REPUBLIQUE ALGERIENNE DEMOCRATIQUE ET POPULAIRE

MINISTERE DE L'ENSEIGNEMENT SUPERIEUR
ET DE LA RECHERCHE SCIENTIFIQUE

Cahier des charges

De reconduction d'une Formation à recrutement national

Master

الجمهورية الجزائرية الـــديمقراطيـــة الـــشعبيـــــة

وزارةالتعليـــــم العالـــــي والبحـــــث العلمـــــي

دفتر الشروط

لتجديد تكوين ذات تسجيل وطني

ماستر

Fiche d’organisation semestrielle des enseignements

Semestre 1:

Unités d'enseignement	Matières	Crédits	Coefficient	Volume horaire hebdomadaire			VHS (14-16 semaines)	Autre*	Mode d'évaluation	
	Intitulé			Cours	TD	TP			Contrôle Continu	Examen
UE Fondamentale Code : UEF 1.1 Crédits : 27 Coefficients : 19	Probability and Statistics	6	4	3	1,5	0	67,5		40%	60%
	Advanced Differential Equation	6	4	3	1,5	0	67,5		40%	60%
	Complex Variable	6	4	3	1,5	0	67,5		40%	60%
	Digital Control	6	4	3	1,5	0	67,5		40%	60%
	Power Eng. Materials	3	3	3	0	0	45		30%	70%
UE Transversale Code : UET 1.1 Crédits : 3 Coefficients : 2	Computation and Simulation using Matlab / Simulink	3	2	1,5	0	1,5	36		40%	60%
Total semestre 1		**30**	21	16,5	6	1,5	346,5			

*Autres travaux supplémentaires

Semestre 2:

Unités d'enseignement	Matières	Crédits	Coefficient	Volume horaire hebdomadaire			VHS (14-16 semaines)	Autre*	Mode d'évaluation	
	Intitulé			Cours	TD	TP			Contrôle Continu	Examen
UE Fondamentale Code : UEF 1.2 Crédits : 24 Coefficients : 19	Digital Signal Processing	4	3	3	0	0	45		40%	60%
	Numerical Methods	4	3	3	0	0	45		30%	70%
	Electric Machines	4	4	3	0	0	45		30%	70%
	Power System Analysis	4	3	3	0	0	45		30%	70%
	Power Electronics	4	3	3	0	0	45		30%	70%
	Network Analysis and Synthesis	4	3	1,5	1,5	0	45		40%	60%
UE Méthodologique Code : UEM 1.2 Crédits : 6 Coefficients : 5	Numerical methods Lab	1	1	0	0	1,5	18		75%	25%
	Power System Analysis Lab	1	2	0	0	1,5	18		75%	25%
	Electric Machines lab	2	1	0	0	1,5	18		75%	25%
	Power Electronics Lab	2	1	0	0	1,5	18		75%	25%
Total semestre 2		**30**	24	16,5	1,5	6	342			

*Autres travaux supplémentaires

Semestre 3:

Unités d'enseignement	Matières	Crédits	Coefficient	Volume horaire hebdomadaire			VHS (14-16 semaines)	Autre*	Mode d'évaluation	
	Intitulé			Cours	TD	TP			Contrôle Continu	Examen
UE Fondamentale Code : UEF 2.1 Crédits : Coefficients :	Power System Control and Operation	5	4	3	0	0	45		30%	70%
	Machines and Drives	4	4	3	0	0	45		30%	70%
	Instrumentation and Protective Systems	4	4	3	0	0	45		30%	70%
	Reliability, Availability, Maintainability and Security	4	3	3	0	0	45		30%	70%
	Instrumentation and Programmable Devices	4	3	3	0	0	45		30%	70%
	Industrial Power Network	2	2	1.5	0	0	18		40%	60%
UE Méthodologique Code : UEM 2.1 Crédits : Coefficients :	Power System Control and Operation Lab	1	1	0	0	1,5	18		75%	25%
	Machines and Drives	1	1	0	0	1,5	18		75%	25%
	Instrumentation and Programmable DevicesLab	1	1	0	0	1,5	18		75%	25%
	Industrial Power NetworkLab	1	1	0	0	1,5	18		75%	25%
UE Découverte Code : UED 2.1 Crédits : Coefficients :	Renewable energy	2	2	1.5	0	0	18		40%	60%
Total semestre 3		**30**	26	18	1,5	4,5	333			

*Autres travaux supplémentaires

Semestre 4 :

	VHS	Coeff.	Crédits
Projet de Fin d'Etudes	**560**	**16**	**24**
Communication Skills	**40**	**2**	**3**
Management	**40**	**2**	**3**
Total Semestre 4	**640**	**20**	**30**

En plus du travail personnel, la matière intitulée Projet de Fin d'Etudes peut renfermer un stage en entreprise et/ou la participation à des séminaires. Elle est sanctionnée par un mémoire et une soutenance.

