الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic Republic of Algeria
وزارة التعليم العالي و البحث 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

TRAINING OFFER

ACADEMIC MASTER

Domain	Field of Study	Speciality
Science and Technology	Electrotechnics	Industrial Electrotechnics

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نموذج مطابقة
عرض تكوين
د .م .ل
ماستر أكاديمية

الميدان	الفرع	التخصص
علوم و تكنولوجيا	كهروتقني	كهروتقني صناعي

I –Master's identity card

Conditions of admission

(Indicate the Bachelor's degree specializations that can lead to admission to the Master's program)

Field of Study	Harmonized Master's	Bachelor's Degrees granting access to the Master's	Ranking based on the compatibility of the Bachelor's Degree	Coefficient assigned to the Bachelor's Degree
Electrotechnics	Industrial Electrotechnics	Electrical Engineering	1	1.00
		Electromechanics	2	0.80
		Industrial Maintenance	2	0.80
		Automatics	3	0.70
		Electronics	3	0.70
		Other licenses in the Science and Technology	5	0.60

II - Semester-wise organization sheets of the of teachings of the specialization.

First Semester

Teaching unit	Study Subjects	Credit	Coefficient	C	TD	TP	Volume (hour)
Fundamental Unit Credits: 10 Coefficients: 5	Transmission networks and distribution of electrical energy	4	2	1h30	1h30		45h00
	Deep power electronics	4	2	1h30	1h30		45h00
	µ-processors and µ-controllers	2	1	1h30			22h30
Fundamental Unit Credits: 8 Coefficients: 4	Deep Electric machine	4	2	1h30	1h30		45h00
	Applied numerical methods and optimization	4	2	1h30	1h30		45h00
Methodological unit Credits: 9 Coefficients: 5	TP:- µ-processors and µ-controllers	1	1			1h00	15h00
	TP: -Transmission networks and distribution of electrical energy	2	1			1h30	22h30
	TP :- deep power electronics	2	1			1h30	22h30
	TP:- Applied numerical methods and optimization	2	1			1h30	22h30
	TP:- Deep electric machine	2	1			1h30	22h30
Discovery unit Credits: 2 Coefficients: 2	Course at choice	1	1	1h30			22h30
	Course at choice	1	1	1h30			22h30
Transversale Unit	Technical English and terminology	1	1	1h30			22h30
Total First semester		**30**	**17**	**12h00**	**6h00**	**7h00**	**375h00**

Second Semester

Teaching unit	Study Subjects	Credit	Coeffi cient	C	TD	TP	Volume (hour)
Fundamental Unit Credits: 10 Coefficients: 5	Industrial electricity	4	2	1h30	1h30		45h00
	Sampled enslaved systems and Digital Regulation	4	2	1h30	1h30		45h00
	Industrial Automation Technology	2	1	1h30			22h30
Fundamental Unit Credits: 8 Coefficients: 4	Modeling and Identification of electrical systems	4	2	1h30	1h30		45h00
	Electric training	4	2	1h30	1h30		45h00
Methodological unit Credits: 9 Coefficients: 5	TP:- Sampled enslaved systems and Regulation Digital	2	1			1h30	15h00
	TP:- Industrial electricity/TP Modeling and Identification of electrical systems	2	1			1h30	22h30
	TP :- Electric training	2	1			1h30	22h30
	Techniques of the High Voltage	3	2	1h30		1h00	22h30
Discovery unit Credits: 2 Coefficients: 2	Course at choice	1	1	1h30			22h30
	Course at choice	1	1	1h30			22h30
Transversale Unit Credits: 1 Coefficients: 1	Ethics, deontology and intellectual property	1	1	1h30			22h30
Total Second Semester		**30**	**17**	**13h30**	**6h00**	**5h30**	**375h00**

Third Semester

Teaching unit	Study Subjects	Credit	Coefficient	C	TD	TP	Volume (hour)
Fundamental Unit Credits: 10 Coefficients: 5	Transitory regimes of electrical systems	6	3	3h00	1h30		67h30
	Control of electrical systems	4	2	1h30	1h30		45h00
Fundamental Unit Credits: 8 Coefficients: 4	Fault diagnosis in electrical installations	2	1	1h30			22h30
	Power Quality and Compatibility electromagnetic	4	2	1h30	1h30		45h00
	Artificial intelligence techniques	2	1	1h30			22h30
Methodological unit Credits: 9 Coefficients: 5	TP Artificial intelligence techniques	2	1			1h30	22h30
	TP Control of electrical systems	2	1			1h30	22h30
	Sizing of industrial systems	5	3	1h30	1h30	1h00	60h00
Discovery unit Credits: 2 Coefficients: 2	Course at choice	1	1	1h30			22h30
	Course at choice	1	1	1h30			22h30
Transversale Unit Credits: 1 Coefficients: 1	Documentary research and Dissertation de sign	1	1	1h30			22h30
Total Third semester		**30**	**17**	**15h00**	**6h00**	**4h00**	**375h00**

Discovery Unit *(S1, S2, and S3)*

1- Centralized and Decentralized Production of Electrical Energy
2- Renewable Energies
3- Maintenance and Safety of Functioning
4- Industrial Computing
5- Implementation of a real-time numerical Command
6- Electrotechnical Materials and their Applications
7- Maintenance of Electrical Networks
8- Standards and Legislation in Electrotechnics
9- Industrial Ecology and Sustainable Development
10- Others...

Semester 4

Internship in a company culminating by a memoir and a defense

	VHS	Coeff	Credits
Personal work	550	09	18
Company internship	100	04	06
Seminars	50	02	03
Other (Supervision)	50	02	03
Total Semester 4	750	17	30

This table is provided as an indication.

Evaluation of the End of Master's Degree Project

- Scientific Value (Assessment by the jury) /6
- Writing of the Thesis (Assessment by the jury) /4
- Presentation and Answering of Questions (Assessment by the jury) /4
- Assessment by the Supervisor /3
- Presentation of the Internship Report (Assessment by the jury) /3

III - Detailed program by subject of Semester S1

First Semester
Fundamental Unit: UEF 1.1.1
Matter: Transmission networks and distribution of electrical energy
VHS: 45h (Course : 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives : The objective of this course can be divided into two : Firstly enlargement knowledge acquired during the course of 'Networks electrical' under license, and on the other hand introduce the necessary knowledge on the management and operation of electrical networks.

recommended Prior knowledge Fundamental laws of electrical engineering (Law Ohm's, Kirchhoff's laws….etc) , Analysis of alternating current electrical circuits, complex calculation. Modeling of power lines (Course electrical networks in License).

Content of the Matter:

I. Architectures of electrical posts (2 weeks) Overall architecture of the electrical network, equipment and architecture of posts (busbar coupler substations, circuit breaker coupler substations), topologies of power transmission and distribution networks.

II. Organization of the transport of electrical energy

II. 1 Organization of the transport of electrical energy (3 weeks) Calculation of transmission lines : Choice of conductor section, insulation, mechanical calculation of lines, Operation of transmission lines in a steady state, operation transient of transmission lines, DC power transmission(HVDC).

II.2. Distribution networks (2 weeks) Introduction to electrical power distribution, primary distribution, secondary distribution, distribution transformers, energy compensation, reactive in distribution networks, distribution reliability.

III. Exploitation of electrical networks MT et BT(3 weeks) Protection of HT/MT substations against overcurrents and overvoltages . Models of the elements of electrical network. Voltage adjustment, Adjustment devices of the voltage, - Control of reactive power on an electrical network.

IV. Neutral Diets (2 weeks) The neutral diets (isolated, grounding, impedance), artificial neutral.

V. Tension adjustment (3 weeks) Voltage drop in electrical networks, voltage adjustment method (automatic voltage adjustment at the terminals of the generators, AVR, reactive energy compensation by conventional and modern means, voltage adjustment by autotransformer), introduction to voltage stability.

Evaluation mode : Continuous control: 40%; Exam: 60%.

References

1. F. Kiessling et al, '*Overhead Power Lines, Planning, design, construction*'. Springer, 2003.
2. T. Gonen et al, '*Power distribution'*, book chapter in Electrical Engineering Handbook. Elsevier Academic Press, London, 2004.
3. E. Acha and V.G. Agelidis, '*Power Electronic Control in Power Systems'*, Newns, London 2002.
4. TuranGönen : Electric power distribution system engineering. McGraw-Hill, 1986

5. TuränGonen : Electric power transmission system engineering. Analysis and Design. John Wiley & Sons, 1988.

First Semester
Fundamental Unit: UEF 1.1.1
Matter: Advanced Power Electronics
VHS: 45h (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives :

To provide the concepts of electrical circuitry behind the various operating modes of inverters in order to enable a deep understanding of their operation.
To provide the necessary skills to obtain the criteria for designing power converters for UPS, Drives, etc.
Ability to analyze and understand the different operating modes of different power converter configurations.
Ability to design different single-phase and three-phase inverters.

Recommended prior knowledge
Power components, basic power electronics.

Content of the Matter :

Chapter 1: Modeling and simulation methods of power semiconductors **(02 weeks)**
Idealized characteristics of different types of semiconductors, logic equations of semiconductors, simulation methods of static converters.

Chapter 2: Switching mechanisms in static converters **(03 weeks)**
Principle of natural switching, principle of forced switching, calculation of switching losses.

Chapter 3: Design methods of static converters with natural commutation **(02 weeks)**
Switching rules, definition of the switching cell, different types of sources, power exchange rules, direct and indirect converters, example: study of a cycloconverter.

