Programme Détaillé par Matière

EE471: Probability and Statistics

Course Information:

Semester: I	**Unit**: UEF11	**Credit Hours:** 6	**Coefficient:** 4
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

Course Objectives:

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

Course Prerequisite(s):

Basic notions of mathematics, computing single and double integrals

Course Outline:

- **Review of Set Theory**
- **Combinatorial Analysis**
- **Probability Definitions**
- **Random Variables, Random Vectors**
- **Some statistics**
- **Some Probability Models**
- **Limit laws: The Central Limit Theorem**
- **Some Statistics**

  - Estimation of Means, Variance, Proportion, Confidence Intervals

  - Introduction to Hypothesis Testing

  - Linear Regression.

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. R. B. Schinazi et R. B. Schinazi, *Probability With Statistical Applications*. Springer, 2001.

2. A. Papoulis, *Probability and Statistics*, 1st ed. Prentice Hall, 1989.

EE473: Advanced Differential Equations

Course Information:

Semester: I	**Unit**: UEF11	**Credit Hours:** 6	**Coefficient:** 4
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

Course Objectives:

To develop, deepen and extend the concepts and tools acquired in previous linear Algebra course.

Course Prerequisite(s):

A course in calculus and a course in linear Algebra

Course Outline:

- **Some Calculus**
- **Ordinary Differential Equations: a continuation**
- **Calculus of Variations**
- **Partial Differential Equations:**
  - First Order PDE
  - Second Order PDE (Linear)
  - Some case studies: Laplace equation, Wave equation and Heat equation for example.

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. G. Stephenson et P. M. Radmore, Advanced Mathematical Methods for Engineering and Science Students. Cambridge University Press, 1990.

2. T. M. U et L. Debnath, *Linear Partial Differential Equations for Scientists and Engineers*. Springer, 2007

EE475: Complex Variable

Course Information:

Semester: I	**Unit**: UEF11	**Credit Hours:** 6	**Coefficient:** 4
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

Course Objectives:

The objective of this course is to introduce the student to basic complex variable function analysis, namely to provide the necessary tools to deal with the analysis of analytic functions

Course Prerequisite(s):

A basic course in analysis (single variable calculus)

Course Outline:

- **Algebra of complex numbers**
- **Function of a complex variable**
- **Analytic functions**
- **Power series**
- **Residues theorem and its applications**
- **Integrals**
- **Conformal mappings**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Ahlfors, Lars V. Complex Analysis : An introduction to the Theory of Analytic functions of One complex variable. 3d Ed. Nex York, McGraw-Hill, 1979.

2. Caratheodory, Constantin. Theory of functions of a complex variable. Vol.2 , NY, Chelsea, 1960.

EE451: Digital Control System

Course Information:

Semester: I	**Unit**: UEF12	**Credit Hours:** 6	**Coefficient:** 4
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

Course Objectives:

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.

Course Prerequisite(s):

Linear algebra and control system courses

Course Outline:

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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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.

EE431: Power Engineering Materials

Course Information:

Semester: I	**Unit**: UEF12	**Credit Hours:** 3	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 52.5

Course Objectives:

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

Course Prerequisite(s):

The student is supposed to have attended physics courses.

Course Outline:

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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Handouts.

EE421: : Computation and Simulation with Matlab

Course Information:

Semester: I	**Unit**: UET11	**Credit Hours:** 3	**Coefficient:** 2
Lecture:1.5 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 36.0

Course Objectives:

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.

Course Prerequisite(s):

Power system, Linear algebra

Course Outline:

- Introduction to use of Matlab : elementary operations, operators, functions.
- Matrix computations and linear algebra.
- programming, curve fitting and visualization
- Introduction to use of SIMULINK with power system toolbox
- Embedding S-function in Simulink
- File I/O, building GUIs.