Programme détaillé par matière

(1 fiche détaillée par matière)

Semestre : 1
UE : Fondamentales
Matière : Complex Variable

Objectifs de l'enseignement

The course objective is to introduce the students to basic complex variables analysis, and to provide the necessary tools for solving analytically the functions of complex variable.

Connaissances préalables recommandées

Single variable calculus course.

Contenu de la matière :

1. Algebra of complex variables
2. Function of complex variable
3. Analytic Function
4. Power series
5. Residues theorem and its applications
6. Integrals
7. Conformal mappings

Mode d'évaluation : Contrôle continu +Examen final

Références

- Ahlfors, Lars V. Complex Analysis : An introduction to the theory of analytic functions of one complex variable. 3rd Ed. New York, McGraw-Hill, 1976
- Caratheodory, Constantin. Theory of function of a complex variable. Vol.2, NY, Chelisa, 1960

Semestre : 1
UE : fondamentales
Matière : AdvancedDifferential Equations

Objectifs de l'enseignement

The course objective is to analyze Partial differential equations used in physics and engineering and to understand techniques for solving them.

Connaissances préalables recommandées

Multivariablecalculus, LinearAlgebra and Ordinarydifferentialequations.

Contenu de la matière :

1. CalculusReview
2. First-Order PDEs
3. Second-Order PDEs
4. Fourier Series
5. Separation of Variables
6. The Sturm-Liouville EigenvalueProb
7. Classical PDE Problems
8. Fourier Transform and its Application

Mode d'évaluation : Contrôle continu +Examen final

Références

1. Asmar N. H., Partial differential equations with Fourier series and Boundary value problems, 2ed., Pearson, 2005.
2. Y. Pinchover and J. Rubinstein, An Introduction to Partial Differential Equations, Cambridge University Press 2005.
3. Myint-U, Debnath, Linear Partial Differential Equations for Scientists and Engineers, 4ed. Birkhäuser 2007.

Semestre : 1
UE : fondamentales
Matière : Probability and Statistics

Objectifs de l'enseignement

Knowledge of basic notions of probabilities, how to deal with the random variables, different types of distributions and solving probability problems by choosing the right corresponding distribution.

Connaissancespréalablesrecommandées

- Basic notions of mathematics, Computing single and double integrals.

Contenu de la matière :

I. Review of Set Theory
II. CombinatorialAnalysis
III. ProbabilityDefinitions
IV. Random Variables, RandomVectors
V. SomeProbabilityModels
VI. Limit laws: The Central Limit Theorem
VII. SomeStatistics
   - Estimation of Means, Variance, Proportion, Confidence Intervals
   - Introduction to HypothesisTesting
   - LinearRegression.

Mode d'évaluation : Contrôle continu +Examen final
EMD 1 ; EMD 2 ; Final Exam

Références

[1] R. B. Schinaziet R. B. Schinazi, *Probability With Statistical Applications*. Springer, 2001.
[2] A. Papoulis, *Probability and Statistics*, 1st ed. Prentice Hall, 1989.

Semestre: 1
UE : Fondamentales
Matière : Digital Control System

Objectifs de l'enseignement
Provide the student with basic tools for the analysis and design of discrete-time linear control systems. This course is the extension of continuous-time linear control systems.

Connaissances préalables recommandées
LinearAlgebra and control system courses.

Contenu de la matière :

1- Introduction : sampling process, Simplified digital control systems.
2- Z-transform analysis
3- Design of discrete-time control systems
4- Frequency response time
5- State-space methods

Mode d'évaluation : Contrôle continu +Examen final

Références

1- H.Ogata, Discrete-time control systems, 2nd Ed, Prentice Hall, 1995.
2- G. F. Franklin, J.D. Powell, M. Workman, Digital control of dynamic systems, 3rd Ed., Pearson Educations, 2005.

Semestre: 1
UE : Fondamentales
Matière: Power Engineering Materials

Objectifs de l'enseignement

The main objective of this course is to teach the students the necessary knowledge about the materials used in the power equipments for understanding well their principle of function.

Connaissances préalables recommandées *Maximum 2 lignes).*

The student is supposed to have attended physics courses.

Contenu de la matière :

- Semi-conductor materials
- Semi-conductor Devices (SCR, GTO, PV cell)
- Magnetic materials
- Dielectric materials
- Conduction materials
- Superconducting materials

Mode d'évaluation :

Contrôle continu +Examen final

Références

1. Handouts.

Semestre : 1
UE : transversales
Matière : Computationand Simulation usingMatlab /Simulink

Objectifs de l'enseignement

The main objective of this course is to introduce the use of Matlab, Simulink and Power System toolboxes, as well as tools for plotting and developing GUIs.