Chapter 4: Design methods for forced-commutation static converters **(3 weeks)**
- Pulse-width modulation inverter (PWM)
- Sinusoidal absorption rectifier
- PWM dimmer
- Switching power supplies

Chapter 5: Multi-level inverter **(3 weeks)**
Multi-level concept, topologies, comparison of multi-level inverters. PWM control techniques for voltage-source inverters - single-phase and three-phase with impedance source.

Chapter 6: Power Quality of Static Converters **(3 weeks)**

- Harmonic pollution due to static converters (case study: rectifier, chopper).
- Study of harmonics in voltage inverters.
- Introduction to pollution mitigation techniques.

Evaluation mode : Continuous control: 40%; Exam (60%)

References

- Electronique de puissance, de la cellule de commutation aux applications industrielles. Cours et exercices, A. Cunière, G. Feld, M. Lavabre, éditions Casteilla, 544 p. 2012.
-Encyclopédie technique « Les techniques de l'ingénieur », traité de Génie Electrique, vol. D4 articles D3000 à D3300.

First Semester
Fundamental Unit: UEF 1.1.1
Matter: µ-processors and µ-controllers
VHS: 45h (Cours: 1h30, TD: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives Know the structure of a microprocessor and its usefulness. To differentiate between microprocessor, microcontroller and calculator. Know the organization of a memory. To know programming in assembler. Know the use of interfaces d'E/S and interruptions. Using the micro controller (programming, system control).

recommended Prior knowledge:
Combinatorial and sequential logic, industrial automatisms

Matter content :

Chapter 1 : Architecture and operation of a microprocessor (3 weeks)
Structure of a calculator, Circulation of information in a calculator, Hardware description of a microprocessor, Operation of a microprocessor, Example Memories : The Intel 8086 microprocessor

Chapter 2 : The programming in assembler (2 weeks)
generality, The instruction set, Programming method.
Chapter 3: The Interrupts and input/output interfaces (3 weeks)
Definition of an interrupt, Support for an interrupt by the microprocessor, , Addressing of interrupt subroutines, I/O port addresses, I/O port management
Chapter 4 : Architecture and operation of a microcontroller (3 weeks)
Hardware description of a µ-controller and its operation. Programming the µ-controller Example : The µ-controller PIC.
Chapter 5 : Applications of microprocessors and microcontrollers (4 weeks)
interface LCD - Interface Keypad -Signal generation from Gate ports to converters– Motor- Control - Control of DC/AC devices- frequency measurement- data acquisition system

Evaluation mode : Exam: 100%.

References
[1] R. Zaks et A. Wolfe. Du composant au système – Introduction aux microprocesseurs.Sybex, Paris, 1988.
[2] M. Tischer et B. Jennrich. La bible PC – Programmation système. Micro Application,Paris, 1997.
[3] R. Tourki. L'ordinateur PC – Architecture et programmation – Cours et exercices.Centre de Publication Universitaire, Tunis, 2002.
[4] H. Schakel. Programmer en assembleur sur PC. Micro Application, Paris, 1995.
[5] E. Pissaloux. Pratique de l'assembleur I80x86 – Cours et exercices. Hermès, Paris,1994

First Semester
Fundamental Unit: UEF 1.1.2
Matter: Deep Electric machine
VHS: 45h (Cours: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives

At the end of this course, the student will be able to establish general electromechanical energy conversion equations applied to synchronous machines, asynchronous and direct current and will be able to determine their characteristics in static or variable regimes. This makes it possible to take into account the association of machines with static converters.

recommended Prior knowledge

three-phase electrical circuits, alternating currents, power. magnetic circuits, Single-phase and three-phase transformers, Direct current electrical machines and alternative (motor and generator functioning).

Content of the Matter:

Chapter 1 : General principles (3 weeks)

Principle of electromechanical energy conversion. Coupling principle stator/rotor : the primitive machine. Windings of electrical machines. calculation of magnetomotive forces. Mechanical equation;

Chapter 2 : Synchronous machines (4weeks)

Generalities and equations of the synchronous machine with smooth poles. Study of the operation of the synchronous machine. Different excitation systems. Armature reactions. Elements on the salient pole synchronous machine without and with dampers. Diagrams of Potier, diagram of the two reactances and Blondel diagram. Elements on permanent magnet machines. Alternators and Coupling in parallel. synchronous motors, start-up

Chapter 3 : Asynchronous machines (4weeks)

Generality. Putting into equation. Equivalent diagrams. Torque of the asynchronous machine. Characteristics and diagram of the asynchronous machine. Motor/generator operation, starting, braking, Deep-slot motors and double-cage , Single-phase asynchronous motors;

Chapter 4 : DC machines (4 weeks)

Structure of direct current machines. Equations of direct current machines. start modes, braking and speed regulation of DC motors. Commutation phenomena. Armature saturation and reaction. Switching auxiliary poles. Motor/generator operation.

Evaluation Fashion: Continuous control: 40%; Exam (60%)

References

1) J.-P. Caron, J.P. Hautier : Modélisation et commande de la machine asynchrone, Technip,1995.
2) G. Grellet, G. Clerc : Actionneurs électriques, Principes, Modèles, Commandes, Eyrolles,1996.
3) J. Lesenne, F. Notelet, G. Séguier : Introduction à l'électrotechnique approfondie, Technique et

Documentation, 1981.
4) Paul C.Krause, Oleg Wasyzczuk, Scott S, Sudhoff, “Analysis of Electric Machinery and Drive Systems”, John Wiley, Second Edition, 2010.
5)P S Bimbhra, “Generalized Theory of Electrical Machines”, Khanna Publishers, 2008.
6) A.E, Fitzgerald, Charles Kingsley, Jr, and Stephan D, Umanx, “ Electric Machinery”, Tata McGraw Hill, 5th Edition, 1992.

First Semester
Fundamental Unit: UEF 1.1.2
Matter: Applied numerical methods and optimization
VHS: 45h (Cours: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives

The objective of this teaching is to present the necessary tools of numerical analysis and optimization to achieve this triple goal. Teaching will combine theoretical mathematical concepts and practical implementation on example applications concrete.

recommended Prior knowledge

Mathematics, mastery of the MATLAB environment

Content of the Matter:

Chapter 1 : Reminders on some numerical methods (3 weeks)

Solving systems of linear and nonlinear equations using iterative methods; Integration and differentiation, etc. Ordinary differential equations (ODE)

- Introduction and canonical formulation of equations and systems of ordinary differential equations;

- Méthodes de résolution : méthodes d'Euler ; méthodes de Runge-Kutta ; Méthode d'Adams.

Chapter 2 : Partial Differential Equations (PDE) (6 weeks)

- Introduction and classifications of partial derivative problems and boundary conditions;
- Solving methods:
  - Finite difference method (FDM);
  - Finite element method (FEM).

Chapter 3 Optimization techniques (6 weeks)

Definition and wording: optimization problems. Classic optimization techniques.
Single and multiple optimization with and without constraints.
Optimization algorithms: linear programming, mathematical model, technique of the solution, duality, Nonlinear programming.

Evaluation Fashion: Continuous control: 40%; Exam (60%)

References

1. G.Allaire, Analyse Numérique et Optimisation, Edition de l'école polytechnique,2012
2. Computational methods in Optimization, Polak , Academic Press,1971.
3. Optimization Theory with applications, Pierre D.A., Wiley Publications,1969.
4. Taha, H. A., Operations Research: An Introduction, Seventh Edition, Pearson Education Edition, Asia, New Delhi ,2002.
S.S. Rao, 'Optimization – Theory and Applications', Wiley-Eastern Limited, 1984.

First Semester
UE Methodological unit : UEM 1.1
Matter: TP : µ-processors and µ-controllers
VHS: 15h00 (TP: 1h00)
Credits: 1
Coefficient: 1

Teaching objectives

To know assembly programming. Know the principle and the execution steps of each instruction. Know the use of I/O interfaces and interrupts. Using the micro controller (programming, command of system).

Recommended Prior knowledge

Combinatorial and sequential logic , industrial automation, algorithmic.

Content of the Matter:

TP1 : Getting started with a programming environment on µ-processor	**(1 weeks)**
TP2 : Programming arithmetic and logic operations in a µ-processor	**(1 weeks)**
TP3 : Use of video memory in a µ-processor	**(1 weeks)**
TP4: µ-processor memory management	**(2 weeks)**
TP5 : Command of a stepper motor by a µ-processor	**(2 weeks)**
TP6: Screen management	**(1 weeks)**
TP7: Programming the PIC µ-microcontroller	**(2 weeks)**
TP8: Command of a stepper motor by a PIC µ-microcontroller	**(2 weeks)**

Evaluation mode : Continuous control: 40%; Exam (60%)

References

[1] R. Zaks et A. Wolfe. Du composant au système – Introduction aux microprocesseurs. Sybex, Paris, 1988.
[2] M. Tischer et B. Jennrich. La bible PC – Programmation système. Micro Application, Paris, 1997.
[3] R. Tourki. L'ordinateur PC – Architecture et programmation – Cours et exercices. Centre de Publication Universitaire, Tunis, 2002.
[4] H. Schakel. Programmer en assembleur sur PC. Micro Application, Paris, 1995.
[5] E. Pissaloux. Pratique de l'assembleur I80x86 – Cours et exercices. Hermès, Paris, 1994

First Semester
UE Methodological unit : UEM 1.1
Matter: TP : Transmission networks and distribution of electrical energy
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives
Allow the student to have all the necessary tools to manage, design and operate electro-energetic systems and more particularly the electrical networks ;

Recommended Prior knowledge
General information on electrical transmission and distribution networks

Content of the Matter

TP N° 1 : Voltage adjustment by synchronous motor
TP N° 2 : Distribution of powers and calculation of voltage drops
TP N° 3 : Voltage adjustment by reactive energy compensation
TP N° 4 : Regime of neutral
TP N° 5 : Interconnected Networks

Evaluation Fashion : Continuous control: 100%;

References
1. Sabonnadière, Jean Claude, Lignes et réseaux électriques, Vol. 1, Lignes d'énergie électriques, 2007.
2. Sabonnadière, Jean Claude, Lignes et réseaux électriques, Vol. 2, Méthodes d'analyse des réseaux électriques, 2007.
3. Lasne, Luc, Exercices et problèmes d'électrotechnique : notions de bases, réseaux et machines électriques, 2011.
4. J. Grainger, Power system analysis, McGraw Hill , 2003
5. W.D. Stevenson, Elements of Power System Analysis, McGraw Hill, 1998.