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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/

EE472: Numerical Methods

Course Information:

Semester: II	**Unit**: UEF21	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

Course Objectives:

Many problems in science, technology, economy etc. can be modeled by mathematical formalisms whose exact solutions are either unknown or are computationally expensive. In these cases, a set of techniques, known collectively as Numerical Methods, produce efficiently approximate solutions to exact solutions.

Course Prerequisite(s):

A basic course in calculus; A basic course in computer programming

Course Outline:

- **Introduction:** Mathematical Preliminaries and Error Analysis.
- **Solutions of equations of one variable:** Bisection, Secant, and Newton-Raphson Methods,. Error Analysis
- **Solution to a system of equations:** Linear Algebraic Methods (Direct Methods (Gauss Elimination, Matrix Factorization, Special Matrices, Iterative Methods. The Jacobi and Gauss-Siedel Methods, the Conjugate Gradient Method Error Analysis.
- **Numerical Integration:** Quadrature Rules, Romberg Integration, Error Analysis.
- **Interpolation and Polynomial Approximation:** Introduction, Lagrange Polynomials, Spline Interpolation, Error Analysis.
- **Numerical Solution of Initial-Value Problems:** Taylor's Methods, Runge-Kutta's Methods, Error Analysis.
- **Approximating Eigen-Values**: Introduction, The Power Method, The Householder's Method, The QR Method, Error Analysis.

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. H.M. Antia. *Numerical Method for Scientists and Engineers*. Mc Graw Hill, 1995.

2. W. Dos Passos. *Numerical Methods, Algorithms and Tools*. Taylor and Francis Group, 2010

3. Numerical Methods. Faires & Burns. 2002.

EE412: Digital Signal Processing

Course Information:

Semester: II	**Unit**: UEF21	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45.0

Course Objectives:

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.

Course Prerequisite(s):

The student is supposed to have attended continuous and discrete time linear systems courses.

Course Outline:

- **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**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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; 3rd edition, 2009.

EE434: Electric Machines

Course Information:

Semester: II	**Unit**: UEF21	**Credit Hours:** 4	**Coefficient:** 4
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45.0

Course Objectives:

The course is intended to provide power engineering students with an active knowledge required to characterize and model the different types of electrical machines.

Course Prerequisite(s):

Calculus I & II, DC and AC circuits, Electric Machines and numerical methods

Course Outline:

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; Revolving fields

Transformer

1- Main types of transformer
2- Inrush current in transformer
3- Characterization of the transformer

Synchronous Machines

1- Main types of AC machines
2- Characterization of the alternator
3- three -phase synchronous motor

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 ;Operation as single-phase motor

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Introduction to Electrical Machines and Transformers» G. McPherson,

2. Lab-Volt laboratory manual.

EE432: : Power System Analysis

Course Information:

Semester: II	**Unit**: UEF22	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

Course Objectives:

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.

Course Prerequisite(s):

Calculus I & II, DC and AC circuits, Electric machines and numerical methods

Course Outline:

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

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

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

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

Transmission lines: modeling and performances

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

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

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

Balanced faults

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

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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

EE444: : Power Electronics

Course Information:

Semester: II	**Unit**: UEF22	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

Course Objectives:

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..

Course Prerequisite(s):

Avoir suivi les cours : electric circuits I and II , Linear differential equations

Course Outline:

- **Introduction** (3h)
- **Power semiconductor switches** (6h)
- **DC/DC converters** (4.5 h)
- **PWM inverters** (6h)
- **Multilevel Inverters** (6h)
- **FACTS** (6h)
- **HVDC** (6h)
- **Gate drive Circuits** (3h)
- **Protection of power devices and circuits** (snubber circuits design ..) (3 h)
- **Reliability of power devices (1.5 h)**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Power Electronics by Muhammad H Rashid

2. http://www.pspice.com

3. Power electronics by Mohan et al.

EE446: NetworkAnalysis

Course Information:

Semester: II	**Unit**: UEF22	**Credit Hours:** 4	**Coefficient:** 3
Lecture:1.5 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

Course Objectives:

To make the students capable of analyzing any given electrical network.