Connaissances préalables recommandées *Maximum 2 lignes).*

The prerequisite courses are: power system, Linear algebra.

Contenu de la matière:

Chapter 1: Introduction to use ofMatlab: elementary operations, operators, functions.

Chapter 2 : Matrix computations and linear algebra.

Chapter 3 : programming, curve fitting and visualization

Chapter 4 : Introduction to use of SIMULINK with power system toolbox
Chapter 5: Embedding S-function in Simulink

Chapter5 : File I/O, building GUIs.

Mode d'évaluation :

Home works +Quizzes + Final exam

Références

1) C.B. Moler, Numerical Computing with Matlab, 2nd Ed, SIM, 2008.
2) G.W. Stagg and Albaid, Computer methods in Power system Analysis,
3) Http://www.mathworks.com/help/techdoc/

Semestre : 2
UE : Fondamentales
Matière : NumericalMethods

Objectifs de l'enseignement:*The course is intended to provide power engineering students with numerical methods required to solve some equations and problems numerically.*

Connaissances préalables recommandées :
The prerequisite courses are : Calculus I & II, and computer programming.

Contenu de la matière :

1- Introduction
2- Solutions of equations of one variable
3- Linear algebraic methods
4- Numerical integration
5- Interpolation and polynomial
6- Numerical solution of initial value problems
7- Approximating Eigen values

Mode d'évaluation : *Continuous + Final exam*

Réferences:

1- H.M. Antia Numerical methods for scientists and engineers, McGraw Hill, 1995.
2- W.DosPassos, Numerical Methods, Algorithms and Tools, Taylor and Francis Group , 2010

Semestre : 2
UE : Fondamentales
Matière : Electric machines

Objectifs de l'enseignement: *The course is intended to provide power engineering students with an active knowledge required to characterize and model* the different types of electrical machines.

Connaissancespréalablesrecommandées : *The prerequisite courses are : Calculus I & II, DC and AC circuits, Electric Machines and numerical methods.*

Contenu de la matière :

Chapter one: Basic Concepts
1- Main types of AC machines
2- E.M.F in AC machines windings
3- Three-phase and single-phase windings of AC machines
4- E.M.F in AC machines windings
5- Revolving fields

Chaptertwo: Transformer
1- Main types of the transformer
2- Inrushcurrent in the transformer
3- Characterization of the transformer

Chapterthree: Synchronous Machines
1- Main types of AC machines
2- Characterization of the alternator
3- three -phase synchronousmotor

Chapter Four: Asynchronous Machines
1- Different types and Construction
2- Characterization of the three-phase motor
3- D-q modeling
4- Operation as three-phase asynchronous generators
5- Operation as single-phase motor

Mode d'évaluation : *Continuous + Final exam*

Réferences:
Introduction to Electrical Machines and Transformers» G. McPherson,
Lab-Volt laboratory manual.

Semestre : 2
UE : Fondamentales
Matière : Digital Signal Processing

Objectifs de l'enseignement
This course will build on the knowledge acquired in the two preceding courses of linear systems. The main objective of this course is to help students to design and implement digital filters using many different approaches.

Connaissances préalables recommandées *Maximum 2 lignes).*
The student is supposed to have attended continuous and discrete time linear systems courses.

Contenu de la matière :

- Sequences and systems
- The Z-transform
- Properties of analog systems
- Signal flow graph and implementation
- Design of digital filters
- Discrete and fast Fourier transform
- Applications of the discrete Fourier transform

Mode d'évaluation : Contrôle continu +Examen final

Références
1. J. G. Proakis, and D. G. Manolakis, "Digital Signal Processing, principles, algorithms, and applications " Prentice-Hall, 3rd edition 1996.
2. A. V. Oppenheim, and R. W. Schafer, " Discrete-time Signal Processing''Prentice Hall; 3 edition, 2009.

Semestre : 2
UE : Fondamentales
Matière : Power system analysis

Objectifs de l'enseignement:*The course is intended to provide power engineering student with a good perspective of the most important power system components and an active knowledge required to analyze a large interconnected power system.*

Connaissancespréalablesrecommandées :*The prerequisite courses are : Calculus I & II, DC and AC circuits, Electric Machines and numerical methods.*

Contenu de la matière :

Chapter 1 : An overview of modern power system

- *History of Power Systems*
- *Modern power system main components*
  - *Generation*
  - *Transmission*
  - *Distribution*
  - *Loads*
- *Power System interconnection*
- *Power system control*
- *Power system protection*

Chapter 2 : Basic concepts

- *Power in single phase AC circuits*
- *Complex power*
- *Conservation of power*
- *Power factor correction*
- *Complex power flow*
- *Three phase circuits*
- *Δ-Y transformations*
- *Per-phase analysis*