First Semester
UE Methodological unit : UEM 1.1
Matter: TP deep power electronics
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives

Enable the student to understand the operating principles of new power electronics converter structures.

Recommended Prior knowledge

Basic principle of power electronics

Content of the Matter

TP1 : New converter structures ;
TP2 : Improved of power factor ;
TP3 : Elimination of harmonics ;
TP4 : Compensators static of reactive powe

Evaluation mode : Continuous control: 100%;

References:

GuySéguier et Francis Labrique, «Les convertisseurs de l'électronique de puissance - tomes 1 à 4» , Ed. Lavoisier Tec et Documentation très riche disponible en bibliothèque. - Site Internet : « Cours et Documentation »
Valérie Léger, Alain Jameau Conversion d'énergie, électrotechnique, électronique de puissance. Résumé de cours, problèmes
corrigés », : ELLIPSES MARKETING

First Semester
UE Methodological unit : UEM 1.1
Matter: TP : Applied numerical methods and optimization
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives

Familiarize students with calculus of variations and problem solving using optimization techniques associated with engineering applications.

Recommended Prior knowledge

Ability to apply programming theory concepts linear in electrical engineering problems

Content of the Matter

-Initialization to the MATLAB environment (Introduction, elementary Aspects, ,the comments, vectors and matrices M-Files or scripts, the functions, loops and control, graphics, etc.); **(01 session)**

Write the following programs for:

- Calculate the integral by the following methods: Trapezium, Simpson and general; **(01session)**
- Solving equations and systems of ordinary differential equations using the various Euler methods, RK-4; **(01 session)**
- Solve systems of linear and non-linear equations : Jacobi ; Gauss-Seidel ; Newton - Raphson ; **(01 session)**
- Solving PDEs by MDF and MEF for the three (03) types of equations (Elliptical, parabolic and elliptical); **(06 session)**
- Minimize of a function with several variables without constraint by the methods: gradient, conjugate gradient, Newton and quasi-Newton; **(02 session)**
- Minimizing a function of several variables with constraints (inequalities and equalities) by the methods: : projected gradient and Lagrange –Newton **(02 session)**

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

Evaluation mode: Continuous control: 100%;

References

1 G.Allaire, Analyse Numérique et Optimisation, Edition de l'école polytechnique,2012
2 Computational methods in Optimization, Polak , Academic Press,1971.
3 Optimization Theory with applications, Pierre D.A., Wiley Publications,1969.
4 Taha, H. A., Operations Research: An Introduction, Seventh Edition, Pearson Education Edition, Asia, New Delhi ,2002.
5 S.S. Rao,"Optimization – Theory and Applications", Wiley-Eastern Limited, 1984.

First Semester
UE Methodological unit : UEM 1.1
Matter: TP - Deep electric machine
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives

Recommended Prior knowledge

Content of the Matter

1. Electromechanical characteristics of the asynchronous machine
2. diagram of the circle ;
3. Autonomous operation asynchronous generator
4. Coupling of an alternator to the network and its operation to the synchronous motor ;
5. Determination of the parameters of a synchronous machine

Evaluation mode : Continuous control: 100%;

References

1 Th. Wildi, G. Sybille "électrotechnique ", 2005.
2 J. Lesenne, F. Noielet, G. Seguier, "Introduction à l'électrotechnique approfondie" Univ. Lille.1981.
3.MRetif "Command Vectorielle des machines asynchrones et synchrone" INSA, cours Pedg.2008.
4R. Abdessemed "Modélisation et simulation des machines électriques " ellipses,2011.

First Semester
Discovery unit: UED 1.1
Matter: Renewable Energies
VHS: 22h30 (Course: 1h30)
Credits: 2
Coefficient: 2

Teaching objectives

Provide students with scientific foundations allowing them to integrate the community of scientific research in the field of renewable energies, of the batteries and sensors associated with engineering applications

Recommended Prior knowledge
Energy conversion devices and technologies

Content of the Matter :

Chapter 1 : **Introduction to renewable energies (Renewable energy sources: deposits and materials** **(4 weeks)**
Chapter 2 : Solar energy (photovoltaic and thermal) **(4 weeks)**
Chapter 3 : Wind power **(3 weeks)**
Chapter 4 : Other renewable sources: hydraulic, geothermal, biomass **(2weeks)**
Chapter 5 : Storage, fuel cells and hydrogen **(2 weeks)**

Evaluation mode : Continuous control: 40%; Exam (60%)

References

1. Sabonnadière Jean Claude. Nouvelles technologies de l'énergie 1: Les énergies renouvelables, Ed. Hermès.
2. Gide Paul. Le grand livre de l'éolien, Ed. Moniteur.
3. A. Labouret. Énergie Solaire photo voltaïque, Ed. Dunod.
4. Viollet Pierre Louis. Histoire de l'énergie hydraulique, Ed. Press ENP Chaussée.
5. Peser Felix A. Installations solaires thermiques: conception et mise en œuvre, Ed. Moniteur

First Semester
Discovery unit: UED 1.1
Matter: Entrepreneurship and Business Management
VHS: 45h (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives
Understand how a business operates and the achievement of overall strategic objectives, Adopt an appropriate management approach, Introduction to the concept of marketing

Recommended Prior knowledge

Content of the Matter
Introduction
I. Awareness of entrepreneurship and entrepreneurial culture
I.1 Company, entrepreneur and entrepreneurship, I. 2 Culture, corporate culture and entrepreneurial culture, I.3 Promoting entrepreneurial culture and its values, I.3.1 The reasons, I.3.2 The foundations, I.3.3 Means, I.3.4 Entrepreneurial values
II. Knowledge of entrepreneurship and its forms
II.1 The need for entrepreneurship in a changing world, II.2 The forms of entrepreneurship: typology and examples, II.2.1 Individual vs collective, II.2.2 Forms of entrepreneurship: some examples, II.2.2.1 Creation of a new company, II.2.2.2 Creation of a spin-off company, II.2.2.3 Creation of a business by franchise, II.2.2.4 Recovery, sale and transfer of companies, II.2.2.5 Organizational entrepreneurship or entrepreneurship, II.2.2.6 Cooperative or collective entrepreneurship: cooperative or collective enterprise, II.2.2.7 Solidarity and social entrepreneurship.
III. Knowledge and awareness of oneself and one's potential
III.1 The motivations to undertake, III.2 The qualities and defects of the individual who wants to undertake, III.3 The development of its entrepreneurial profile, III.4 The business of the entrepreneur: components and key activities
IV. Knowledge of the socio-economic environment
IV.1 Family and close environment, IV.2 Professional environment, trades and professions, IV.3 Business Support Environment, IV.4 Associative environment
V. Knowledge of the entrepreneurial project
V.1 The entrepreneurial project: definition, V.2 The fundamental conditions of the project ,V.3 The foundations of an entrepreneurial project, V.4 The stages and components of an entrepreneurial project,

Evaluation mode : Exam (100%)

Références
Brilman Jean, HérardJacques, 2006, *Les meilleures pratiques du management*, Paris,Ed. Organisation
- Leban Raymond, 2005, *management de l'entreprise*, Paris, Ed. Organisation
- Lispe, 2005, *Strategor*, Paris, Ed. Dunod
- Buttrick Robert, 2006, *gestion de projets*, Paris, Ed. Village mondial
- Muller Jean-Louis, 2005, *management de projet*, Paris, Ed. AFNOR.

First Semester
Discovery unit: UED 1.1
Matter: Industrial Ecology and Sustainable Development
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

Raising awareness of sustainable development, à l'écologie industrielle et au recyclage

Recommended Prior knowledge

Content of the Matter

• Birth and evolution of the concept of industrial ecology
• Definition and principles of industrial ecology
• Experiences of industrial ecology in Algeria and in the world
• Industrial symbiosis (parks/eco-industry networks)
• Gaseous, liquid and solid waste
• Recycling

First Semester
Discovery unit: UET 1.1
Matter :Technical English and Terminology
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

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

Recommended Prior knowledge

Vocabulary and basic grammar in English

Content of the Matter

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

- Oral comprehension : From authentic popular science video documents, taking notes, summarizing and presenting the document.

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

- Written expression :Extraction of ideas from a scientific document, Writing a scientific message, Exchange of information in writing, writing of CV, application letters for internships or jobs.

