III - Programme détaillé par matière

Semestre : 1
Unité d'enseignement : UEF 1.1
Matière : Maths I
VHS: 67h30 (Cours: 3h00, TD: 1h30)
Crédits: 6
Coefficient: 3

Course Objectives:

This course is designed to provide a foundation whereby students develop a good understanding of differential and integral calculus, develop the ability to reason logically and rigorously and are prepared for higher level mathematical courses. At the end of the course, students are expected to gain conceptual and practical knowledge and understanding of differential calculus, integral calculus.

Course Prerequisite(s):

High school mathematics program

Course Outline:

- **Review of Basic notions:** limits, continuity, derivatives, graphs
- **Integrals, Exponentials, Logarithms :**
- **Polar Coordinates**: parametric curves, Length of a curve
- **Circular and Hyperbolic Trig Functions**: Definitions, Graphs, Inverses
- **Techniques of Integration :** Partial fraction expansion, Trigfunctions, IrrationalFunctions
- **Improper Integrals:** Limits, Hospital's Rule, Indeterminate Forms
- **Infinite Series :** Convergence, Tests, Power series, Taylor'sseries

Assessment Method : Continuous + Final Exam

Textbook(s) and/or other required material:

Salas and Hill, 'Calculus', John Wiley and Sons.

Semestre: 1
Unité d'enseignement: UEF1.1
Matière : Algorithmic
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Crédits: 5
Coefficient: 2

Course Objectives:

The objective of this course is to enable students to learn the programming basics for problem solving. This course will focus more on the solution's analysis and design. The purpose is therefore to make students able to gather the problems' requirements before tracing the design of their solutions. The use of algorithms and flowcharts in the design stage covers the major part of the course. At the end of this semester, students will be introduced with an implementation stage in which they will learn how to convert a given algorithm into a computer program using the C high programming language.

Course Prerequisite(s): None

Course Outline:

1. Introduction to computers and computing.
   a. Computer fundamentals, b) Computer hardware, c) Computer software
2. Introduction to algorithms and programming concepts
   a. Programming basics for problem solving
   b. Steps of the program development process
   c. Key features of an algorithm and the step-form
   d. Variables and data types
   e. Input/output functions
   f. Control Statements (conditional and iterative control statements).
   g. Flowcharts
   h. Complex data types (arrays, strings, and structures).
3. The Process of Programming
   a. Programming environment, b) Programming in C, c) Converting algorithms into C programs, d) C control flow (conditional and iterative control statements in C).

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Introduction to algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein.
2. Problem solving and programs with C by Christie Ezeife.

Computer Fundamentals and Programming in C by Pradip Dey and Manas Ghosh.

Semestre: 1
Unité d'enseignement: UEF 1.2
Matière : Physics I
VHS: 67h30 (Cours: 3h00, TD: 1h30)
Crédits: 6
Coefficient: 3

Course Objectives:

To give students an understanding of the physical concepts of translational and rotational kinematics, dynamics and heat and to help them develop an organized approach to solving problems

Course Prerequisite(s):

High school physics and mathematics programs

Course Outline:

- **Measurements:** Units, dimensions, the International System of units, dimensional analysis
- **Vectors**: Scalar and vector products
- **Kinematics**: Concepts of position, displacement, speed, velocity and acceleration, planar motion, circular motion, relative motion
- **Force and Newton's Laws:** Concept of a force, Newton's laws, free body diagrams, friction application of Newton's Laws
- **Work and Energy:** Work**,** kinetic energy, work energy theorem, potential energy, conservative forces, conservation of mechanical Energy, non-conservative Forces
- **Center of Mass and Linear Momentum:** conservation of linear momentum, collision in 1D
- **Rotating Rigid Bodies:** Moment of inertia, parallel axis and perpendicular axis theorems, torque, rotational kinetic Energy
- **Torque and Angular Momentum:** Angular momentum**,** conservation of angular momentum

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Fundamentals of Physics, D. Halliday and R. Resnick, 9th Ed.
Physics for Scientists and Engineers, R. A. Serway, J. W. Jewett, 6th ed.

Semestre: 1
Unité d'enseignement: UEF 1.2
Matière : Chemistry I
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Crédits: 4
Coefficient: 2

Course Objectives:

Students will acquire a fundamental background in electronic and nuclear reactions, interactions of chemical elements and related properties, electronic structures, wave nature and atomic spectra of matter related to electronic excitations states mostly used in electronics.

Course Prerequisite(s):

Differential and integral calculus, dimensional analysis

Course Outline:

- **Matter and Atomic Structure:** Kinds of substances, Microscopic and macroscopic nature of matter, Atomic theories, Atomic mass measurement, Isotopes
- **Radioactivity and Nuclear Reactions:** Radioactivity, Nuclear reactions, energy and Einstein equation, Nuclear stability and binding energy, Rate of radioactive decay
- **The Electronic Structure of the Atom and Atomic Spectra:** Properties of electron in the atom and molecule, the BOHR theory- the hydrogen atom, Electron configuration and arrangement in the atom
- **Chemical Reaction Equations :** Le Chatelier principle, Chemical equation, Reaction kinetics, Acid- base reactions, oxydo-reduction reaction and electrochemistry
- **Chemical Bonding:** Ionic bonding, Covalent bonding, Lewis structure, Molecular geometry

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

Chemistry, J. A. Olmsted, G. M. Williams, 4th edition, J. Willey & sons inc,2006

Semestre: 1
Unité d'enseignement: UEM 1.1
Matière : Physics I Lab
VHS: 22h30 (TP: 1h30)
Crédits: 2
Coefficient: 2

Course Objectives:

These physics experiments are designed to help students verify physical laws and relationships by manipulating equipment, recording and organizing data, and drawing conclusions through data and error analysis.

Course Prerequisite(s):

Calculus, Physics I

Course Outline:

- Measurement and error analysis
- Free fall or Projectile motion
- Inertia balance
- Applications of Newton's laws
- Collisions in one dimension
- Rotational motion and moment of inertia

Assessment Method: Continuous

Textbook(s) and/or other required material:

Physics Laboratory Booklet.