Chapter 3 :Modeling of Generators and Transformers

- *Introduction*
- *Synchronous generators*
- *Steady state characteristics*
- *Salient-pole synchronous generators*
- *Power transformer*
- *Equivalent circuit of a transformer*
- *Three phase transformers*
- *Autotransformers*
- *Three winding transformers*
- *Voltage control of transformers*

Chapter 4 : Series and shunt impedance of transmission lines

- *Introduction*
- *Types of TLs conductors*
- *Resistance of TLs*
- *Inductance of TLs*
  - *Inductance of a single conductor*
  - *Inductance of a single-phase line*
  - *Inductance of a composite conductor*
  - *Inductance of a symmetrical and non-symmetrical TLs*
  - *Bundled conductors*
  - *Parallel-circuit three phase transmission lines*

- *Capacitance of TLs*
  - *Potential difference between two points due to a charge*
  - *Multi-conductors case*
  - *Capacitance of a single-phase lines*
  - *Capacitance of a symmetrical and non-symmetrical TLs*
  - *Bundled conductors*
  - *Parallel-circuit three phase transmission lines*
  - *Effect of earth on the capacitance of 3 phase lines*

Chapter 5: Transmission lines: modeling and performances

- *Introduction*
- *Short line model*
- *Medium line model*
- *Long transmission lines*
- *Voltage and current waves*
- *Lossless line*
- *Surge impedance loading*

Chapter 6: Power system representation and solutions

- *Single line diagram*
- *Single line diagram symbols*
- *Equivalent Impedance and reactance diagram*
- *Per-unit representation*
- *Node elimination*
- *Nodal analysis*
- *Construction of bus admittance*

Chapter 7: Load flow analysis

- *Introduction*
- *Power flow problem*
- *Classification of busbars*
- *Solution of power flow problem*
  - *Solution using Gauss-Seidal*
  - *Solution using Gauss-Seidal accelerated*

- *Inclusion of PV buses in Gauss-Seidal*
- *Solution using Newton-Raphson*

Chapter 8: Balanced faults

- *Introduction*
- *Balanced three phase faults*
- *Short-circuit capacity*
- *Systematic fault analysis*
- *Formation of the bus impedance matrix*

Chapter 9: Symmetrical components and unbalanced faults

- *Introduction*
- *Fundamentals of symmetrical components*
- *Sequence impedances*
- *Sequence networks of a loaded generator*
- *Single line-to-ground fault*
- *Line-to-line fault*
- *Double line-to-ground fault*
- *Unbalanced fault analysis*

Mode d'évaluation: *Continuous + Final exam*

Réferences:

1. Elements of power system analysis, D. W. Stevenson, 1985, third edition, Library code: TK3001.S85

Semestre : 2
UE : Fondamentales
Matière : Power Electronics

Objectifs de l'enseignement :
Acquérir la capacité de comprendre et d'analyser des dispositifs et circuits représentant les fonctions de conversion de base de l'électronique de puissance ainsi que des convertisseurs plus avancés. Les connaissances acquises doivent permettre à l'étudiant de développer des compétences de conception.

Connaissances préalables recommandées :
Avoir suivi les cours : electric circuits I and II ,Lineardifferentialequations ;

Contenu de la matière : on the basis of 45 h of teaching (15 weeks of teaching)
1. Introduction
2. Power semiconductor switches
3. DC/DC converters
4. PWM inverters
5. Multilevel Inverters
6. FACTS
7. HVDC
8. Gate drive Circuits
9. Protection of power devices and circuits(snubber circuits design ..)
10. Reliability of power devices

Mode d'évaluation:
One mid term exam + one final exam
Graded Lab. work (report submission and oral exam)

References : Power Electronics by Muhammad H Rashid /http://www.pspice.com
Power electronics by Mohan et al

Semestre : 2
UE : Fondamentales
Matière : Network Analysis and Synthesis

Objectifs de l'enseignement

- To make the students capable of analyzing any given linear electrical network.
- To make the students learn how to synthesize an electrical network from a given Impedance/admittance or transfer function.

Connaissances préalables recommandées

AC/DC Circuits and Linear System courses.

Contenu de la matière :

Unit I

S-Domain Analysis: Network functions for the one port and two port networks – Driving point and transfer functions – Properties of driving point and transfer functions - Poles and zeros of Network Functions – Significance of poles and zeros -Time domain response from pole zero plots.

Unit II

Frequency Domain Analysis

Amplitude and phase response from pole zero plots – Stability criterion for active networks – Routh Criteria - Magnitude and phase plots for RL and RC networks – Complex loci for RL, RC
and RLC networks - Plots based on S- Plane Phasors.

Unit III

Topological Network Analysis: Network graph, Tree/cotree, Incidence matrix and its partitioned form - Fundamental cutsetsandfundamental loops — Generalized branch model and Formulation ofequilibrium equation (Nodal, Loop and Cutset Analysis), special elements (controlled sources, transformers, gyrators, NICs …) - the hybrid analysis .