To make the students learn how to synthesize an electrical network from a given

impedance/admittance function.

Course Prerequisite(s):

AC/DC Circuit, and Linear System courses

Course Outline:

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.

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.

Network Topology: Network graph, Tree, Incidence matrix - Fundamental cutsets and fundamental loops – Tie set and cut set schedules – V shift and I shift – Formulation of equilibrium equation on loop basis and node basis, Formulation of equilibrium equation in matrix form – Duality, Construction of dual of a network.

Two Port Networks & Filters: Characterization of two port networks in terms of Z, Y, h, g, T and inverse T parameters – Relations between the network parameters - Network equivalents –Analysis of T, π , ladder and lattice networks - Transfer function of terminated two port networks. Filters- Design of constant K, m derived and composite filters

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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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 McGraw Hill Publishing company limited, New Delhi, 3rd edition, 2007.

EE472L: Numerical Methods Lab

Course Information:

Semester: II	**Unit**: UEM21	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

Course Objectives:

These Numerical analysis Laboratory experiments are designed to help students to solve some equations numerically by applying thought methods.

Course Prerequisite(s):

Numerical analysis and computer programming

Course Outline:

- **Solution of a system of linear equation**
- **Numerical integration**
- **Lagrange Interpolation and polynomial**
- **Spline Interpolation**
- **Numerical solution of differential equations**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

2. W.Dos Passos, Numerical Methods, Algorithms and Tools, Taylor and Francis Group , 2010

EE432L: Power System Analysis Laboratory

Course Information:

Semester: II	**Unit**: UEM21	**Credit Hours:** 2	**Coefficient:** 2
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

Course Objectives:

These experiments are designed to help students to implement some power network using the machines available in the laboratory.

Course Prerequisite(s):

Machines and power systems

Course Outline:

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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

Lab Volt Laboratory Manual

EE434L: Electric Machines Laboratory

Course Information:

Semester: II	**Unit**: UEM21	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

Course Objectives:

These experiments are designed to help students to implement experimental set up and to characterize some electric machines.

Course Prerequisite(s):

Electric Machines courses.

Course Outline:

- **Alternator: Behn-Eshenburg and potier diagram, load studies (isolated), connection to network**
- **Synchronous motor mordey curves, blondel diagram**
- **Asynchronous motor circle diagram, Identification of the equivalent circuit, load studies**
- **Operation as asynchronous generator.**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

Lab Volt Laboratory Manual

EE444L: Power Electronic Laboratory

Course Information:

Semester: II	**Unit**: UEM22	**Credit Hours:** 2	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

Course Objectives:

These experiments are designed to help students to implement some power electronic circuits such as controlled rectifier, chopper; inverters and some FACTS.

Course Prerequisite(s):

Power Electronic course

Course Outline:

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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

Laboratory Manual

EE559: Power System Control and Operation

Course Information:

Semester: III	**Unit**: UEF31	**Credit Hours:** 5	**Coefficient:** 4
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45.0

Course Objectives:

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.

Course Prerequisite(s):

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

Course Outline:

Introduction

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

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

Stability analysis

- Introduction
- Swing equation

- Model of synchronous machine for stability studies
- Steady state stability
- Transient stability
- Numerical solution
- Multimachine systems

Review of system control

- The control problem
- Stability
- Steady state error
- Step response
- Root-locus design of controllers
- Frequency response

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

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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

2. Power generation: operation and control, Allen J. Wood, Bruce F. Wollenberg, J. Wiley and Sons, New York, second edition, 1996.

EE533: : Electric Machines and Drives

Course Information:

Semester: III	**Unit**: UEF31	**Credit Hours:** 4	**Coefficient:** 4
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 52.5

Course Objectives:

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.

Course Prerequisite(s):

Avoir suivi les cours : Power electronics – Electric machines - Electric circuits I and II , Linear differential equations .