***Recommandation* :**

It is highly recommended to the person responsible of the Matter to 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 mode : Exam (100%)

References:

1. P.T. Danison, Guide pratique pour rédiger en anglais: usages et règles, conseils pratiques, Editions d'Organisation 2007
2. A. Chamberlain, R. Steele, Guide pratique de la communication: anglais, 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

IV- Detailed program by subject of Semester S2

Second Semester
Fundamental Unit: UEF 1.2.1
Matter : Industrial electricity
VHS: 45h (Course: 1h30, TD 1h30)
Credits: 4
Coefficient: 2

Teaching objectives

The subject aims to give students the necessary knowledge of industrial electrical networks (architectures, diagrams and plans), calculation of the power balance, of energy minimization, choice of electrical channeling, of fault calculation, of protection and security

Recommended Prior knowledge

Basics of electrical networks

Content of the Matter

I. Receivers **2 week**

Nature of the receiver; Characteristics of the receivers (current, voltage, power factor, operating regimes).

II. Sources of feeding **2 week**

Feeding by RDPs; alternators (synchronous generators), asynchronous generators, Advantages and disadvantages ; Uninterruptible power supplies (UPS),

III. Source-receptor interactions **2 week**

The disturbances in industrial networks (unbalanced operation, overloads, overvoltages, harmonics, etc.), The cures.

IV. Methodology and sizing of electrical installations **6 weeks**

- Power Balance sheet
- Determination of conductor sections;
- Choice of protective devices and low voltage neutral systems;
- Calculation of interior lighting;
- Calculation of exterior lighting;

V. Reactive energy compensation **2 weeks**

ER compensation interest, ER compensation techniques.

VI. Tariff of electric energy **1 week**

Choice of Tariff, , Blue Tariff, "Yellow" tariff, Green Tariff, Purchase tariffs; Connection fees and strengthening networks of feeding client.

Evaluation mode : Continuous control: 40%; Exam (60%)

References *(Livres et polycopiés, sites internet, etc).*

[1] Denis MARQUET, Didier Mignardot, Jacques SCHONEK, "Guide de l'installationélectrique 2010-Normes
internationales CEI et nationales françaises NF", Schneider Electric, 2010
[2] Jean Repérant, "Réseaux électriques industriels - Introduction", Tech. del'Ing., D5020, 2001
[3] Jean Repérant, "Réseaux électriques industriels - Ingénierie", Tech.del'Ing., D5022, 2001
[4] Dominique SERRE, "Installations électriques BT - Protections électriques", Tech. del'Ing., D5045, 2006
[5] SOLIGNAC (G.). – Guide de l'Ingénierie élec-trique des réseaux internes d'usines 1076 p.bibl. (30 réf.) lectra Tech &
Doc Lavoisier, EDF. Paris, 1985.
[6] *Catherine* Le *Trionnaire Vade-mecum* électrotechnique *réseaux production machines systemes industriels* génie
électrique niv.A. Sortie : 25 septembre 2010.

Second Semester
Fundamental Unit: UEF 1.2.1
Matter :Sampled enslaved systems and Digital Regulation
VHS: 45h (Course: 1h30, TD 1h30)
Credits: 4
Coefficient: 2

Teaching objectives

Know the sampling, the difference between continuous system, sampled system and discrete system, Know and master the mathematical tool "z-transform".Know the discrete models. Do the analysis of discrete systems and the synthesis of regulators discrete PIDs, RST and by status feedback. Know how to implement digital regulators (discrete).

Recommended Prior knowledge

The mathematical tool (polynomials, recurrent equations, rational functions with complex variable), control of continuous linear systems.

Content of the Matter

Chapter 1: Sampling and reconstitution **(01 week)**
Chapter 2 : Z-transform: properties and applications **(01 week)**
Chapter 3 : Discrete systems, discrete transfer function, analysis of discrete systems and stability **(03 week)**
Chapter 4 : Digital regulation: principle and implementation **(02 week)**
Chapter 5 : Control by digital PID regulator **(03 week)**
Chapter 6 : Digital RST command **(03 week)**
Chapter 7 : Digital control by status feedback **(02 week)**

Evaluation mode : Continuous control: 40%; Exam (60%)

References:

1. Réglages échantillonnés (T1 et T2), H. Buhler, PPR
2. Régulation industrielle, E. Godoy, Dunod
3. Computer controlled systems, K. J. Astrom et B. Wittenmark, Prentice Hall
4. Automatique des systèmes échantillonnés, J. M. Retif, INSA

Second Semester
Fundamental Unit: UEF 1.2.1
Matter 1: Industrial Automation Technology
VHS: 22h30 (Course: 1h30)
Credits: 2
Coefficient: 1

Content of the Matter

I. General information on automation and industrial production systems

II. Pneumatic technology

Notions of compressed air; Compressors; Air conditioning ;

II.1 Pneumatic distributors

II.2 Pneumatic sensors:

- Presence detectors with mechanical action and push buttons
- Fluid proximity sensors
- Proximity sensors with pressure threshold
-Detectors depression

II.3 Pneumatic actuators:

Pneumatic jacks; air motors; suction cups; vacuum generators

II.4 The logical functions

III. Hydraulic technology

II.1 theory of Hydraulic

II.2 Pump families

II.3 Les récepteurs hydrauliques :

- For translation movement (jacks)
- For rotary motion (hydraulic motors)

II.4 Linking elements: distributors

II.5 The Accumulators

II.6 The Protection and regulation apparatus(pressure, flow, etc.)

IV. Electromechanical technology

IV.1 Organs of Communication (greatness physical conveyed, concept of electrical contact, ...)

IV.2 electrical contacts

IV.3 The electromechanical sensors: position detectors, of depression, temperature; buttons and selectors

IV.4 The electromechanical actuators (relays, contactors)

V. The electronic technology

Notions on the different electronic elements used in automation: sensors, preactuators and actuators.

Evaluation Fashion : Exam (60%)

Second Semester
Fundamental Unit: UEF 1.2.2
Matter 1: Modeling and Identification of electrical systems
VHS: 45h (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Program

Chapter 1 : Systems and experiences **(02 weeks)**
General, types of models, models and simulation, how to obtain a model

Chapter 2 : Mathematical model **(02 weeks)**
Block diagram of a system, characteristic variables, internal and external representations of a system

Chapter 3 : Modeling of electrical systems **(02 weeks)**
Modeling of a passive component, an active component, of the basic electrical circuits

Chapter 4 : Modeling tools **(02 weeks)**
Bond graph (BG) or causal information graph (CIG)) (Application to electrical circuits

Chapter 5 : General information on identification **(02 weeks)**
Definitions, steps, SBPA generation, choice of model structure

Chapter 6 : Graphic identification methods **(02 weeks)**
Strejc's method, Broida's method

Chapter 7 : Digital identification methods **(03 weeks)**
Recursive methods, non-recursive method.

Evaluation mode : Continuous control: 40%; Exam (60%)

Handouts and books

Second Semester
Fundamental Unit: UEF 1.2.2
Matter 1: Electric training
VHS: 45h (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives

The aim of this course is to enable students to acquire the necessary knowledge to choose the components of an electric drive. It will also allow them to understand the issues and the solutions available in the field of electrical drives in industrial electrical engineering.

I. General information on electric drives

Definition of electric drives, functional point of view, structure of an electric drive, methodology for studying an electric drive **(03 weeks)**

II. Load characteristics T(Ω)

Fan load, lifting load, of ascent, traction etc… **(03 weeks)**

III. Operation of electric drives:

Methods for varying speeds, of starting and braking DC motors, of the asynchronous motors and synchronous motors **(09 weeks)**

- Principle of variation of the speed of DC motors;
- Variable speed drive by controlled rectifiers;
- Variable speed drive by choppers;
- Principle of adjusting the speed of motors c. alternative;
- Variable speed drive by voltage inverter;
- Variable speed drive by current inverter (without and with slip control)

Evaluation mode : Continuous control: 40%; Exam (60%)

Handouts and books

Second Semester
Methodological Unit: UEM 1.2.
Matter 1: TP Sampled enslaved systems and Regulation Digital
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives

Know how to model and simulate discrete systems. understand sampling and reconstitution. check the dynamic behavior of discrete systems. simulate and implement regulators digital PID, RSTand by status feedback.

Recommended Prior knowledge
Know how to use simulation and programming software. Control of continuous linear systems.

Content of the Matter

TP 1: Sampling and reconstitution	**(01 weeks)**
TP 2: Sampled systems: temporal analysis and frequency analysis	**(02 weeks)**
TP3: Control by digital PID regulator	**(04 weeks)**
TP4: Digital RST command	**(04 weeks)**
TP5: Digital control by status feedback	**(04 weeks)**

Evaluation Fashion : Continuous control(100%)

References:
1. Réglages échantillonnés (T1 et T2), H. Buhler, PPR
2. Régulation industrielle, E. Godoy, Dunod
3. Computer controlled systems, K. J. Astrom et B. Wittenmark, Prentice Hall
4. Automatique des systèmes échantillonnés, J. M. Retif, INSA

Second Semester
Methodological Unit: UEM 1.2.
Matter 1: TP Industrial electricity/TP Modeling and Identification of electrical systems
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Practical work of Industrial Electricity

TP n°1 : Sizing of the various boxes and electrical protection cabinets

TP n°2 : Sizing of protection apparatus and calculation of cable sections

TP n°3 : Insulation measurement and earth fault protection devices

TP n°4 : Industrial schemes.