Unit IV

Multiport Network Analysis: Characterization of two port networks in terms of Z, Y, h, g, T – Relations between the network parameters - Network equivalents –
Analysis of T, π , ladder and lattice networks - Transfer function, Input and output immitance of terminated two port Networks – Two port networks Interconnection – Multiport networks, Indefinite Impedance and Admittance matrix.

Unit V

Elements of Network Synthesis: Realisability of one port network – Hurwitz polynomials andproperties – Positive real functions and its properties – Synthesis of RL, RC and LC one portnetworks.

Unit VI

Design of Active Filters: Definitions – Butterworth and Tchebyshef models - Filters- Design of active filters based Sallen and Key circuit.

Mode d'évaluation : Contrôle continu +Examen final

Références

1. W.H Hayt, JE Kemmerly, SM Durbin, “Engineering Circuit Analysis”, Tata McGraw Hill Publishing Company Limited, ND, 6th Edition, 2006.
2. Sudhakar A. Shyammohan, “Circuits and Networks Analysis and Synthesis” Tata Mc Graw Hill Publishing company limited, New Delhi, 3rd edition, 2007.

Semestre : 2
UE : méthodologie
Matière : NumericalMethodsLaboratory

Objectifs de l'enseignement:*These*Numerical analysis Laboratory experiments are designed to help students to solve some equations numerically by applying thought methods.

Connaissances préalables recommandées :
The prerequisite courses are : Numericalanalysis*and computer programming.*

Contenu de la matière :

1- Solution of a system of linear equation

2- Numerical integration

3- Lagrange Interpolation and polynomial

4- Spline Interpolation

5- Numerical solution of diffrential equations

Mode d'évaluation : *Continuous + Final exam*

Réferences:

3- H.M. Antia Numerical methods for scientists and engineers, McGraw Hill, 1995.

W.DosPassos, Numerical Methods, Algorithms and Tools, Taylor and Francis Group , 2010

Semestre : 2
UE : méthodologie
Matière : Power system analysis Laboratory

Objectifs de l'enseignement:*These*experimentsare designed to help students to implement some power network using the machines available in the laboratory.

Connaissances préalables recommandées :
The prerequisite courses are: Machines and power systems.

Contenu de la matière :

1- Safety and the power supply
2-Power flow and voltage Regulation of a Simple Transmission Line
3-Phase Angle and Voltage Drop between Sender and Receiver
4-Parameters which affect Real and Reactive Power Flow
5-Parallel Lines, Transformers and power-Handling Capacity
6-The Synchronous Motor and long High Voltage Lines
7-Transmission Line Networks and the Buck-Boost, Phase-Shift Transformer
8-Power System Transients

Mode d'évaluation : *Continuous + Final exam*

Réferences:
Lab Volt Laboratory Manual

Semestre : 2
UE : Méthodologie
Matière : Electric machine Laboratory

Objectifs de l'enseignement:
*These*experimentsare designed to help students to implement experimental set up and to characterize some electric machines.

Connaissances préalables recommandées :
Electric Machines courses.

Contenu de la matière :

1- Alternator: Behn-Eshenburg and potier diagram, load studies (isolated), connection to network
2- Synchronous motor mordey curves, blondel diagram
3- Asynchronous motor circle diagram, Identification of the equivalent circuit, load studies
4- Asynchronousgenerator.

Mode d'évaluation : *Continuous + Final exam*

Réferences:

Lab Volt Laboratory Manual

Semestre : 2
UE : Méthodologie
Matière : Power ElectronicLaboratoryExperiments

Objectifs de l'enseignement:
These experiments are designed to help studentsto implement some power electronic circuits such as controlled rectifier, chopper; inverters and some FACTS.

Connaissances préalables recommandées :
Power Electronic course.

Contenu de la matière :

1- Introduction to SPICE.
2- Power semi-conductor diode frequency effects
3- -half wave SCR Controlled rectification with R and RL loads
4- -single phase and three phase controlled rectifier with inversion mode
5- - DC/DC step down chopper and step up chopper
6- -PWM inverters
7- -FACTS Systems (TCCS compensation)

Mode d'évaluation : *Continuous + Final exam*

Réferences:
Laboratory Manual

Semestre : 3
UE : Fondamentales
Matière : Power system control and Operation

Objectifs de l'enseignement: *This advanced course comes in logic sequential to complete the first semester course that's power system I. It provides students with an understanding of the methods and tools used to make a large interconnected power system efficient, stable and secure*.

