, consequences, methods of combating and sanctioning corruption)

II. Honest and responsible research (3 weeks)

1. Respect for the principles of ethics in teaching and research
2. Responsibilities in teamwork: Professional equality of treatment. Conduct against discrimination. The search for the general interest. Inappropriate conduct in the context of collective work
3. Adopting responsible conduct and combating abuses: Adopting responsible conduct in research. Scientific fraud. Conduct against fraud. Plagiarism (definition of plagiarism, different forms of plagiarism, procedures to avoid unintentional plagiarism, plagiarism detection, sanctions against plagiarists, etc.). Falsification and fabrication of data.

B- Intellectual property

I- Fundamentals of Intellectual Property (1 weeks)

1- Industrial property. Literary and artistic property.
2- Rules for citing references (books, scientific articles, communications at a conference, theses, dissertations, etc.)

II- Copyright (5 weeks)

1. Copyright in the digital environment

Introduction. Copyright of databases, copyright of software. Specific case of free software.

2. Copyright in the Internet and Electronic Commerce

Domain name law. Intellectual property on the internet. E-commerce Site Law. Intellectual Property and Social Media.

3. Patent

Definition. Rights in a patent. Usefulness of a patent. Patentability. Patent application in Algeria and around the world.

4. Trade marks and designs

Definition. Trademark Law. Design law. Designation of Origin. The secret. Counterfeiting.

5. Geographical Indications Law

Definitions. Protection of Geographical Indications in Algeria. International treaties on geographical indications.

III- Protection and enhancement of intellectual property (3 weeks)

How to protect intellectual property. Violation of rights and legal tool. Valuation of intellectual property. Protection of intellectual property in Algeria.

Method of evaluation:
Review: 100%

References:

1. Charter of University Ethics and Professional Conduct, https://www.mesrs.dz/documents/12221/26200/Charte+fran ais+d f.pdf/50d6de61-aabd-4829-84b3-8302b790bdce
2. Orders No. 933 of 28 July 2016 laying down the rules relating to the prevention and fight against plagiarism
3. The ABCs of Copyright, United Nations Educational, Scientific and Cultural Organization (UNESCO)
4. E. Prairat, De la déontologie enseignante. Paris, PUF, 2009.
5. Racine L., Legault G. A., Bégin, L., Éthique et ingénierie, Montréal, McGraw Hill, 1991.
6. Siroux, D., Déontologie: Dictionnaire d'éthique et de philosophie morale, Paris, Quadrige, 2004, p. 474-477.
7. Medina Y., La déontologie, ce qui va changer dans l'entreprise, éditions d'Organisation, 2003.
8. Didier Ch., Penser l'éthique des ingénieurs, Presses Universitaires de France, 2008.

9. Gavarini L. and Ottavi D., Editorial. Professional Ethics in Training and Research, Research and Training, 52 | 2006, 5-11.
10. Caré C., Morale, éthique, déontologie. Administration and Education, 2nd Quarter 2002, No. 94.
11. Jacquet-Francillon, François. Concept: professional ethics. Le télémaque, May 2000, n° 17
12. Carr, D. Professionalism and Ethics in Teaching. New York, NY Routledge. 2000.
13. Galloux, J.C., Industrial Property Law. Dalloz 2003.
14. Wagret F. and J-M., Patent of invention, trademarks and industrial property. PUF 2001
15. Dekermadec, Y., Innovating through patents: a revolution with the internet. Insep 1999
16. AEUTBM. The engineer at the heart of innovation. University of Technology Belfort-Montbéliard
17. Fanny Rinck and Léda Mansour, Literacy in the Digital Age: Copying and Pasting Among Students, Université Grenoble 3 and Université Paris-Ouest Nanterre la Défense Nanterre, France
18. Didier DUGUEST IEMN, Citing your sources, IAE Nantes 2008
19. Similarity detection software: a solution to electronic plagiarism? Report of the Working Group on Electronic Plagiarism presented to the CREPUQ Subcommittee on Pedagogy and ICT
20. Emanuela Chiriac, Monique Filiatrault and André Régimbald, A Student's Guide: Intellectual Integrity, Plagiarism, Cheating and Fraud... avoid them and, above all, how to cite your sources, 2014.
21. Publication of the University of Montreal, Plagiarism Prevention Strategies, Integrity, Fraud and Plagiarism, 2010.
22. Pierrick Malissard, Intellectual Property: Origin and Evolution, 2010.
23. The World Intellectual Property Organization website www.wipo.int
24. http://www.app.asso.fr/

Proposal of some discovery materials

Semester:..
Teaching unit: UED..
Subject 1:VHS Sensor and Instrumentation: 10:30 pm (Course: 1 hour 30 minutes)
Credits: 1

Teaching objectives:

Master the basic principle of operation of a sensor, the metrological characteristics that must be taken into account when using and choosing a sensor as well as the different elements that make up a measurement chain

Recommended prior knowledge:

General Electricity, Electrical and Electronic Measurements

Material content:

Chapter 1.General and metrological characteristics of sensors (02weeks)

Reminders on dimensional analysis and uncertainty calculation, principles and classification of sensors, passive sensors, active sensors

Chapter 2. Metrology characteristics of the sensors (01 week)

Calibration, sensitivity, linearity, precision...