REMARK : The 1st and 2nd in the form of mini projects, the 3rd and 4th with preparation and realization in the laboratory.

Practical work of Identification and Modeling of Electrical Systems

TP n° 1 : Modeling and simulation of passive or active electrical circuits.

TP n° 2 : Modeling and simulation of electromechanical converters

TP n° 3 Direct measurement of system response

TP n° 4 : Parametric identification of an electrical system by the Methods of Strejc and Broïda

TP n° 5 : Numerical (online) identification of a DC Machine by the MCR Recursive Least Squares

Method

TP n° 6 : Numerical (on-line) identification of an AC Machine by the MCR Recursive Least Squares

Method

Evaluation mode:

Continuous control (100%)

Second Semester
Methodological Unit: UEM 1.2.
Matter 1: TP Electric training
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

TP1 : Training of a DC machine..
TP2 : Methods of starting an asynchronous motor
TP3 : Association Static frequency converter-Asynchronous motor-traction load
TP4 : Association Voltage converter- Asynchronous motor- fan load
TP5 : Variable speed drive – asynchronous motor

The Practical labs that you cannot do (given the lack of material) can be done by simulation.

Evaluation mode : Continuous control (100%)

Second Semester
Methodological Unit: UEM 1.2.
Matter 1: Techniques of the High Voltage
VHS: 37h30 (Course: 1h30, TP: 1h00)
Credits: 3
Coefficient: 2

Objectives

Matter aims to control electrical energies both in terms of understanding physical phenomena that on the design plan and sizing of high voltage equipment insulation. Also, after this teaching, the student will be able to master insulation coordination problems in electrical networks.

Pre-requisite: Notions of fundamental physics, fundamental electrical engineering

Program

I. Familiarize with the phenomena and techniques related to high voltage.
II. Production and measurement of high voltages in the laboratory: DC voltage, a alternative and shock.
III. Generation and measurement of currents: leakage current and high current.
III. Material tests of high voltage.
IV. The control of electric fields and applications to the design of the equipment.
VEtude approfondie des mécanismes de conduction dans les isolants (solids, liquid and gas) application to the sizing of electrical networks.
VI. Statistical techniques of isolation coordination.

Practical work

- The high voltage transformer
- Dielectric strength of liquids, solids and gases at 50 Hz
- Capacitance and loss factor, partial discharges and crown effect

Evaluation mode : Continuous control: 40%; Exam (60%)

References:

[1]- E.Kuffel, W.S Zanegl, J.Kuffel « High Voltage engineering : Fundamentals", 2ème édition, Edition Newnes, 2006
[2]- C.Gary "Les propriétés diélectriques dans l'air et les très hautes tension", Editions Eyrolles, 1984
[3]- M.Aguet, M.Ianovic « Traité d'électricité, Volume XIII :Haute Tension », Edition GEORGI, 1982
[4]- P.Bergounioux « Haute tension », Edition Willam blake & Co, 1997
[5] J. Arrillaga, , "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983

Second Semester
Teaching unit: UET 1.2.
Matter 1: Ethics, deontology and intellectual property
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

Develop student awareness of ethical principles. 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. Make them aware of the respect and valuation of intellectual property. Explain to them the risks of moral evils such as corruption and how to combat them.

Recommended Prior knowledge
None

Content of the Matter

A- Ethics and deontology

I. Notions of Ethics and Deontology **(3 weeks)**

1. Introduction
    1. Definitions: Morality, ethics, deontology
    2. Distinction between ethics and deontology

2. Charter of Ethics and Deontology of the MESRS: Integrity and honesty. Academic freedomMutual respect. Requirement of scientific truth, objectivity and critical thinking.
Equity. Rights and obligations of the student, of the teacher, administrative and technical staff.
3. Ethics and deontology in the world of work

Legal confidentiality in business. Loyalty to the company. Responsibility within the company, Conflicts of interest. Integrity (corruption in work, its forms, its consequences, methods of fighting and sanctions against corruption).

II. Integrity and responsible research **(3 weeks)**

1. Respect for the principles of ethics in teaching and research
2. Responsibilities in teamwork: Egalité professionnelle de traitement. Conduite contre la discrimination. The search for the general interest. Inappropriate conduct in the context of collective work
3. Adopt a behavior responsible and combating drifts : Adopt responsible conduct in research. Scientific fraud.. Conduct against fraud. Plagiarism (definition of plagiarism, different forms of plagiarism, procedures to avoid unintentional plagiarism, detection of plagiarism, sanctions against plagiarists, etc.). Falsification and fabrication of data.

B- Intellectual Property

I- Fundamentals of Intellectual Property (1 week)

1- Industrial property. Literary and artistic property

2- Rules for citing references (books, scientific articles, conference papers, theses, dissertations, etc.)

II- Copyright (5 weeks)

1. Copyright in the digital environment

Introduction.Database copyright, software copyright. Specific case of free software.

2. Copyright in the internet and e-commerce

Domain name rights. Intellectual property on the internet. Site law of commerce electronic . Intellectual property and social networks.

3. Patent

Definition. Rights in a patent. Usefulness of a patent. Patentability. Inquiry Patent application in Algeria and worldwide.

4. Trademarks, designs and models

Definition. Trademark Law. Design law. Denomination of origin. The secret. Counterfeit.

5. Right 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.

Evaluation mode : Exam (100%)

References:

1. Charte d'éthique et de déontologie universitaires, https://www.mesrs.dz/documents/12221/26200/Charte+fran__ais+d__f.pdf/50d6de61-aabd-4829-84b3-8302b790bdce
2. Arrêtés N°933 du 28 Juillet 2016 fixant les règles relatives à la prévention et la lutte contre le plagiat
3. L'abc du droit d'auteur, organisation des nations unies pour l'éducation, la science et la culture (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. et Ottavi D., Éditorial. de l'éthique professionnelle en formation et en recherche,Recherche et formation, 52 | 2006, 5-11.
10. Caré C., Morale, éthique, déontologie. Administration et éducation, 2e trimestre 2002, n°94.
11. Jacquet-Francillon, François. Notion : déontologie professionnelle. Le télémaque, mai 2000, n°17
12. Carr, D. Professionalism and Ethics in Teaching. New York, NY Routledge. 2000.
13. Galloux, J.C., Droit de la propriété industrielle. Dalloz 2003.
14. Wagret F. et J-M., Brevet d'invention, marques et propriété industrielle. PUF 2001
15. Dekermadec, Y., Innover grâce au brevet: une révolution avec internet. Insep 1999
16. AEUTBM. L'ingénieur au cœur de l'innovation. Université de technologie Belfort-Montbéliard
17. Fanny Rinck et léda Mansour, littératie à l'ère du numérique : le copier-coller chez les étudiants, Université grenoble 3 et Université paris-Ouest Nanterre la défense Nanterre, France
18. Didier DUGUEST IEMN, Citer ses sources, IAE Nantes 2008
19. Les logiciels de détection de similitudes : une solution au plagiat électronique? Rapport du Groupe de travail sur le plagiat électronique présenté au Sous-comité sur la pédagogie et les TIC de la CREPUQ
20. Emanuela Chiriac, Monique Filiatrault et André Régimbald, Guide de l'étudiant: l'intégrité intellectuelle plagiat, tricherie et fraude… les éviter et, surtout, comment bien citer ses sources, 2014.
21. Publication de l'université de Montréal, Stratégies de prévention du plagiat, Intégrité, fraude et plagiat, 2010.
22. Pierrick Malissard, La propriété intellectuelle : origine et évolution, 2010.
23. Le site de l'Organisation Mondiale de la Propriété Intellectuelle www.wipo.int
24. http://www.app.asso.fr/

V - Detailed program by subject of Semester S3

Third Semester
Fundamental Unit: UEF 2.1.1
Matter :Transitory regimes of electrical systems
VHS: 67h30 (Course: 3h, TD 1h30)
Credits: 6
Coefficient: 3

Teaching objectives

The objectives of this course are to allow the student to master the characteristics, system performance and specificities of electrotechnics as well as having the basics necessary to deal with transient regimes. Then consider either their association with static converters in the case of electrical machines or for the analysis of stability in the case of electrical networks.

Prior knowledge recommended

Electrical networks, electrical machines, the mathematical tool, etc

Content of the Matter

I. Electromagnetic transients and electromechanical transients. (. Faults, switching surges, lightning. Machine excitation systems, ……) 4 week

II. Propagation of transient phenomena on power lines 2 week

- Study of wave propagation in the frequency domain;
- Propagation of overvoltage waves in the presence of an injection or an internal disturbance in the system.

III. modeling in transient regimes of lines by the Laplace method and the mobile wave method .

2 week

Disturbances industrial in the networks (unbalanced operation, overloads, overvoltages, harmonics, etc.); The remedies;

IV. Modeling of electrical machines for dynamic regimes 7 week

- Park and Fortescue transformations, transformation matrices;
- Use of the method for the calculations of transitory regimes;
- Study of transient regimes and torque expressions;

Evaluation mode : Continuous control: 40%; Exam (60%)

References *(Livres et polycopiés, sites internet, etc).*

[1] M.Grappe « Stabilité et sauvegarde des réseaux électriques », Edition HERMES, 2003
[2] Yoshihide Hase, Power Systems engineering, British Library Cataloguing in Publication Data, USA
[3] ARIEH L. SHENKMAN, Transient analysis of electric power circuit hand book, Holon Academic Institute of
Technology, Springer revue, Netherlands, 2005.
[4] Electric Power Generation, Transmission, and Distribution, Leonard L. Grigsby, University of California, Davis,2006.
[5]SÉGUIER, G., Electrotechnique Industrielle, Technique et Documentation, 1984.
[6]Fitzgerald, Electric machinery, McGraw-Hill, 5th Edition.
[7]CHATELAIN, J., Machines Électriques, Tomes 1 et 2, Traité d'électricité, Dunod, 1984.