Semestre: 1
Unité d'enseignement: UET 1.1
Matière : ENGLISH I
VHS: 45h00 (TD: 3h00)
Crédit: 3
Coefficient: 2

Objectives
The course outlines are suggested to accomplish a set of objectives while focusing on the teaching of the four language skills.

The English course includes the following modules:
1. Reading and writing
2. Listening and speaking
3. EST topics
4. Language and Grammar

Recommended prior Knowledge: Basic general English

1. READING AND WRITING MODULE

Reading
The reading course is tailored to develop student's abilities to read complex, challenging and lengthy texts, written with different styles, independently. In addition to the ability to analyze the texts critically and practice answering the different instructions related to reading comprehension tasks.
Whole semester materials for teaching are based on sentence and paragraph levels. Teachers are called to adopt materials and use different textbooks to reach the course objectives. Thus, creativity is a crucial ability for teachers.

Content:

Unit one: Introduction to skimming and scanning (short extracts)
Unit two: Skimming for main idea (-Paragraph headings -Sentence and summary completion)
Unit three: I identifying main and supporting ideas in paragraphs (multiple choice questions)
Unit four: Following sequence of events (Flow charts – note completion)
Unit five: Distinguishing facts/ opinions (yes/ no/ not mentioned – true /false/ not given)
Unit six: Dealing with research based texts (asking and answering questions – summary writing)
All the previous units include tasks related to learning vocabulary retention, grammar structures and punctuation.

Writing
The main objective of the writing course is to train students to efficiently write coherent and cohesive paragraphs and develop critical thinking in writing by recognizing elements of discourse in different writing genres. In addition to mastering the skill of summarizing scientific and literary works in an appropriate academic style.

Content:

Unit one: Introduction (understanding process writing- punctuation- capitalization- spelling)
Unit two: Writing different types of sentences (simple/ complex/ compound/ compound complex
Link words- connecting phrases and sentences together – paraphrasing and avoiding plagiarism)
Unit three: Structure of a paragraph (topic sentence- supporting details- concluding statement- summary writing)

Unit four: Types of paragraphs (definition descriptive and process- opinion- comparison and contrast- problem solution)
Unit five: Analyze and report information (graphs/ charts/ tables – structure of lab reports)
Unit six: Editing and proofreading (revising drafts intelligently- academic style)

Evaluation mode: continuous(40%) exam(60%)

2. LISTENING AND SPEAKING MODULE

Objectives

The following list is a sequence of objectives to be accomplished by the student while focusing on listening and speaking as language skills. These skills are important since classroom learning is based on these abilities.

Content

- Pronounce letters and sounds (keyed to spelling)
- Repeat words / sentences / phrases
- Read aloud comprehensibly (sound-spelling coordination)
- Ask for word meaning
- Ask for information when something is not understood
- Understand question forms : yes/no, wh-, affirmative-negative
- Give information about a person : biographical details, activities
- Practice intonation and pronunciation of questions, commands, and sentences
- Produceinflectionalendings (plurals, verbtense, etc.)
- Recognize new words occurring within a mini-lecture by context and knowledge of roots and affixes
- Recognize or supply correct vocabulary or grammatical form necessary in a focused listening text
- Understand the description and function of an object
- Discuss instruments or tools : parts, size, types, colors, materials and purposes.
- Express simple desires
- Make requests and commands (recognize difference)
- Comprehend intonation and stress pattern that would occur within a lecture
- Be able to produce and understand the purpose of an instruction or command
- Identify significant facts, main ideas and supporting evidence from a simple lecture with visual cues
- Tell a simple narrative in the past
- Relate future plans
- Hear and define key sub- technical vocabulary within a listening text
- Answer a problem with visuals as aids
- Explain moving parts or changes
- Ask specific questions about specific details : wh-, yes/no, either-or
- Understand technical definitions given within a lecture

Evaluation mode: continuous(40%) exam(60%)

3. EST MODULE

Objectives

The list bellow consists of EST topics to be introduced in the first semester. The concepts are introduced at a sentence and a paragraph level. The aim is to get students acquainted with the special technical terminology (English for Specific Purposes ESP), and language structure needed when communicating in the technical courses.
Although the module is constructed on a subject syllabus, it treats the language on a topical-structural basis. In addition to the technical and structural components, functional notions are introduced gradually to prepare students write definitions, descriptions, comparisons…
The method of teaching is not exclusively limited to the reading and reading lessons; they are rather treated on in an integrative basis using videos and other materials.

Content

Drawings- shapes- measurements –area – size and mass – numbers and calculations – materials technology – materials properties - current – magnetism – voltage – circuits – energy and temperature – induction – deduction – probability - metals – non metals – compounds – elements……

- Introduction to Electricity
- Structure of Matter
- Atomic Theory
- Electrical Charges
- How to Produce Electricity
- Electric Current
- Effects of Electricity
- Magnetism
- Electromagnetism
- Electricity and magnetism at work

Evaluation mode: continuous(40%) exam(60%)

4. GRAMMAR MODULE

The grammar course is too vast to be covered in one semester. The teacher has to decide on which items to cover in class according to the students' levels. The following points are mainly to be covered.