Course Outline:

Introduction : The Drive System

DC Drives: single phase drives/3 phase drives / DC to DC converter drives/ Closed loop control of drives

AC drives: Induction motor drives Performance characteristics/ V, I and frequency control/ Closed loop control of Induction motors/ Vector control/

AC drives: Synchronous motor drives / Stepper motor drives

Optimal control of drives (loss minimization)

Power quality Problems effects on drives

Vibration analysis of drives

Protection of electric drive systems

Reliability of electric drive systems

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Power Electronics by Muhammad H Rashid

2. Power Electronics by Mohan et al.

EE535: Protection Devices and Systems

Course Information:

Semester: III	**Unit**: UEF31	**Credit Hours:** 4	**Coefficient:** 4
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45.0

Course Objectives:

The course is intended to provide power engineering students with a good understanding of the most important protection techniques and an active knowledge required to design and implement any protective systems.

Course Prerequisite(s):

The prerequisite courses are: Power System, AC circuits, Electric Machines and DSP.

Course Outline:

Introduction

Fault Analysis

Instrumentation of Measurement

Protective System: modeling and performances

Protection techniques

Electrical Machines Protection

Transformer Protection

Transmission lines Protection

Digital Protection

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Handouts, 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.

EE529:Instrumentation and Programmable Devices

Course Information:

Semester: III	**Unit**: UEF32	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45.0

Course Objectives:

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.

Course Prerequisite(s):

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

Course Outline:

- **Introduction.**
- **Measurement and instrumentation principles.**
- **Instrument transformer.**
- **Signal processing and Measurement systems.**
- **Intelligent electronic devices.**
- **Digital communication and communication protocols**
- **Programmable devices PAC and PLC**
- **Introduction to data acquisition and virtual instruments.**
- **Substation instrumentation and control.**
- **Introduction to SCADA system.**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

EE537: Industrial Power Network

Course Information:

Semester: III	**Unit**: UEF32	**Credit Hours:** 2	**Coefficient:** 2
Lecture: 1.5 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 18.0

Course Objectives:

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.

Course Prerequisite(s):

The student is supposed to have attended power system and Electric Machines courses.

Course Outline:

- **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**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

Handouts

EE539: Reliability, Availability, Maintainability and Safety (RAMS)

Course Information:

Semester: III	**Unit**: UEF32	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45.0

Course Objectives:

- 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.

Course Prerequisite(s):

Knowledge of probabilities and statistics

Course Outline:

- **Introduction to dependability in Power system**
- **Reliability engineering in Power systems**
- **Availability**
- **Maintainability**
- **Safety**
- **Cost reliability optimization**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

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

EE559L: Power System Control and Operation Laboratory

Course Information:

Semester: III	**Unit**: UEM31	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18.0

Course Objectives:

These Power System control and operation experiments are designed to help students implement some controller dedicated to power system.

Course Prerequisite(s):

The student is supposed to have attended in parallel Power System control and operation.

Course Outline:

- **Introduction to software power world.**
- **Load flow study.**
- **Power system including stabilizer.**
- **Power system including AGC**
- **Some modern control application to power system**
- **SCADA system.**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Lab Volt laboratory manual

2. G.W. Stagg and Albaid, Computer methods in Power system Analysis,

EE533L: Machines and Drives Laboratory

Course Information:

Semester: III	**Unit**: UEM31	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18.0

Course Objectives:

These experiments help the students to investigate:

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

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

Course Prerequisite(s):

The student is supposed to have attended in parallel Machines and Drives course.

Course Outline:

- **DC Motor Speed Control using Controlled Rectifier** (Open-loop Speed Control)
- **DC Motor Speed Control using Chopper** (Open-loop Speed Control)
- **DC Motor Drive with Current and Speed Feedbacks** (Closed-loop Speed Control)
- **AC Motor Speed Control using Variable Voltage** (Open-loop Speed Control)
- **AC Motor Speed Control using Variable Frequency** (Open-loop Speed Control**)**
- **AC Motor Drive with Current and Speed Feedbacks Using Inverter (**Closed-loop Speed Control)
- **Autopilot Synchronous Machine**

Assessment Method: Continuous+ Final Exam

Textbook(s) and/or other required material:

Lab Volt laboratory manual

EE529L: Instrumentation and Programmable Devices Laboratory

Course Information:

Semester: III	**Unit**: UEM31	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18.0

Course Objectives:

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.