Third Semester
Fundamental Unit: UEF 2.1.1
Matter : Control of electrical systems
VHS: 45h (Course: 1h30, TD 1h30)
Credits: 4
Coefficient: 2

Teaching objectives
Learning to choose the components of the control and actuators of an electrical system. Approaching the control of industrial systems such as pumps, overhead cranes, extractors, etc.

Recommended prior knowledge
Electrical machines, identification of systems, control and regulation, etc.
Content of the Matter
Chapter 1:Criteria for choosing an electric motor in an industrial environment
1.1 - Electric motors
- Use of electrical machines of normal construction
- Engines of specific construction

1.2- Choice of motors according to:
- of the industrial environment
- of the power
- operating mode

Chapter 2: Electrical control and automation of pumps, fans and compressors

2-1- Principles
2-2- Power at the end of the shaft
2-3- Starting the mechanisms with couple of fans
2-4- Electric fan Command

Chapter 3: Power supply and automation of elevators and extractors
3-1- 1Principles
3-2- Accuracy of lifting systems parking
3-3- Requirements in elevator control systems
3-4- Typical elevator control diagrams
3-5- Automation of elevator speed controls

Chapter 4: Automation of overhead cranes
4-1 Principles
4-2 Motor loads of crane mechanisms
4-3 Electromagnetic lifting systems
4-4 Electrical control systems for overhead cranes
4-5 Requirements for mechanical characteristics of electrical controls for overhead cranes
4-6 Automation of overhead cranes using thyristor converters
4-7 Equipment for large overhead cranes
4-8 Remote control of overhead cranes
4-9 Power supply for overhead cranes

Evaluation mode : Continuous control: 40%; Exam: 60%

References : Books and handouts.
Semester 3 Master: Industrial Electrotechnics

Third Semester
Fundamental Unit: UEF 2.1.2
Matter :Fault diagnosis in electrical installations
VHS: 22h30 (Course: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives

The diagnosis is the reasoning leading to the identification of the cause (the origin) of a failure, problem or anomaly". This course allows familiarization with industrial failure diagnostic tools based on the knowledge of the symptom(s) to determine the cause(s). The course is divided into a set of chapters that enhance the student's skills in using diagnostic techniques and analytical thinking in problem situations, while providing the necessary tools for establishing a rigorous and effective approach. "This subject will enable the student to acquire essential knowledge for avoiding breakdowns in order to ensure reliability and continuity of service in an electrical installation."

Recommended prior knowledge

Electrical machines, Electrical circuits, Signal theory, Numerical analysis

Content of the Matter

Chapter 1: Introduction to Fault Diagnosis (02 Weeks)
Basic concepts: equipment, failure, breakdown, preventive maintenance, diagnosis and prognosis, tests and methods, testing devices;

The pathological behaviors of equipment:
• Quantitative analysis of failures and their stakes;
• Qualitative analysis after failures;
• Failure modes (mechanical, plastic, due to corrosion, control parts).

Chapter 2: Fault Diagnostic Tools (03 Weeks)

Basic tools for industrial diagnostics: Sensors, Signal acquisition and visualization; Signal processing techniques: Time analysis, Frequency analysis (spectral analysis and envelope analysis), Time-frequency analysis.

Chapter 3: Fault Diagnostic Techniques (03 Weeks)
Thermal analysis (temperature measurement), Current analysis, Vibration analysis, Lubricant analysis

Chapter 4: Practical Case Studies: Electrical Machines (03 Weeks)
Machine failures and extension of their useful life: the case of the asynchronous machine; Testing of electrical machines;
Diagnostics through monitoring of physical parameters: currents, vibration, and temperature.

Chapter 5: Diverse Practical Case Studies (04 Weeks)
Switches and circuit breakers: Overloads and faults;

Distribution panels: Electrical contact, resistance formula, contact degradation, and monitoring through thermal measurement.
Variable speed drive: global protection and diagnostics, fault analysis of control circuits (defective capacitor, resistor, or transformer, short-circuited or open diode, blown fuse);
Transformers: Causes of breakdowns, In-service maintenance and analysis of some problems;
Electrical cabinet: Thermal analysis of the electrical cabinet (conduction, convection, and radiation), sensor placement and priority criteria, Temperature threshold crossing indicator

Evaluation mode : Exam : 100%.

References:

[1] M. Brown, J. Rawtani et D., Maintenance Electrotechnique : équipements électriques et circuits de commande. Edition Dunod, Paris, 2012.
[2] Traité EGEM sous la direction de J-C. Trigeassou, Diagnostic des machines électriques,Edition Lavoisier, Paris 2011.
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[5] Ron Patton, Paul Frank and Robert Clark. Fault Diagnosis in Dynamic Systems. Theory and Applications. Prentice Hall Publishers, 1989.
[6] Rolf Isermann. Fault Diagnosis of Machines via Parameter Estimation and Knowledge Processing- Tutorial Paper. Automatica, Vol. 29, No. 4, pp. 815-835, 1993.

Third Semester
Fundamental Unit: UEF 2.1.2
Matter : Power Quality and Compatibility electromagnetic
VHS: 45h (Course: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives

The objective of the course is twofold: firstly, to master the qualitative aspects of electrical energy for efficient energy performance, and secondly, to understand electromagnetic disturbances from both the source and victim's perspective in order to provide solutions for proper cohabitation of various devices in an industrial installation.

Recommended prior knowledge

Usual mathematical tools of electrotechnics, Electromagnetism, Electrical installations, Power electronics, Electrical control, Transient regime of electrical systems.

Content of the Matter

I. **Degradation of electrical energy quality**: Origins, characteristics, and consequences.
II. **EMC concept:** Terminology, context, challenges, and compatibility margins.
III. **EMC actors:** Sources, victims, and couplings.
IV. **Disturbances generated by power and digital electronic circuits**: switching, voltage and current distortions, malfunction, clock signal.
V. **Disturbances generated by electrostatic discharges:** Static electricity, humidity, lightning, direct and indirect effects of lightning, and models
VI. **Equivalent electrical models of electromagnetic effects**: own and mutual magnetic effect, dielectric effect, and antenna effect
VII. **Study and reduction of couplings**: Types of coupling (conduction, radiation, and ionization), modes of coupling (common and differential), equivalent coupling circuit, and methods for reducing couplings (equipment arrangement, cable and grounding arrangement).
VIII. **Measurement and protection techniques in EMC**: Grounding, shielding, reducing effect, filtering and protection against overvoltages, clipping, measurement units and reference values, spectrum analyzer.
IX. **Energy optimization and application in the industrial sector**: Harmonic reduction, time and frequency filtering, passive and active filtering, power supply decoupling, reactive energy compensation.
X. **Regulatory and normative provisions**: Current regulations

Evaluation mode : Continuous control: 40%; Exam (60%)

References

1. P. Degauque, A. Zeddam, **« Compatibilité électromagnétique : Des concepts de base aux applications** », **Volume** 1 et **2**, Editeur **Hermès - Lavoisier, 2007.**
2. **Alain CHAROY , « CEM – Parasites et perturbations des électroniques »**, Tome 1 : sources, couplages, effets (2006), Tome 2 : Terres, masses, câblages (2006), Tome 3 : Blindages, filtres, câbles blindés (2007),Tome 4 : Alimentation, foudre, remèdes (2007), 2ème édition DUNOD
3. **A. KOUYOUMDJIAN, « Les harmoniques et les installations électriques »**, Édition Groupe Schneider, 1998
4. **Jean-Louis COCQUERELLE, « C.E.M. et électronique de puissance »,** Édition TECHNIP, 1999.

Third Semester
Fundamental Unit: UEF 2.1.2
Matter :Artificial intelligence techniques
VHS: 22h30 (Course: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives
To have a basic understanding of artificial intelligence techniques and their use in control, optimization, diagnosis, and decision-making. The module covers the various topologies of neural networks and their learning algorithms, the basic concepts of fuzzy logic and its applications, and finally, the principle of heuristic methods and their programming.

Recommended prior knowledge
Dynamical systems. Optimization. Logic. Probability.

Content of the Matter

Chapter 1: Introduction to Soft Computing **(01 week)**

Chapter 2: Fuzzy Logic and its Applications **(02 weeks)**
- Basic concepts: fuzzy subsets and fuzzy logic. - Structure of a fuzzy system.
- Fuzzy reasoning model - Fuzzy identification and control.

Chapter 3: Artificial Neural Networks **(02 weeks)**
- Multilayer networks and backpropagation algorithm - Recurrent neural networks - RBF networks and learning

Chapter 4: Adaptive Networks and Neuro-Fuzzy Networks **(01 week)**
- Associative memories and classification networks.
- Neuro-fuzzy networks

Chapter 5: Genetic Algorithms **(02 weeks)**
- GAs - Differential evolution - Firefly algorithm

Chapter 6: Particle Swarm Optimization Technique **(02 weeks)**
- Local search - Advanced local search (simulated annealing, tabu search, etc.)
- Cooperative algorithms: ant colonies, etc.