Chapter 3. Optical sensors (02 weeks)
Photoconducting cells, photodiode, phototransistor.

Chapter 4. Temperature Sensors (02 weeks)
Introduction to thermometry, resistance thermometer, thermocouple, thermistor, pyrometer.

Chapter 5. Pressure sensors (02 weeks)
Strain gauge sensors, solid-state sensors

Chapter 6. Level and flow sensors (02 weeks)
Float, ultrasonic and Doppler sensors

Chapter 7. Displacement and speed sensors (02weeks)
Variable reluctance sensors, optical sensor

Chapter 8. Conditioning of measured signals (02weeks)
Bridges, instrumentation amplifiers, isolation amplifiers...

Evaluation method:

Review: 100%.

References:

1. J.Niard, ''Mesures électriques'', Nathan 1981.
2. J. P. Bentley, ''Principles of mesure systems'', Pearson education 2005.
3. P. Dassonvalle, ''Les capteurs'', Dunod 2013.
4. J. M. Broust, ''Industrial electrical apparatus and installations: design, coordination, implementation and maintenance'', Dunod, Paris 2008.

Semester:..
Teaching unit: UED..
Subject 1: Cold and Air Conditioning VHS:
10:30 pm (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

This subject allows the student to: acquire knowledge in the field of air conditioning and air conditioning, to master the basic principle of operation of a refrigeration circuit, to approach the technology of refrigeration installations.

Recommended prior knowledge:

Thermodynamics and heat transfer.

Material content:

Chapter 1. General **(02 weeks)**
Notion of comfort, refrigeration, humidification.

Chapter 2. Refrigeration circuit **(03 weeks)**
Constitution, operation, refrigerants.

Chapter 3. Enthalpy diagram **(04 weeks)**
Definition, refrigeration cycle, application and use of the diagram.

Chapter 4. Case Study **(04 weeks)**
Thermal balance, sizing of a refrigeration circuit, determination of the main components.

Chapter 5. Air humidifiers **(02 weeks)**
Necessity, applications.

Evaluation method:

Review: 100%.

References:

1. H. Noack and R. Seidel, ''Pratique des installations frigorifiques'', Editions PYC 1999.
2. P. Rapin, P. Jacquard, J. Desmons, '"Technologie des installations frigorifiques'', Editions PYC 2015.
3. J. Bouteloup, M. Le Guay, J.E. Ligen, **''Climatisation** - Conditioning d'**air''**, Tome 1: Traitement de l'air, Editions parisiennes (EDIPA) 1996.
4. F. Reinmuth, ''Climatisation et conditioning d'air modernes par l'exemple'', Tome 1: Les calculs, Editions PYC Livres, Paris 1999.
5. F. Reinmuth, ''Climatisation et conditioning d'air modernes par l'exemple'', Tome 2: Le choix d'un système, Editions PYC Livres, Paris 1999.

Semester:..
UE Discovery Code: UED..
Subject: Exploitation of renewable energies VHS:
22:30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

To provide students with the scientific foundations to integrate the scientific research community in the field of renewable energies, batteries and sensors associated with engineering applications.

Recommended prior knowledge:

Energy conversion devices and technologies.

Material content

Chapter. Introduction to Renewable Energy **(04 weeks)**

Chapter 2.Harnessing Solar Energy **(04 weeks)**

Chapter 3.Harnessing Wind Energy **(03 weeks)**

Chapter 4.Exploitation of other renewable sources: hydro, geothermal, biomass ... **(02 weeks)**

Chapter 5. Storage, fuel cells and hydrogen **(02 weeks)**

Method of evaluation:

Review: 100%.

References:

1. Sabonnadière Jean Claude. New Energy Technologies 1: Renewable Energies, Ed. Hermès.
2. Gide Paul. Le grand livre de l'éolienne, Ed. Moniteur.
3. A. Labouret. Solar Energy Photo Voltaic, Ed. Dunod.
4. Viollet, Pierre Louis. Histoire de l'énergie hydraulique, Ed. Press ENP Chaussée.
5. Peser Felix A. Solar thermal installations: design and implementation, Ed. Moniteur.

Semester:..
UE Discovery Code: UED.. Subject:
VHS Signal Processing: 10:30 pm
(Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

This subject aims to provide students with the basic tools on signal and spectra analysis for use in maintenance and fault detection.