Content

- Review of the English tenses: simple resent, simple past, present continuous, past continuous, present perfect, past perfect, and future, etc. .
- Models, if clauses, passive voice, reported speech, questions, and auxiliary verbs
- Articles, countable and uncountable nouns, pronouns, determiners
- Relative clauses, adjectives and adverbs, conjunctions and prepositions, and phrasal verbs

Evaluation mode: continuous(40%) exam(60%)

References:

1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office des Publications Universitaires, 1994.
2. A.J. Herbert, The Structure of Technical English, Longman, 1972.
3. S. Berland-Delepine, Grammaire méthodique de l'anglais moderne avec exercices, Ophrys, 1982.
4. Test of English as a Foreign Language – Preparation Guide, Cliffs, 1991.
5. R. Fowler, The Little, Brown Handbook, Little, Brown Company, 1980.
6. Cambridge – First Certificate in English, Cambridge books, 2008.
7. K. Wilson, Th. Healy, First Choice, Oxford, 2007.
8. M. Mann, S. Tayore-Knowles, Destination: Grammar & Vocabulary with Answer Key, MacMillan, 2006.
9. E. Hamby, Ph. Bedford Robinson, Special English Computer Applications, Cassell, 1980.
10. P. Charles Brown, Norma D. Mullen, English for Computer Science, Oxford University Press, 1989.
11. Graeme Kennedy, Structure and Meaning in English: A Guide for Teachers, Pearson, 2004.
12. Anne M. Hanson, Brain-Friendly Strategies for Developing Student Writing Skills, 2nd Edition, Corwin Press, 2008.
13. Ann Bridges, How to Pass Higher English, Hodder Gibson-Hachette, 2009.
14. Claude Renucci, Anglais : 1000 Mots et expressions de la presse : Vocabulaire et expressions du monde économique, social et politique, Fernand Nathan, 2006.

Online resources :

1. Ielts preparation; toefel preparation. listening comprehension, and note taking
2. http://www.learn4good.com/languages/spec_english_toefl.htm;

3. http://www.rong-chang.com/listen.htm;
4. http://www.testpreppractice.net/IELTS/Free-Online-IELTS-Practice-Tests.aspx

Semestre: 1
Unité D'enseignement: UET 1.1
Matière : Writing Methods
VHS: 45h00 (TD: 3h00)
Crédits: 3
Coefficient: 2

Objectives
The course outlines are suggested to accomplish a set of objectives while focusing on the teaching of two language skills.

Recommended prior Knowledge: Basic general English

1. READING AND WRITING MODULE

Reading
The reading course is tailored to develop student's abilities to read complex, challenging and lengthy texts, written with different styles, independently. In addition to the ability to analyze the texts critically and practice answering the different instructions related to reading comprehension tasks.
Whole semester materials for teaching are based on sentence and paragraph levels. Teachers are called to adopt materials and use different textbooks to reach the course objectives. Thus, creativity is a crucial ability for teachers.

Content:

Unit one: Introduction to skimming and scanning (short extracts)
Unit two: Skimming for main idea (-Paragraph headings -Sentence and summary completion)
Unit three: I identifying main and supporting ideas in paragraphs (multiple choice questions)
Unit four: Following sequence of events (Flow charts – note completion)
Unit five: Distinguishing facts/ opinions (yes/ no/ not mentioned – true /false/ not given)
Unit six: Dealing with research-based texts (asking and answering questions – summary writing)
All the previous units include tasks related to learning vocabulary retention, grammar structures and punctuation.

Writing
The main objective of the writing course is to train students to efficiently write coherent and cohesive paragraphs and develop critical thinking in writing by recognizing elements of discourse in different writing genres. In addition to mastering the skill of summarizing scientific and literary works in an appropriate academic style.

Content:

Unit one: Introduction (understanding process writing- punctuation- capitalization- spelling)
Unit two: Writing different types of sentences (simple/ complex/ compound/ compound complex Link words- connecting phrases and sentences together – paraphrasing and avoiding plagiarism)
Unit three: Structure of a paragraph (topic sentence- supporting details- concluding statement- summary writing)
Unit four: Types of paragraphs (definition descriptive and process- opinion- comparison and contrast- problem solution)
Unit five: Analyze and report information (graphs/ charts/ tables – structure of lab reports)
Unit six: Editing and proofreading (revising drafts intelligently- academic style)

2. GRAMMAR MODULE

The grammar course is too vast to be covered in one semester. The teacher has to decide on which items to cover in class according to the students' levels. The following points are mainly to be covered.

Content

- Review of the English tenses: simple resent, simple past, present continuous, past continuous, present perfect, past perfect, and future, etc.
- Models, if clauses, passive voice, reported speech, questions, and auxiliary verbs
- Articles, countable and uncountable nouns, pronouns, determiners
- Relative clauses, adjectives and adverbs, conjunctions and prepositions, and phrasal verbs

References :

1. J. Upjohn, S. Blattes, V. Jans, Minimum Competence in Scientific English, Office des Publications Universitaires, 1994.
2. A.J. Herbert, The Structure of Technical English, Longman, 1972.
3. S. Berland-Delepine, Grammaire méthodique de l'anglais moderne avec exercices, Ophrys, 1982.
4. Test of English as a Foreign Language – Preparation Guide, Cliffs, 1991.
5. R. Fowler, The Little, Brown Handbook, Little, Brown Company, 1980.
6. Cambridge – First Certificate in English, Cambridge books, 2008.
7. K. Wilson, Th. Healy, First Choice, Oxford, 2007.
8. M. Mann, S. Tayore-Knowles, Destination: Grammar & Vocabulary with Answer Key, MacMillan, 2006.
9. E. Hamby, Ph. Bedford Robinson, Special English Computer Applications, Cassell, 1980.
10. P. Charles Brown, Norma D. Mullen, English for Computer Science, Oxford University Press, 1989.
11. Graeme Kennedy, Structure and Meaning in English: A Guide for Teachers, Pearson, 2004.
12. Anne M. Hanson, Brain-Friendly Strategies for Developing Student Writing Skills, 2nd Edition, Corwin Press, 2008.
13. Ann Bridges, How to Pass Higher English, Hodder Gibson-Hachette, 2009.
14. Claude Renucci, Anglais : 1000 Mots et expressions de la presse : Vocabulaire et expressions du monde économique, social et politique, Fernand Nathan, 2006.