Chapter 7: Probability and Probabilistic Reasoning **(02 weeks)**
- Probabilistic reasoning - Bayesian networks

Chapter 8: Expert Systems and their Applications **(02 weeks)**
- Expert systems - Fuzzy expert systems - Application to decision making - Application to diagnosis.

Evaluation mode : Continuous control: 40%; Exam (60%)

References:

1. P. A. Bisgambiglia, La logique floue et ses applications, Hermès-science
2. H. Buhler, Commande par logique floue, PPR
3. Heikki Koivo, Soft computing
4. D. R. Hush & B.G. Horne,*"Progress in Supervised Learning Neural Networks,"* IEEE signal proc. magazine, Vol.10, No.1, pp.8-39, Jan. 1993.
5. B. Kosko, *" Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence,"* Englewood Cliffs, Nj: Prentice-Hall, 1992.
6. L.X.Wang, "*Adaptive Fuzzy Systems & Control: Design & Stability Analysis*": Prentice-Hall,1994.
7. David E. Goldberg, *Algorithmes Génétiques*, Edit. Addison Wesley, 1994.

Third Semester
Methodological unit: UEM 2.1.
Matter : TP Artificial intelligence techniques
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives
Program and simulate control laws based on artificial intelligence techniques

Recommended prior knowledge
Software for simulation and programming. Dynamical systems. Optimization. Logic. Probabilities.

Content of the Matter

TP 1: Introduction to fuzzy logic**.** **(03 weeks)**

TP 2: Artificial neural networks. **(03 weeks)**

TP 3: Adaptive networks and neuro-fuzzy networks. **(02 weeks)**

TP 4: Genetic algorithms. **(03 weeks)**

TP 5: PSO (Particle Swarm Optimization). **(02 weeks)**

TP 6: Expert systems and probabilistic reasoning. **(02 weeks)**

Evaluation mode : Continuous control: 100%

References:
1. P. A. Bisgambiglia, La logique floue et ses applications, Hermès-science
2. H. Buhler, Commande par logique floue, PPR
3. Heikki Koivo, Soft computing
4. D. R. Hush & B.G. Horne,*"Progress in Supervised Learning Neural Networks,"* IEEE signal proc. magazine, Vol.10, No.1, pp.8-39, Jan. 1993.
5. B. Kosko, *" Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence,"* Englewood Cliffs, Nj: Prentice-Hall, 1992.
6. L.X.Wang, "*Adaptive Fuzzy Systems & Control: Design & Stability Analysis*": Prentice-Hall,1994.
7. David E. Goldberg, *Algorithmes Génétiques*, Edit. Addison Wesley, 1994

Third Semester
Methodological unit: UEM 2.1.
Matter : TP Control of electrical systems
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Title of Practical Work:

Practical Work n^0 01: Control of a centrifugal pump

Practical Work n^0 02: Study of an automated gate

Practical Work n^0 03: Study of treadmill training

Practical Work n^0 04: Automation of a goods lift

Evaluation mode : Continuous control: 100%

References:

Textbooks and course materials.

Third Semester
Methodological unit: UEM 2.1.
Matter :Sizing of industrial systems
VHS: 22h30 (Course: 1h30 ; TD : 1h30 ; TP: 1h00)
Credits: 5
Coefficient: 3

Chapter I: Elements of Industrial Mechanism Equipment

I.1- General Principles of Industrial Systems
I.2- Criteria for Choosing a Motor
I.3- Main Parameters to Consider when Choosing a Motor for the Drive: Speeds, Torques, Powers, Moment of Inertia, reduction/multiplication

Chapter II: Types of Service for Electric Motors

II.1- Main Service Types: S1…S9;
II.2- Average Values of Power, Torque, and Current;
II.3- Motor Power and Service Types;
II.4- Power Increase compared to S1;
II.5- Mechanical Limiting Capacity;
II.6- Power Reduction compared to S1.

Chapter III: Characteristic Torque Curves

III.1- Load Torques as a Function of Speed;
III.2- Load Torques as a Function of Travel;
III.3- Load Torques as a Function of Time;
III.4- Initial Torque peeling off .

Chapter IV: Choice and Sizing of Electric Motors

IV.1- Motor Power;
IV.2- Catalog Data and Application Parameters;
IV.3- Determination of homologated Power;
IV.4- Catalog Data;
IV.5- Operating Conditions;
IV.6- Motor Selection Procedure;
IV.7- Sizing using Load Torque;
IV.8- Calculation using Torque or Acceleration Time;
IV.9- Acceleration Time and Torque;
IV.10- Preliminary Motor Choice ;
IV.11- Motor Verification;
IV.12- Motor Verification at Start-Up;
IV.13- Motor Verification after Heating;
IV.14- Calculation using Switching Frequency;
IV.15- Selection by Consulting the Catalog;
IV.16- Life Cycle Cost.

Chapter V: Various Applications

A- Choice and Sizing of Electric Motors in Cases such as:

1. Elevators, Goods Lifts, Machine Tools.
2.Vehicles at Low and High Speeds.

3.Compressors.
4.Centrifugal Fans and Pumps.
5.Grinders

B- Industrial Applications

1.Electric Furnaces;
2.Welding Equipment;
3.Electrolysis and Metal Coating;
4 .Metallurgical Plants;
5.Agri-food Industry;
6.Oil Drilling Stations;
7.Paper Industry;
8.Cement Industry;
9.Glass Industry;
10.Metal Industry

Practical Work

PW01: Study of a goods lift
PW02: Study of a conveyor belt drive
PW03: Study of a centrifugal pump

Note: For the practical work and the last part of the course "industrial applications", it would be more useful to organize them as mini-projects and educational visits.

Evaluation mode : Continuous control: 10

Reference:
Books and course materials.

Third Semester
Discovery unit : UET 1.3
Matter : Research and Design of the Thesis
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives
Provide the student with the necessary tools to search for useful information and better utilize it in their final project. Assist them in navigating the various stages leading to the writing of a scientific document. Emphasize the importance of communication and teach them how to present their work rigorously and pedagogically.

Recommended prerequisite knowledge:
Writing methodology, Presentation methodology.

Content of the Matter
Part I: Documentary research:
Chapter I-1: Defining the subject (2 weeks)

-Subject title
-List of keywords related to the subject
-Gathering basic information (Acquisition of specialized vocabulary, meaning of terms, linguistic definition.)
-Information to be searched for
-Taking stock of one's knowledge in the field

Chapter I-2: Selecting Information Sources (2 weeks)
-Type of documents (books, theses, dissertations, journal articles, conference proceedings, audiovisual materials...)
-Type of resources (libraries, internet...)
-Evaluate the quality and relevance of information sources

Chapter I-3: Locating Documents (1 Week)

-Search techniques
-Search operators

Chapter I-4: Processing Information (2 Weeks)
-Organization of work
-Initial questions
-Synthesis of selected documents
-Links between different parts
-Final plan of documentary research

Chapter I-5: Bibliography presentation (01 Week)
-Systems for presenting a bibliography (Harvard system, Vancouver system, mixed system...)
-Presentation of documents
-Citation of sources

Part II: Design of the thesis

Chapter II-1: Plan and steps of the thesis **(02 weeks)**

-Identify and delimit the topic (Summary)
-Problematic and objectives of the thesis
-Other useful sections (Acknowledgments, List of abbreviations...)
-Introduction (Writing the introduction last)
-State of the specialized literature
-Formulation of hypotheses
-Methodology
-Results
-Discussion
-Recommendations
-Conclusion and perspectives
-Table of contents
-Bibliography
-Appendices

Chapter II-2: Writing Techniques and Standards **(2 weeks)**

-Formatting. Numbering of chapters, figures, and tables.
-Cover page
-Typography and punctuation
-Writing. Scientific language: style, grammar, syntax.
-Spelling. Improving general language skills in terms of understanding and expression.
-Saving, securing, and archiving data.

Chapter II-3: Workshop: Critical Study of a Manuscript **(01 Week)**

Chapter II-4: Oral Presentations and Defenses **(01 Week)**

-How to present a poster
-How to give an oral presentation
-Defense of a thesis

Chapter II-5: How to Avoid Plagiarism? **(01 Week)**

(Formulas, sentences, illustrations, graphs, data, statistics, etc.)
-Citation
-Paraphrasing
-Providing a complete bibliographic reference

Evaluation mode : Exam (100%)

References:

1. M. Griselin et al., Guide de la communication écrite, 2e édition, Dunod, 1999.
2. J.L. Lebrun, Guide pratique de rédaction scientifique : comment écrire pour le lecteur scientifique international, Les Ulis, EDP Sciences, 2007.
3. A. Mallender Tanner, ABC de la rédaction technique : modes d'emploi, notices d'utilisation, aides en ligne, Dunod, 2002.
4. M. Greuter, Bien rédiger son mémoire ou son rapport de stage, L'Etudiant, 2007.
5. M. Boeglin, lire et rédiger à la fac. Du chaos des idées au texte structuré. L'Etudiant, 2005.
6. M. Beaud, l'art de la thèse, Editions Casbah, 1999.
7. M. Beaud, l'art de la thèse, La découverte, 2003.
8. *M. Kalika, Le mémoire de Master, Dunod, 2005.*

Proposal of some discovery materials

Third Semester
Discovery unit : UED
Matter : Industrial Computing
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

This subject allows students in this Master's program to become familiar with the field of industrial computing. They will acquire knowledge of communication protocols.

Recommended prior knowledge

Combinatorial and sequential logic, microprocessors and microcontrollers, computer science.