Connaissancespréalables*The prerequisites for this course courses are Calculus I & II, DC and AC circuits, Electric Machines, numerical methods and power system I.*

Contenu de la matière :

Chapter 1 : Introduction

Chapter 2 : Load flow analysis

- *Introduction*
- *Standard format of data*
- *Tap changing transformers*
- *Fast-decoupled power flow solution*
- *Line flows and losses*
- *Standard format of output data*

Chapter 3 : Economic dispatch problem

- *Introduction*
- *Nonlinear function optimization*
  - *Constrained equality optimization*
  - *Constrained inequality optimization*
- *Operating cost of a thermal plant*
- *ED neglecting losses and generator limits*
- *ED neglecting losses and including generator limits*
- *ED including losses*
- *Derivation of loss formula*

Chapter 4: Stability analysis

- *Introduction*
- *Swing equation*
- *Model of synchronous machine for stability studies*
- *Steady state stability*
- *Transient stability*
- *Numerical solution*
- *Multimachine systems*

Chapter 5 : Review of system control

- *The control problem*
- *Stability*

- *Steady state error*
- *Step response*
- *Root-locus design of controllers*
- *Frequency response*

Chapter 6 : Power System Control

- *Introduction*
- *Basic generator control loops*
- *Frequency control*
  - *Load frequency control*
  - *Automatic generation model*
  - *AGC with optimal dispatch of generation*
- *Reactive power and voltage control*
- *Amplifier Model*
- *Exciter model*
- *Generator model*
- *Sensor model*
- *Excitation model*
- *AGC including excitation system*
- *Introductory modern control application*

Chapter 7: Preventive, Emergency and Restorative Control

- *Introduction*
- *Power system state estimation*
- *Normal and alert state in a power system*
- *Load shedding*
- *Emergency control*
- *Power system restoration*

Mode d'évaluation : *Continuous + Final exam*

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

2. *Elements of power system analysis, D. W. Stevenson, 1985, third edition, Library code: TK3001.S85*
3. Power generation: operation and control, Allen J. Wood, Bruce F. Wollenberg, J. Wiley and Sons, New York, second edition, 1996.

Semestre : 3
UE : Fondamentales
Matière : Electric Machines and Drives

Objectifs de l'enseignement :
Acquérir la capacité d'analyser des systèmes de variateurs de vitesse à moteurs à CC et CA et prédire leur performance en régime établi ainsi qu'en régime dynamique. Les connaissances acquises doivent permettre à l'étudiant de développer des compétences de conception.

Connaissances préalables recommandées :
Avoir suivi les cours : Power electronics – Electric machines - Electric circuits I and II ,Lineardifferentialequations .

Contenu de la matière :
1. Introduction : The Drive System
2. Dc Drives: single phase drives/3 phase drives / DC to DC converter drives/ Closed loop control of drives
3. AC drives : Induction motor drives Performance characteristics/ V, I and frequency control/ Closed loop control of Induction motors/ Vector control/
4. AC drives : Synchronous motor drives / Stepper motor drives
5. Optimal control of drives (loss minimization)
6. Power quality Problems effects on drives
7. Vibration analysis of drives
8. Protection of electric drive systems
9. Reliability of electric drive systems

Mode d'évaluation: Onemid term exam + one final exam
Graded Lab. work (report submission and oral exam)
References : Power Electronics by Muhammad H Rashid
Power Electronics by Mohan et al

Semestre : 3
UE : Fondamentales
Matière : Instrumentation and Protective Systems

Objectifs de l'enseignement: *The course is intended to provide power engineering students with a good understanding of the most important protectiontechniques and an active knowledge required to design and implement any protective systems.*

Connaissances préalables recommandées : *The prerequisite courses are : Power System, AC circuits, Electric Machines and DSP.*

Contenu de la matière :

Chapter 1 : Introduction

Chapter 2 : FaultAnalysis

Chapter 3 : Instrumentation of Measurement

Chapter 4: Protective Components

Chapter 5 : Protection techniques

Chapter 6: Electrical Machines Protection

Chapter 7: Transformer Protection

Chapter 8: Transmission line Protection

Chapter 9: Digital Protection

Mode d'évaluation : *Continuous + Final exam*

Réferences:

1. Polycopie, Protection System: Theory and applications, H. Bentarzi, 1994.
2. P.M. Anderson, Power System Protection, IEEE Press, NY, 1999.
3. P. Rush, Network Protection and Automation Guide, 1st Ed, Library of Cayfosa, Barcelona, 2002.

Semestre : 3
UE : Fondamentales
Matière : Renewableenergy

Objectifs de l'enseignement :
Comprendre les principes, structures et fonctionnement des systèmes photovoltaiques et de leurs applications ; développer les capacités d'analyse de ces systèmes en vue de leur optimisation globale.