Online resources :

1. Ielts preparation; toefel preparation. listening comprehension, and note taking
2. http://www.learn4good.com/languages/spec_english_toefl.htm;
3. http://www.rong-chang.com/listen.htm;
4. http://www.testpreppractice.net/IELTS/Free-Online-IELTS-Practice-Tests.aspx

Evaluation mode : continuous (40%) exam (60%)

Semestre: 1
Unité d'enseignement : UET 3.1
Matière : Ethics and Deontology : The Fundamentals.
VHS : 22h30 (Cours : 1h30)
Crédits : 1
Coefficient : 1

Subject Objective:

This subject aims at introducing students to ethics and deontology principles that guide their academic life and prepare them for their future career as they represent the nation's future employees, researchers and social actors.

Course Prerequisite (s): Basic English

Subject content:

Introduction

1. Basic Notions

a. Morality
b. Ethics
c. Deontology
d. Law
e. Ethics Vs Morality
f. Ethics Vs Deontology

2. References

a. Philosophical references
b. Religious reference
c. Civilisations evolution
d. Institutional reference

3. Academic Freedom "University Franchise"

a. The Academic Freedom Concept
b. Regulations
c. Academic Freedom Guarantees
d. Campus Players

4. Academic Values

a. Social Values
b. Community Values
c. Professional Values

5. Rights and Duties

a. Student Rights
b. Student Duties
c. Teacher Rights
d. Teacher-Researcher Duties
e. Administrative and Technical Personnel Duties

6. Academic Relations

a. Definition of the Academic Relations Concept
b. Student-Teacher Relations
c. Student-Student Relations
d. Student-Personnel Relations
e. Student-Association Member Relations

7. Practices

a. Good Practices for the Teacher
b. Good Practices for the Student

References

1. Recueil des cours d'éthique et déontologie des universités algériennes.
2. Barberi, J.F., « Morale et droit des sociétés » *inLes Petites Affiches*, n°68, 7 juin 1995.
3. Russ, J., *La pensée éthique contemporaine*, Paris, Puf, Que sais-je ?, 1995.
4. Legault, G.A., *Professionnalisme et délibération éthique*, Québec, Presses de l'université du Québec, 2003.
5. Siroux, D., « Déontologie », *in* M. Canto-Sperber (dir.), *Dictionnaire d'éthique et de philosophie morale*, Paris, Quadrige, 2004.
6. Prairat, E., « Les métiers de l'enseignement à l'heure de la déontologie » *in Education et sociétés*, n°23, 2009.
7. https://elearning.univ-annaba.dz/pluginfile.php/39773/mod_resource/content/1/Cours%20Ethique%20et%201a%20d%C3%A9Ontologie.pdf.

Semestre: 2
Unité d'enseignement : UEF21
Matière : Maths II
VHS: 52h30 (Cours: 2h30, TD: 1h00)
Crédits: 4
Coefficient: 2

Objectifs de l'enseignement

The course is designed to help students deepen conceptual understanding of calculus and develop the intuitive understanding, theory, and computational skills necessary for the concepts of calculus of scalar functions of several variables and the calculus of vector functions.

Connaissances préalables recommandées

Mathematics I

Contenu de la matière:

- **Multivariable functions: Partial derivatives, Conic surfaces, Min and Max**
- **Double and Triple Integrals: Application to Centroids**
- **Cylindrical and Spherical coordinates: Applications, Area of a surface**
- **Line Integrals: Fundamental Theorem, Green's Theorem, applications**
- **Vector Product, Divergence, Curl and Gradient:**

Mode d'évaluation:

Continuous: 40% ; Final Exam : 60%.

Références bibliographiques:

1. Salas and Hill, Calculus, John Wiley ans Sons

Semestre: 2
Unité d'enseignement: UEF21
Matière : Maths III
VHS: 37h30 (Cours: 1h30, TD: 1h00)
Crédits: 4
Coefficient: 2

Objectifs de l'enseignement

To help students understand the concepts and methods of linear algebra and develop abstract and critical reasoning by studying logical proofs and the axiomatic method as applied to linear algebra.

Connaissances préalables recommandées

Differential and IntegralCalculus

Contenu de la matière:

- Basic Algebraic Structures: Sets, Groups, Rings, Fields, Polynomials
- Vector Spaces of Finite Dimension: Vector spaces, subspaces, spanned subspaces, operations on subspaces
- Basis/Dimension: Linear independence, basis, dimension, extensions to a basis
- Linear Mappings: Mappings, types, linear mappings, rank/nullity, Non singular mappings, matrix representation of linear mappings
- Matrices: Operations, rank/nullity, special matrices, echelon form, non-singular matrices
- Determinants: Explicit form, Laplace expansion , Adjoint matrices, Applications
- Equivalence/Similarity: Change of basis, equivalence, similarity
- Eigenvalues/Eigenvectors: Eigenvalues, eigenvectors, diagonalization, Jordan canonical form, minimal polynomial

Mode d'évaluation:

Continuous + Final Exam

Références bibliographiques:

1. Elementary Differential Equations with Linear Algebra, R.S. Finney, Addison-Wesley.
2. Introduction to matrices and linear transformations, D.T. Finkbeiner II, W. H. Freeman

Semestre: 2
Unité d'enseignement: UEF22
Matière : Physics II
VHS: 60h00 (Cours: 3h00, TD: 1h00)
Crédits: 6
Coefficient: 3

Objectifs de l'enseignement

To acquire the principles of electrostatics, magneto-statics and geometrical optics

Connaissances préalables recommandées

Differential and IntegralCalculus, Physics I

Contenu de la matière:

- **Electric Field:** Electric charge, Coulomb's law, superposition principle, electric field, electric field of a discrete charge distribution and of a continuous charge distribution.
- **Gauss's Law:** Flux of a vector field, Gauss's theorem, conductors in an electric Field
- **Electrostatic Potential:** Potential energy, potential, potential due to a point charge, to a discrete charge distribution and to a continuous charge distribution, relationship between the electric field and the potential, equipotential surfaces, electric potential energy of a system of a system of N discrete point charges, the electric dipole
- **Current and Ohm's Law:** Current density, Ohm's law
- **The Magnetic Field:** The magnetic field**, f**orce on a moving charge, work of a magnetic force, magnetic force on a current, torque on a current Loop, motion of a point Charge in a magnetic Field, applications
- **Ampere's Law:** Ampere's law, Biot-Savart law, magnetic Field near a long Straight current, magnetic field along the axis of a plane circular current, definition of the Amp
- **Electromagnetic Induction:** Faraday's experimental observations, Faraday' law of induction, Lenz's law,Self inductance, Mutual inductance
- **Geometrical Optics**: Reflection and refraction, thin lenses

Mode d'évaluation:

Continuous + Final Exam

Références bibliographiques:

1. Fundamentals of Physics, D. Halliday and R. Resnick, 9th Ed.
2. Physics for Scientists and Engineers, R. A. Serway, J. W. Jewett, 6th Ed.