Content of the Matter

Chapter 1: Introduction to industrial computing; **(2 weeks)**
Chapter 2: Connecting hardware to a microprocessor; **(2 weeks)**
Chapter 3: Devices and interfaces (ports, timers, etc.); **(4 weeks)**
Chapter 4: Serial communication buses (RS-232, DHCP, MODBUS, I2C); **(5 weeks)**
Chapter 5: Data acquisition: CAN and DAC peripherals; **(2 weeks)**

Evaluation mode : Exam (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 microcontrôleurs PIC : applications », Paris : Francis Lefebvre, 2000, ISBN : 2100059572 ;
4. Tavernier, Ch., « Les microcontrôleurs PIC : description et mise en œuvre », Paris : Francis Lefebvre,2004, ISBN : 2100067222 ;
5. Cazaubon , christian, « Les microcontrôleurs HC11 et leur programmation », Paris : Masson, [s.d], ISBN :2225855277 ;
6. Tavernier, Christian, « Les microcontrôleurs AVR : description et mise en œuvre », Paris : Francis Lefebvre, 2001, ISBN : 2100055798 ;
7. Dumas, Patrick, « Informatique industrielle : 28 problèmes pratiques avec rappel de cours », Paris : Francis Lefebvre, 2004, ISBN : 2100077074.

Third Semester
Discovery unit : UED…
Matter :Industrial Ecology and Sustainable Development
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

Raising awareness about sustainable development, industrial ecology, and recycling

Recommended prior knowledge

Content of the Matter

- Birth and evolution of the concept of industrial ecology
- Definition and principles of industrial ecology
- Industrial ecology experiences in Algeria and worldwide
- Industrial symbiosis (eco-industrial parks/networks)
- Gaseous, liquid, and solid waste
- Recycling

Evaluation mode : Exam 100%

References:

1 Écologie industrielle et territoriale, COLEIT 2012, de Junqua Guillaume , Brullot Sabrina
1 Vers une écologie industrielle,comment mettre en pratique le développement durable dans une société hyper-industrielle, Suren Erkman 2004.
2 L'énergie et sa maîtrise. Montpellier Cedex 2 : CRDP de Languedoc-Roussillon, 2004. . ISBN 2-86626-190-9,
3 Appropriations du développement durable: émergences, diffusions, traductions B Villalba – 2009

Third Semester
Discovery unit : UED…
Matter :Renewable Energies
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient:

Teaching objectives

Providing students with scientific foundations that enable them to integrate into 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.

Content of the Matter

Chapter 1: Introduction to Renewable Energies (Renewable Energy Sources: Deposits and Materials) **(4 weeks)**

Chapter 2: Solar Energy (Photovoltaic and Thermal) **(4 weeks)**

Chapter 3: Wind Energy **(3 weeks)**

Chapter 4: Other Renewable Sources: Hydropower, Geothermal, Biomass, etc. **(2 weeks)**

Chapter 5: Storage, Fuel Cells, and Hydrogen **(2 weeks)**

Evaluation mode : Continuous control: 40%; Exam (60%)

References:

6. Sabonnadière Jean Claude. Nouvelles technologies de l'énergie 1: Les énergies renouvelables, Ed. Hermès.
7. Gide Paul. Le grand livre de l'éolien, Ed. Moniteur.
8. A. Labouret. Énergie Solaire photo voltaïque, Ed. Dunod.
9. Viollet Pierre Louis. Histoire de l'énergie hydraulique, Ed. Press ENP Chaussée.
10. Peser Felix A. Installations solaires thermiques: conception et mise en œuvre, Ed. Moniteur.

Third Semester
Discovery unit : UED…
Matter :Materials in Electrotechnics
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Objectives:

The objective of this course is to provide the basic knowledge necessary to understand the physical phenomena involved in materials and to make an appropriate choice for the design of electrical components and systems. The fundamental characteristics of different types of materials and their behavior in the presence of electric and magnetic fields are discussed.

Prerequisites : Fundamentals of Physics and Applied Mathematics

Content:

I. Know and understand the operation, constitution, technology, and specification of electrical equipment used in electrical networks.

II. Magnetic materials: properties, losses, types, thermal and mechanical properties, characterization, magnets.

III. Conductive materials: properties, losses, insulation, tests, and applications

IV. Dielectric materials: properties, losses, breakdown and performance, stress, tests

Evaluation mode :Continuous control: 40%; Exam (60%)

References:

[1] A.C. Rose-Innes and E.H. Rhoderick, Introduction to Superconductivity, Pergamon Press.
[2] P. Tixador, Les supraconducteurs, Editions Hermès, Collection matériaux, 1995.
[3] P. Brissonneau, Magnétisme et Matériaux Magnétiques Editions Hermès.
[4] P. Robert, Matériaux de l' Electrotechnique, Volume II, Traité d'Electricité, d'Electronique et d'Electrotechnique de l'Ecole Polytechnique Fédérale de Lausanne, Edition Dunod.
[5] Techniques de l'Ingénieur.
[6] R. Coelho et B. Aladenize, Les diélectriques, Traité des nouvelles Technologies, série Matériaux, Editions Hermès, 1993.
[7] M. Aguet et M. Ianoz, Haute Tension, Volume XXII, Traité d'Electricité, d'Electronique et d'Electrotechnique de l'Ecole Polytechnique Fédérale de Lausanne, Edition Dunod.
[8] C. Gary et al, Les propriétés diélectriques de l'air et les très hautes tensions, Collection de la Direction des Etudes et Recherches d'Electricité de France, Edition Eyrolles, 1984.
[9] Matériaux Diélectriques pour le Génie Electrique, Tome 1 & 2, HERMES LAVOISIER, 2007.

Third Semester
Discovery unit : UED…
Matter :Standards and Legislation in Electrotechnics
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Part I: Management

I. Types of enterprises to manage
- Profit-oriented traditional enterprises;
- Non-profit organizations: Administrations, Hospitals
- International organizations

II. Business management tools
- Methods of analysis and understanding of socio-economic phenomena;
- Decision-making in a changing and complex economic environment

III. Examples of management policies and concepts
- Lean management;
- Benchmarking

Part II: Standards in Electrotechnics

- Different standardization organizations
- French NFC Standard
- European EN Standard
- International IEC Standard
- Standards and symbols

Part III: Certification

I. Implementation of a Quality Management System (QMS)
- How to do it?
- Why do it?

II. Quality as a means of growing the company

- 2-1 Quality Policy (QP);
- 2-2 Quality Approach (QA);
- 2-3 Quality Management Officer (QMO);
- 2-4 PCDA tool (Plan, Do, Check, Act)

III. Certification process
- Certification of the ISO9001 standard,
- Steps to follow,
- Awareness, Diagnosis, Actions,
- Audit and certification technical file.

Evaluation mode : Exam (100%)

Third Semester
Discovery unit : UED…
Matter : Maintenance and Reliability
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Content of the Matter

I-History, context, and definitions of R&M (Reliability and Maintainability)

II-Analysis of systems with independent components (-Modeling of the malfunctioning logic by fault trees, -Qualitative and quantitative Boolean analysis, -Limits of the method)

III-Analysis of systems with consideration of certain dependencies (-Modeling of systems, -Markovian modeling by state graphs, -Quantitative exploitation of the model, -Limits of the method)

IV-Analysis of systems with generalized consideration of dependencies (-Modeling by Petri nets (PN), -Quantitative exploitation of the model: Stochastic PN)

V-Application of R&M methodologies (-Reliability, -Maintainability, -Availability, -Safety)

VI-Reliability prediction methodology (-Predictive calculation of reliability, -Failure mode analysis, -Fault diagnosis and maintenance techniques)

Evaluation mode : Continuous control: 40%; Exam (60%)

References:

1. Patrick Lyonnet, "Ingénierie de la fiabilité, Edition TEC & DOC, Lavoisier, 2006.
2. Roger Serra, "Fiabilité et maintenance industrielle", Cours, Ecole de technologie supérieure ETS, Université de Québec, 2013.
David Smith, Fiabilité, maintenance et risque, DUNOD, Paris 2006.

Third Semester
Discovery unit : UED…
Matter : Real-time implementation of a numerical control
VHS: 22h30 (Course: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives

This teaching unit deals with the digital control of machine converter assemblies using programmable components (µControllers, DSP, ARM, FPGA).

Recommended prior knowledge

µ-microprocessors and µ-microcontrollers, computer science, control, electrical machines, power converters.

Content of the Matter

Chapter 1: Description of real-time systems; **(03 weeks)**

Chapter 2: Digital control of systems; **(04 weeks)**

Chapter 3: Study of the implementation of PWM techniques on a digital processor; **(04 weeks)**

Chapter 4: Examples of implementation of machine control: DC Machine, Asynchronous Machine, Synchronous Machine. **(04 weeks)**

Evaluation mode : Exam (100%)

References:

1. B. Bouchez « Applications audionumériques des DSP : Théorie et pratique du traitement numérique », Elektor, 2003.
2. Baudoin, Geneviève & Virolleau, Férial, « Les DSP famille, TMS 320C54X [texte imprimé] : développement d'applications », Paris : Francis Lefebvre, 2000, ISBN : 2100046462.
3. Pinard, Michel, « Les DSP, famille ADSP218x [texte imprimé] : principes et applications », Paris : Francis
Lefebvre, 2000, ISBN : 2100043439 ;
4. Tavernier, Ch., « Les microcontrôleurs PIC : applications », Paris : Francis Lefebvre, 2000, ISBN : 2100059572.