Connaissances préalables recommandées :
Avoir suivi les cours : Power electronics – Electric machines - Electric circuits I and II ,Lineardifferentialequations

Contenu de la matière :

1. Solar Cells : Solar cells Operation/ Semiconductor physics /The solar cell / Power losses in solar cells / Temperature and irradiance effects

2. Photovoltaic (PV) System Engineering **/** Structure of a PV system / The PV Generator / Energy Storage / Power Conditioning and Control / MPPT Control / Sizing and Reliability of PV systems / PV – Diesel hybrid Systems

3 Applications: Economics of PV installations/ Isolated Regions Electrification / Water Pumping / Grid Connected Systems

4. Specialised topics / Large PV generating plants / PV under concentrated sunlight

Mode d'évaluation:
One exam (final)

Références :Solar Electricity , Tomas Markvart , 2nd edition , 2001, John Wiley.
Energie Solaire Photovoltaique , 3ème édition, Anne Labouret , Michel Villoz, Dunod 2006.

Semestre : 3
UE : Fondamentales
Matière : Instrumentation and Programmable Devices

Objectifs de l'enseignement

This course provides the fundamentals of measurement instrumentation in power system. Topics range from basic measurements, signal processing, analog and digital transmission, to virtual instrumentation and smart intelligent electronic devices.

Connaissances préalables recommandées *Maximum 2 lignes).*

The student is supposed to have attended DSP and Electronic courses.

Contenu de la matière :

1. Introduction.
2. Measurement and instrumentation principles.
3. Instrument transformer.
4. Signal processing and Measurement systems.
5. Intelligent electronic devices.
6. Digital communication and communication protocols
7. Programmable devices PAC and PLC
8. Introduction to data acquisition and virtual instruments.
9. Substation instrumentation and control.
10. Introduction to SCADA system.

Mode d'évaluation :

Contrôle continu +Examen final

Références

J.G. Webster, Measurement, Instrumentation and sensors Handbook, CRC press LLC, 1999.

Semestre: 3
UE : Fondamentales
Matière : Reliability, Availabilty, Mantianability and Safety

Objectifs de l'enseignement :
- Enable students to identify and use the appropriate models to analyze reliability, maintainability, availability and safety (RAMS) goals for a system.
- Introduce students to the engineering of reliability, particularly the tradeoffs between cost, functionality and reliability.
- Familiarise students with the derivation of maintenance policies for the kinds of systems and sub-systems likely to be encountered in their professional life.

-Connaissances préalables recommandées : Knowledge of probabilities and statistics

Contenu de la matière :

1- Introduction to dependability in Power system

2- Reliability engineering in Power systems

3- Availability

4- Maintainability

5- Safety

6- Costreliabilityoptimization

Mode d'évaluation : Contrôle continu +Examen final

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

- Ali A. Chowdhury Don O. Koval POWER DISTRIBUTION SYSTEM RELIABILITY Practical Methods and Applications

- E.E.Lewis, *Introduction to Reliability Engineering,* Ed. John Wiley & Sons, 1987

Semestre : 3
UE : Fondamentales
Matière : IndustrialPower Network

Objectifs de l'enseignement
The main objective of this course is to teach the students the necessary knowledge about the Instrumentation and components in Industrial Power Network for understanding well their principle of function.

Connaissances préalables recommandées *Maximum 2 lignes).*
The student is supposed to have attended power system and Electric Machines courses.

Contenu de la matière:

- Introduction
- Connecting Components (power lines, connectors, bus bars)
- Interrupting devices (Switches, contactors, circuit breakers)
- Protective systems (grounding conductor, grounding systems)
- Regulating devices (starters, pf compensators, braking systems, speed controllers)
    - Industrial Hardwired systems design and considerations

Mode d'évaluation :
Contrôle continu +Examen final

Références
1.Handouts.

Semestre : 3
UE : Méthodologie
Matière : Power System control and operationLaboratory

Objectifs de l'enseignement
ThesePower System control and operationexperiments are designed to help students implement some controller dedicated to power system.
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Connaissances préalables recommandées *Maximum 2 lignes).*
The student is supposed to have attended in parallel Power System control and operation.

Contenu de la matière :

1. Introduction to software power world.
2. Load flow study.
3. Power system including stabilizer.
4. Power system including AGC
5. *Some modern control application to power system*
6. SCADA system.

Mode d'évaluation :
Contrôle continu +Examen final

Références

- Lab Volt laboratorymanual
- G.W. Stagg and Albaid, Computer methods in Power system Analysis,

Semestre : 3
UE : Méthodologie
Matière : Machines and Drives Laboratory

Objectifs de l'enseignement
These experiments help the students toinvestigate:

- characteristics of various dc motor speed control schemes (open loop and closed loop)
- characteristics of various ac motor speed control schemes (open loop and closed loop)

Connaissances préalables recommandées *Maximum 2 lignes).*
The student is supposed to have attended in parallel Machines and Drives course.