Semestre: 2
Unité d'enseignement: UEF22
Matière : Chemistry II
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Crédits: 3
Coefficient: 2

Objectifs de l'enseignement

Acquire fundamentals in organic compounds and intermediates mostly used in electronic technologies, as solvents, etchings agents, dopants and many other chemicals.

Connaissances préalables recommandées

Chemistry 1 serves as an important support to understand organic structures

Contenu de la matière:

- **Matter, Molecular Formula and Identification of Organic Compounds**: Molecular formula of OC, Separation of matter, Identification of org. compounds
- **Molecular Structure and Stereochemistry of Organic Compounds**: Molecular Geometry, Conformation configuration of org. compounds, ,Isomers, optical activity, Enantiomers, Fischer projection and R, S configuration, (Cahn-Imgold) Nomenclature
- **Chemical Reactions of Organic Compounds:** Type of reactions, reaction mechanism, reaction rates and kinetics, Catalysis of org. reactions
- **Hydrocarbons** : Classification of Hydrocarbons (HC), Nomenclature of organic compounds, Aliphatics: saturated and unsaturated, Aromatics
- **Oxygenated Hydrocarbons**: Single bonded oxygenated HC: Alcohols, phenols, Double bonded oxygenated HC: carboxylic acids, esters and carboxylic acids derivatives
- **HeterofunctionnalHydrocarbons** : Amides, Amines, Halides and chlorinated

Mode d'évaluation:

Contrôle continu: 40% ; Examen: 60%.

Références bibliographiques:

1. Organic chemistry, Thomas N. Sorrell, 2nd edition, copyright 1999-2006.

Semestre: 2
Unité d'enseignement: UEM21
Matière : Electrical Engineering I
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Crédits: 3
Coefficient: 2

Objectifs de l'enseignement

At the end of this course, the student is expected to be able to apply Ohm's law and Kirchhoff's voltage and current laws to analyze simple circuits, excited by dependent and independent direct current sources, using mesh and nodal analysis methods**.**

Connaissances préalables recommandées

High school calculus + physics

Contenu de la matière:

- **Voltage and Current:** Definitions and measurements
- **Ohm's Law, Power and Energy**: resistance of a section of a conductor, resistor color codes, conductance, Voltage, current and resistance in a simple circuit using Ohm's, Power, energy
- **Basic DC Analysis:** Ohm's and voltage divider rule, Kirchhoff's voltage law, Kirchhoff's current law
- **Methods of Analysis:** Convert a voltage source to an equivalent current source and vice versa, analyze circuits having two or more current sources in parallel, write and solve mesh equations for a network, write and solve nodal equations for a network, convert a resistive Λ to an equivalent Y circuit and vice versa
- **Network Theorems:** Superposition, Thévenin's theorem and Norton's theorem, maximum power
- **Capacitance and capacitors:** Concept of capacitance, capacitors, capacitance of series and parallel capacitors, voltage and current for simple time varying waveforms, stored energy, charge and discharge of a capacitor in simple RC circuits

Mode d'évaluation:

Contrôle continu: 40% ; Examen: 60%.

Références bibliographiques:

1. Engineering Circuit Analysis, .W. H. Hayt, J. E. Kemmerly, and S. T. Durbin, 6th edition
2. Introductory Circuit Analysis, R. L. Boylestad, 10th edition

Semestre : 2
Unité d'enseignement : UEM21
Matière : Introduction to Programming
VHS: 37h70 (Cours: 1h30, TD: 1h00)
Crédits: 2
Coefficient: 2

Objectifs de l'enseignement

Students will become familiar with problem solving techniques and algorithm development and implementation using computers.

Connaissances préalables recommandées

Algorithmique.

Contenu de la matière :

- **Introduction to Programming & Basics of C**: Concepts of algorithm and flowcharts, process of compilation, generation of languages, basic features of C language like identifier, keywords, variable, data types, operators and expressions, basic screen and keyboard I/O.
- **Control Statements**: Test conditions, conditional execution and selection, iteration and repetitive executions, nested loops.
- **Arrays:** Introduction to contiguous data types, one dimensional arrays, multidimensional arrays, array as strings, multidimensional character arrays, operations on strings.
- **Functions:** Concept of modular programming using functions, scope of data, recursive functions, command line arguments
- **Pointers:** Need of pointers, types and uses of pointers, array and pointers, pointers and strings, pointer to pointer, pointers and functions, other aspect of pointers
- **User Defined Data Types:** Introduction to structures, usage of structure, nested structures, union and its usage, enumeration types, bit fields
- **Files:** Types of files, working with files, usage of file management functions
- **Linked Lists:** Introduction to dynamic memory allocation, singly link list, operations on singly link list.
- **Other Features of C:** Bitwise operators and its usage, C preprocessor statements

Mode d'évaluation:

Continuous + Final Exam

Références bibliographiques:

1. Programming in C, by Pradip Dey & Manas Ghosh
2. C for Dummies, by D. Gookin

Semestre: 2
Unité d'enseignement : UEM21
Matière : Electrical Engineering Lab
VHS: 22h30 (TP: 1h30**)**
Crédits:2
Coefficient: 1

Objectifs de l'enseignement

These laboratory physics experiments are designed to enhance the students' skills in performing experiments related to electrical engineering course.