Recommended prior knowledge:

Mathematics, Algebra

Material content:

Chapter 01. General **(03 weeks)**
Introduction; Definitions; Signal classification; Special signals; Frequency representation

Chapter 02. Analog signal processing **(04 weeks)**
Fourrier series; Fourrier transform; Convolution; Notion of filtering; Concept of modulation

Chapter 03. Digitisation **(04 weeks)**
Sampling; Quantization; Coding

Chapter 04. Digital signal processing **(04 weeks)**
Fourrier transform of a discrete signal; Discrete Fourrier transform; Notion of fast Fourrier transform

Evaluation method:

Review: 100%.

References:

1. Dominique Placko, "Measurement and Instrumentation: Volume 1. From the physics of the sensor to the electrical signal", Publisher: Hermès – Lavoisier, October 1970.
2. Maïtine Bergouniou, "Mathematics for signal processing - Corrected courses and exercises", SCIENCES SUP – Dunod, 2010.
3. M. Benidir, "Theory and Signal Processing: Volume 1 - Representation of Signals and Systems ", Collection: Sciences Sup, Dunod, 2002.

Semester:..
UE Transversal Code: UDE..
Subject: Industrial Safety and VHS
Accreditation: 10:30 p.m. (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

The purpose of the subject is to inform the future master's degree on the nature of electrical accidents, the methods of rescue of electrical accident victims and to give him sufficient knowledge to enable him to best size the protection devices for equipment and personnel involved in industry and other areas of use of this equipment.

Recommended prior knowledge:

Electrical energy transmission and distribution networks.

Material content:

Chapter 1. Electrical hazards **(03 weeks)**
Historical; Standards; Electrical Accident Statistics

Chapter 2. Nature of electrical accidents and dangers of electric current **(03 weeks)**

Chapter 3. Safeguards **(03 weeks)**
Protection of people and equipment

Chapter 4. Safety measures against the indirect effects of electric current **(04 weeks)**
Harmful materials; Fire; Explosions, etc

Chapter 5. Relief and care **(02 weeks)**

Evaluation method:

Review: 100%.

References:

1. Detection, extinction and consignment plans, Editions CNPP-France, 15th edition, 2014, 224 pages.
2. Fire safety instructions: instructions for use. Editions CSTB-France, 2013, 218 pages.
3. Nichan Margossian, Risques et accidents industriels majeurs, L'usine nouvelle, 2006, Dunod
4. CHARLES. R. Electrical safety. Prevention techniques. DUNOD.
5. FISHER. D. Accidents of electrical origin and their prevention. MAN.
6. Villemeur A., "Sûreté de fonctionnement des systèmes industriels", Collection de la Direction des Études et Recherches d'Électricité de France N° 67, Eyrolles, 1988.

Semester:..
UE Discovery Code: UED.. Subject:
Industrial Computing VHS: 10:30
pm (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

This subject allows students of this master's degree to become familiar with the field of industrial computing. They will acquire the notions of communication protocols.

Recommended prior knowledge:

Combinatorial and sequential logic, µ-processors and µ-controllers, computer science.

Material content:

Chapter 1. Introduction to Industrial Computing (02 weeks)

Chapter 2. Connecting the hardware to a µP (02 weeks)

Chapter 3. Peripherals and interfaces (Ports, Timers, ... etc) (04 weeks)

Chapter 4. Serial communication bus (RS-232, DHCP, MODBUS, I2C) (05 weeks)

Chapter 5. Data acquisition: CAN and DAC devices (02weeks)

Evaluation method:

Review: 100%.

References:

1. Baudoin, Geneviève & Virolleau, Férial, "Les DSP famille, TMS 320C54X [texte imprimé]: développement d'applications", Paris: Francis Lefebvre, 2000, ISBN: 2100046462.
2. Pinard, Michel, "Les DSP, famille ADSP218x [texte imprimé]: principes et applications", Paris: Francis Lefebvre, 2000, ISBN: 2100043439.
3. Tavernier, Ch., "Les microcontrollers PIC: applications", Paris: Francis Lefebvre, 2000, ISBN: 2100059572.
4. Tavernier, Ch., "Les microcontrollers PIC: description et mise en œuvre", Paris: Francis Lefebvre, 2004, ISBN: 2100067222.
5. Cazaubon , Christian, "Les microcontrollers HC11 et leur programmation", Paris : Masson, [n.d], ISBN : 2225855277.
6. Tavernier, Christian, "Les microcontrollers AVR: description et mise en œuvre", Paris: Francis Lefebvre, 2001, ISBN: 2100055798.
7. Dumas, Patrick, "Industrial Computer Science: 28 Practical Problems with Course Reminder", Paris: Francis Lefebvre, 2004, ISBN: 2100077074.