Course Prerequisite(s):

The student is supposed to attend instrumentation and programmable devices course.

Course Outline:

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

Assessment Method: Continuous+ Final Exam

Textbook(s) and/or other required material:

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

EE537L: Industrial Power Network Laboratory

Course Information:

Semester: III	**Unit**: UEM31	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18.0

Course Objectives:

This is a companion laboratory experiments for the Industrial Power Network course; the objective is to provide the students by the practical concepts and discuss the limitations.

Course Prerequisite(s):

The student is supposed to attend Industrial Power Network course.

Course Outline:

- **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**

Assessment Method: Continuous+ Final Exam

Textbook(s) and/or other required material:

Lab Volt Laboratory Manual

EE531: Renewable Energy

Course Information:

Semester: III	**Unit**: UED31	**Credit Hours:** 2	**Coefficient:** 2
Lecture:1.5 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 18.0

Course Objectives:

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.

Course Prerequisite(s):

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

Linear differential equations

Course Outline:

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

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

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

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

Assessment Method: Final Exam

Textbook(s) and/or other required material:

1. Solar Electricity , Tomas Markvart , 2nd edition , 2001, John Wiley.

2. Energie Solaire Photovoltaique , 3ème édition, Anne Labouret , Michel Villoz, Dunod 2006.

EL502: Communication Skills

Course Information:

Semester: IV	**Unit**:	**Credit Hours: 3**	**Coefficient: 2**
Lecture: hrs/week	**Recitation:** hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 40.0

Course Objectives:

To provide samples of academic writing and appropriate practice materiel for such student and also for those students who need to write papers and reports in English

Course Prerequisite(s):

English

Course Outline:

a) Part One

- Transition from sentence production to the development of continuous prose
- Devices for linking ideas and sentences: logical, grammatical and lexical connectors
- Concepts of reference
- Paragraph Development: Producing pieces of coherent discourse
- Different types of paragraphs (analysis, description, comparison/contrast, analogy,definition ...)

b) Part Two

- Definition: Explaining what something is
- Instructions and Process: Explaining how to do something
- Description of a Mechanism: Explaining how something works
- Analysis through Classification and Partition: Putting things in order
- Analysis through Effect and Cause: Answering Why
- The Summary: Abstracting and Getting to the heart of the matter
- Using the Library: Getting acquainted with ressource materials
- Visuals: Seeing is convincing
- Report Writing: Telling it like it is
- Oral Communication: Saying it clearly
- Business Letters: Sending a Message through the mail

Assessment Method: Continuous + Final exam

Textbook(s) and/or other required material:

1. R. R. Jordan, "Academic writing course , " Harper Collins publishers 1990.

2. T. A. Sherman and S. S. Johnson "Modern Technical Writing " 5th ed, prentice hall.

EE582: Project Management

Course Information:

Semester: IV	**Unit**:	**Credit Hours: 3**	**Coefficient: 2**
Lecture: hrs/week	**Recitation:** hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 40

Course Objectives:

The objectives of this course are to provide a basic acquaintance with elementary concepts of production planning and organization in order to make sound production and management decisions.

Course Prerequisite(s):

Economics Basics

Course Outline:

- **Background of production management**
- **Basic economic concepts**
- **Equipment and storage**
- **Procurement and storage**
- **Production planning and control**
- **Product design**

Assessment Method: Continuous + Examen final

Textbook(s) and/or other required material:

1. Harold Koontz and Cyril O'donnel, "Management, " 5th ed, Mc Graw Hill.
2. F. G. Moore and T. E. Henkel, , "Production/Operations Management, " 8th ed, Mc Graw Hill.