Connaissances préalables recommandées

High school calculus + physics

Contenu de la matière:

- **Voltage and Current:** Definitions and measurements
- **Ohm's Law, Power and Energy**: resistance of a section of a conductor, resistor color codes, conductance, Voltage, current and resistance in a simple circuit using Ohm's, Power, energy
- **Basic DC Analysis:** Ohm's and voltage divider rule, Kirchhoff's voltage law, Kirchhoff's current law
- **Methods of Analysis:** Convert a voltage source to an equivalent current source and vice versa, analyze circuits having two or more current sources in parallel, write and solve mesh equations for a network, write and solve nodal equations for a network, convert a resistive Λ to an equivalent Y circuit and vice versa
- **Network Theorems:** Superposition, Thévenin's theorem and Norton's theorem, maximum power
- **Capacitance and capacitors:** Concept of capacitance, capacitors, capacitance of series and parallel capacitors, voltage and current for simple time varying waveforms, stored energy, charge and discharge of a capacitor in simple RC circuits

Mode d'évaluation: Examen: 100%.

Références bibliographiques:

1. Engineering Circuit Analysis, .W. H. Hayt, J. E. Kemmerly, and S. T. Durbin, 6th edition
3. Introductory Circuit Analysis, R. L. Boylestad, 10th edition

Semestre: 2
Unité d'enseignement: UEM2.1
Matière : Physics II Lab
VHS: 15h00 (TP: 1h00)
Crédits: 2
Coefficient: 1

Objectifs de l'enseignement

These laboratory physics experiments are designed to enhance the students' skills in performing experiments (Verification of laws, data recording and data analyzing).

Connaissances préalables recommandées

Calculus, Physics I and Physics II

Contenu de la matière:

- Electric field mapping
- Measurement of the permittivity of air
- Magnetic effects or electromagnetic induction
- Measurement of the permeability of air or Measurement of the permeability of iron
- Reflection and refraction
- Lenses

Mode d'évaluation: Examen: 100%.

Références bibliographiques :

Physics Laboratory Booklet

Semestre: 2
Unité d'enseignement: UET 2.1
Matière : English II
VHS: 30h00 (TD: 2h00)
Crédits: 2
Coefficient: 1

Objectives
The objectives of the second semester courses are the same as the ones of the first semester, the difference between them being the length of materials used for teaching. In addition to the use of chapter or article materials, there is a strong emphasis on managing time. The latter, to train students to achieve many tasks of reading, writing, speaking, and listening in a limited time.

Recommended prior Knowledge:
English I courses taught in semester 1

This semester includes only two modules:

1. Reading and writing
2. Listening and speaking

1.READING AND WRITING MODULE

Reading
The course content is similar to the one in the first semester, but the reading texts are longer and more challenging.

Writing
The course mainly focuses on essay writing and report writing

- Structure of an essay (Thesis statement/ outlining/ Introduction/ main body paragraphs/ conclusion)
- Types of essays
-Understanding instructions for essay tests
-Structure of reports
- Writing different types of letters
-Writing CV

Evaluation
Continuous(40%) exams(60%)

2.LISTENING AND SPEAKING MODULE

In addition to comprehension of longer audio visual materials with time control, students are expected to do the following tasks in the second semester:

- Report on information from a video or a text
- Compare and contrast the appearance, configuration, and steps of processes and usage of tools
- Present opinions or hypothesis from a coursework
- Present short prepared lectures on technical subjects
- Defend opinions and arguments

Evaluation Continuous(40%) exams(60%

References:

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

Semestre: 2
Unité d'enseignement : UET 2.1
Matière : Oral Presentation Methodology
VHS: 30h00 (TD : 2h00)
Crédits: 2
Coefficient: 1

ORAL PRESENTATION SKILLS MODULE

Objectives
This course aims to develop students' communication and language skills in order to plan and deliver an effective presentation. Students will be taken systematically through the key stages of giving presentations, from planning and introducing to concluding and handling questions. Additionally, students will experience not only how to give an effective presentation, but also how to become an effective listener.

Recommended prior Knowledge: Acquired language from Enlish I and English II
Content

- Pronunciation. A basic overview of the sounds of English and stress, rhythm, and intonation.
- Presentation skills
    - Overview of the process of developing a presentation
    - Analysis of speakers and speaking styles
    - The parts of a presentation: introduction, body, and conclusion
    - Practice with common presentation types
    - Using visuals (e.g., PowerPoint) effectively

Students are supposed to present two presentations on topics of their choice to be able to evaluate their performances.

There is no textbook for the course. Some materials will be passed out in class and others will be available online.

Evaluation : Exam100%

Semestre: 3
Unité d'enseignement: UEF 3.1
Matière : Maths IV
VHS: 52h30 (Cours: 2h30, TD: 1h00)
Crédits: 5
Coefficient: 2

Course Objectives:

The goal of this course is to provide students with an understanding of the solutions and applications of ordinary differential equations. The course serves also as an introduction to non linear differential equations.

Course Prerequisite(s):

Students must have taken calculus and linear algebra courses

Course Outline:

- **Introduction to Differential Equations:** Types, order
- **First Order Differential Equations:** Separation of variables, Homogeneous coefficients, Exact equation, Integrating factor
- **Order Reduction:** missing independent variable, missing dependent variable
- **Linear Differential Equations:** First order, Bernoulli's equation, dimension of solution space, Wronskian
- **Linear Differential Equations With Constant Coefficients:** Homogeneous solutions, particular solution, the method of variation of parameters, the method of undetermined coefficients
- **Laplace Transform:** Properties, solution of initial value problems, convolution
- **Systems of First Order Linear Differential Equations:** matrix representation, solution, eigenvalues/eigenvectors, application to state space equations

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Elementary Differential Equations with Linear Algebra, R.S. Finney, Addison-Wesley

Semestre: 3
Unité d'enseignement: UEF 3.1
Matière : Physics III
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Crédits: 3
Coefficient: 1

Course Objectives:

The phenomena of vibrations and waves provide a fundamental background necessary to approach a wide variety of applications in physics and engineering. The course will introduce students to the fundamentals of vibrations. And waves. Basic wave phenomena including diffraction and interference will be discussed.