Contenu de la matière :

1. DC Motor Speed Control using Controlled Rectifier (Open-loop Speed Control)
2. DC Motor Speed Control using Chopper (Open-loop Speed Control)

3. DC Motor Drive with Current and Speed Feedbacks (Closed-loop Speed Control)

4. AC Motor Speed Control using Variable Voltage (Open-loop Speed Control)
5. AC Motor Speed Control using Variable Frequency (Open-loop Speed Control)
6. AC Motor Drive with Current and Speed Feedbacks Using Inverter (Closed-loop Speed Control)
7. Autopilot Synchronous Machine

Mode d'évaluation :
Contrôle continu +Examen final

Références

- Lab Volt laboratorymanual

Semestre : 3
UE : Méthodologie
Matière : Instrumentation and Programmable DevicesLaboratory

Objectifs de l'enseignement
This is a companion laboratory course for the instrumentation and programmable devices course; the objective is to put the theoretical concepts into practical Implementations and discuss their potential limitations.

Connaissances préalables recommandées
The studentissupposed to attend instrumentation and programmable devices course.

Contenu de la matière :

1- measurement transducers used in power system
2- Signal processing (current to voltage converter, filtering, sample/hold….)
3- Measurement and data acquisition system
4- Virtual instrumentation (virtual to visual measurement)
5- Introduction to digital data communication.
6- Networked Intelligent electronic devices.

Mode d'évaluation : Contrôle continu +Examen final

Références
J.G. Webster, Measurement, Instrumentation and sensorsHandbook, CRC press LLC, 1999.

Semestre : 3
UE : Méthodologie
Matière : IndustrialPower Network Laboratory

Objectifs de l'enseignement
This is a companion laboratory experiments for the Industrial Power Network course; the objective is to providethe students by the practical concepts and discuss the limitations.

Connaissancespréalablesrecommandées
The student is supposed to attend Industrial Power Network course.

Contenu de la matière :

Electrical Installation (Two way switching, ect..)
Two direction control of Electric motor
Two level speed control of Electric motor
Ywe-Delta starter for Induction motor
Rotor resistance starter for Induction motor
Starter of DC motor
Electric Braking System for Induction motor

Mode d'évaluation :
Contrôle continu +Examen final

Références
Lab Volt Laboratory Manual

Semestre : 4
UE : Découverte
Matière : Project Management

Objectifs de l'enseignement :

1. Understand and apply the sequential steps of the project management framework.
2. Understand the importance and function of project management and apply the project process of initiating, planning, executing, controlling and closing the project.

Connaissances préalables recommandées : fundamentalKnowledge of management

Contenu de la matière :

1.INITIATING THE PROJECT

2. PROJECT PLANNING ACTIVITIES

3. EXECUTING THE PROJECT

4.CLOSING DOWN THE PROJECT

5- APPLICATIONS & CASES STYUDY:
- Representing &scheduling project plans
- Software Programme : PRIMAVERA

Mode d'évaluation : Contrôle continu +Examen final

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

- Fundamentals of Project ManagementJames P. Lewis ISBN: 9780814408797

- Project Management: A Systems Approach to Planning, Scheduling, and Controlling Harold, Ph.D. Kerzner. (ISBN-10: 0471741876/ISBN-13: 978-0471741879).

Semestre : 4
UE : Découverte
Matière : Communications skills

Objectifs de l'enseignement :

This is a 'service English' communication course intended to prepare the students to communicate and function in English (Lab reports, Industrial experience reports and end of study cycle project reports). The course outline presented in this document is divided into two parts: a first part (first five units) which is considered as a link between the students' previous work in the first two semesters; and a second part consisting of eleven units which will present the students with discourse behaviours and discourse means to communicate and function in English. Other items are treated throughout the programme: mechanics of writing (punctuation, numbering of chapters and sub-chapters, labelling of visuals, quotations...).

Connaissances préalables recommandées : English Courses and Project management

Contenu de la matière :

a) **Part One**

1. Transition from sentence production to the development of continuous prose

2. Devices for linking ideas and sentences: logical, grammatical and lexical connectors

3. Concepts of reference

4. Paragraph Development: Producing pieces of coherent discourse

5. Different types of paragraphs (analysis, description, comparison/contrast, analogy,definition ...)

b) **Part Two**

1. Definition: Explaining what something is

2. Instructions and Process: Explaining how to do something

3. Description of a Mechanism: Explaining how something works

4. Analysis through Classification and Partition: Putting things in order

5. Analysis through Effect and Cause: Answering Why

6. The Summary: Abstracting and Getting to the heart of the matter

7. Using the Library: Getting acquainted with resource materials

8. Visuals: Seeing is convincing

9. Report Writing: Telling it like it is

10. Oral Communication: Saying it clearly

11. Business Letters: Sending a Message through the mail

Mode d'évaluation : Contrôle continu +Examen final