Course Prerequisite(s):

Calculus and Physics I

Course Outline:

- **Harmonic Oscillation:**Equation of motion, Energy of a Simple Harmonic Oscillator, Superposition of Two Simple Harmonic Vibrations in One Dimension , Superposition of Two Perpendicular Simple Harmonic Vibrations.
- **Damped Oscillations:** Equation of Motion and characteristics
- **Forced Oscillations and Resonance:** Equation of motion of a Forced Oscillator, Displacement and Phase versus Driving Force Frequency, Power Supplied to Oscillator by the Driving Force, Bandwidth.
- **Coupled Oscillations and Modes of Oscillations:** Normal Coordinates, Degrees of Freedom and Normal Modes of Vibration, General Method for Finding the Normal Mode Frequencies.
- **N coupled Oscillators:** Oscillations of a Loaded String, Continuous systems in one Dimension, Wave Equation in one Dimension.
- **Transverse Wave Motion:**The Wave Equation, Solution of the Wave Equation, Reflection and Transmission of Waves on a String at a Boundary , Energy
- **Standing Waves:** Standing waves on a String of Fixed Length, Energy of a Vibrating String, Energy in Each Normal Mode of a Vibrating String.
- **Introduction to Physical Optics:** Interference and Diffraction.

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Vibrations and Waves, A.P. French, MIT introductory Physics Series
2. The Physics of Vibrations and Waves, H. Pain, 6ed., Wiley, 2005

Semestre: 3
Unité d'enseignement: UEF 3.1
Matière : Numerical Methods
VHS: 37h30 (Cours: 1h30, TD: 1h00)
Crédits: 2
Coefficient: 1

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 when analytical solutions are not possible.

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.
- ***Introduction to Optimization*** **:** basic concepts, Formulating an Optimization Problem,

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.

Semestre: 3
Unité d'enseignement: UEF 3.2
Matière : Active Devices I
VHS: 60h00 (Cours: 2h30, TD: 1h30)
Crédits: 5
Coefficient: 3

Course Objectives:

The main goal is to provide students with an understanding of the relation between physical structure and circuit behavior of semiconductor active devices. At the end of the course students will know the basic mechanism of rectification, amplification and switching and their implementation with various types of semiconductor devices.

Course Prerequisite(s):

The prerequisites for this course are the differential and integral calculus, the DC and AC circuit courses.

Course Outline:

- **Introduction to Semiconductor Materials:** Atomic structure, covalent bonds, Classes of materials (conductors, insulators, semiconductors), Intrinsic semiconductor materials, Extrinsic semiconductor materials (N-type and P-type)
- **Semiconductor Diodes and their Applications:** Diode description, operation and voltage-current characteristics (under no bias, forward bias and reverse bias), Diode models, Diode circuit analysis and applications: Logic gates, Rectifiers (Half wave and full wave), Power supply filters and regulators, Clipping and clamping circuits, Voltage multipliers. Special-purpose diodes description, operation and applications (Schottky diode, Zener diode, Light Emitting Diode, photodiodes – Photovoltaic cells, Varactor)
- **Bipolar Junction Transistors (BJT's):** BJT description, operation, voltage-current characteristics and parameters, DC operating point and load line analysis, BJT as a switch (Logic gates using BJT), BJT biasing circuits, maximum and optimum swings, Q_{pt} stability analysis, coupling and bypass capacitors.
- **BJT Amplifiers Small Signal Low Frequency Analysis and Design:** Circuit parameters (voltage gain, current gain, input impedance, output impedance), BJT AC model, Common emitter BJT amplifier configuration, Common collector BJT amplifier configuration, Common base BJT amplifier configuration, Darlington amplifier, Multi-stage amplifier.

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. R. BOYLESTAD and L. NASHELSKY, 'Electronic Principles and Circuit Theory', 9th ed.
2. T. FLOYD, 'Electronic Devices', 9th ed.

Semestre: 3
Unité D'enseignement: UEF 3.2
Matière : Digital Systems I
VHS: 37h30 (Cours: 2h30)
Crédits: 4
Coefficient: 2

Course Objectives:

Provide students with the basic foundations for the analysis and design of digital systems. Digital design using an HDL-based approach is emphasized.

Course Prerequisite(s):

Basic Programming

Course Outline:

- **Basic Concepts:** Digital vs analog electronics, basic digital functions.
- **Number Systems and Data Representation:** Conversions, signed-numbers, unsigned numbers, floating-point numbers, special digital codes, arithmetic operations.
- **Logic gates:** NOT, AND, OR, NAND, NOR, XOR, XNOR.
- **Boolean Algebra and logic simplification:** Axioms, theorems, standard and canonical forms, Karnaugh's map and Quine McCluskey methods.
- **Introduction to CAD tools and HDL modeling:** Fixed-function ICs, introduction to PLDs and FPGAs, FPGA programmming (schematic and HDL).
- **Gates' universality:** Gates' universal property, NANA-NAND & NOR-NOR networks
- **Combinational logic analysis and design :** Digital adders, digital subtractors, adder/subtractors, arithmetic logic units (ALUs), digital comparators, parity generators/checkers. (with fixed-function ICs and PLDs)
- **Integrated Circuits' Logic Families:** TTL and CMOS families, electrical and dynamic parameters

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Fundamentals of Digital Logic with VHDL. By S. Brown & Z. Vranesic
2. Digital Design with CPLD Applications & VHDL By R. K. Dueck
3. Digital Fundamentals, By Thomas L. Floyd

Semestre: 3
Unité d'enseignement: UEF 3.2
Matière : Electrical Engineering II
VHS: 52h30 (Cours: 2h30, TD: 1h00)
Crédits: 5
Coefficient: 2

Course Objectives:

This course will introduce fundamental concepts of AC electric circuits building on concepts developed in the DC circuits course and will provide students with electric circuits analysis techniques.

Course Prerequisite(s):

Electrical Engineering I and Calculus

Course Outline:

- **AC Fundamentals and Sinusoidal Alternating Waveforms:** Basic definitions, Phase difference, average and effective values
- **R, L and C Elements and Impedance Concept:** Review of complex numbers, ac voltage and current phasors, inductive and capacitive reactances, impedance concept, simple ac circuits
- **Power in AC Circuits:** Active, reactive and apparent powers, power triangle, power factor
- **Series and Parallel AC circuits- series/Parallel AC Networks:** Use of Ohm's law, voltage divider rule, Kirchhoff's laws to determine voltage, current and power for any series/parallel circuit, equivalent networks
- **Methods of AC Circuit Analysis:** Convert an ac voltage source into its equivalent current source and vice versa, circuits with a dependent current source or a dependent voltage source, mesh analysis, Λ toY and Y to Λ conversions
- **AC Network Theorems:** Thévenin and Norton equivalent circuits, maximum power transfer
- **Resonance:** Resonant frequency, bandwidth, Q factor for series or parallel circuits, impedance, current and power response curves for a series circuit

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Engineering Circuit Analysis, .W. H. Hayt, J. E. Kemmerly, and S. T. Durbin, 6th edition
2. Introductory Circuit Analysis, R. L. Boylestad, 10^{th} edition

Semestre: 3
Unité d'enseignement: UEM 3.1
Matière : Physics III Lab
VHS: 15h00 (TP: 1h00)
Crédits: 1
Coefficient: 1

Course Objectives:

The phenomena of vibrations and waves provide a fundamental background necessary to approach a wide variety of applications in physics and engineering. The course will introduce students to the fundamentals of vibrations. And waves. Basic wave phenomena including diffraction and interference will be discussed. Many experiments will be performed by students to understand the waves and vibrations phenomena

Course Prerequisite(s):

Calculus and Physics I

Course Outline:

- Hook's Law and Simple Harmonic Motion.
- Harmonic and forced oscillations on an air cushion bench.
- Simple Harmonic Oscillator in Electrical system: LC circuit.
- Damped Oscillations In Electrical system : RLC circuit.
- Study of Coupled Oscillations in Electrical system.
- String Vibration: Study of transverse stationary waves generated by the excitation of a taut string.

Assessment Method: Continuous

Textbook(s) and/or other required material:

Laboratory Manual

Semestre: 3
Unité d'enseignement: UEM 3.1
Matière : Active Devices I Lab
VHS: 30h00 (TP: 2h00)
Crédits: 2
Coefficient: 2

Course Objectives:

Upon completion of this course, students must be able to verify experimentally the characteristics of semiconductor devices, implement circuits and test their operation and evaluate their design.

Course Prerequisite(s):

Students must have been introduced to measuring instruments, power supplies and should have implemented and tested circuits.

Course Outline:

- Diode characteristics
- Diode applications
- Special-purpose diodes
- Bipolar Junction Transistors (BJT) Characteristics
- BJT biasing
- BJT as a switch
- BJT amplifier circuits

Assessment Method: Continuous

Textbook(s) and/or other required material:

1. R. BOYLESTAD and L. NASHELSKY, *'Electronic Principles and Circuit Theory'*, 9th ed.
2. T. FLOYD, '*Electronic Devices'*, 9th ed.

Semestre: 3
Unité d'enseignement: UEM 3.1
Matière : Digital Systems I Lab
VHS: 37h30 (TP: 2h30)
Crédits: 2
Coefficient: 2

Course Objectives:

Get hands on practice with discrete ICs and a modern CAD tool such as Quartus II and VHDL.

Course Prerequisite(s):

Basic Programming

Course Outline:

- Basic combinational circuits using discrete ICs
- Introduction to the CAD tools & development board
- Implementation of combinational circuits using schematic capture design entry
- Implementation of combinational circuit using HDL design entry
- Implementation of arithmetic circuits: adders, comparators, ALUs, with fixed-function ICs and programmable devices.

Assessment Method: Continuous

Textbook(s) and/or other required material:

1. Fundamentals of Digital Logic with VHDL. By S. Brown & Z. Vranesic
2. Digital Design with CPLD Applications & VHDL By R. K. Dueck

Semestre: 3
Unité d'enseignement: UEM 3.1
Matière : Electrical Engineering II Lab
VHS: 22h30 (TP: 1h30)
Crédits: 1
Coefficient: 1

Course Objectives:

To develop the practical skills required to build, test, troubleshoot and analyze AC sinusoidal networks involving resistors, capacitors, inductors.

Course Prerequisite(s):

Electrical Engineering, I and Calculus

Course Outline:

- The Oscilloscope
- Transients
- RLC transients
- Reactance
- Frequency response
- Series and parallel Circuits
- Resonance
- Transformers
- Thevenin' s equivalent circuits

Assessment Method: Continuous

Textbook(s) and/or other required material:

Laboratory Manual

Semestre: 4
Unité D'enseignement: UEF 4.1
Matière : Probability & Statistics
VHS: 45h00 (Cours: 1h30, TD: 1h30)
Crédits: 4
Coefficient: 2

Course Objectives:

This course is a curriculum that concludes with the fundamentals of both estimation and hypothesis testing.

Course Prerequisite(s):

Calculus and Linear Algebra courses

Course Outline:

Chapter #1: Probability
1. Sample space and events
2. Operations on events
3. Composite of random experiments
4. Mathematics of probabilities
5. Some basics ideas
6. Conditional probability
7. Bayes' rule

Chapter #2: Random variables
1. Introduction
2. Discrete random variable
3. Continuous random variable
4. Expectation and variance
5. Moments
6. Popular parametric probability models
7. Conditional distributions
8. Function of a random variable

Chapter #3: Multiple random variables
1. Introduction
2. Bivariate random variables
3. Joint and marginal distribution functions
4. Discrete random variables
5. Continuous random variables
6. Conditional distributions
7. Covariance and correlation
8. Central limit theorem
9. Special distributions
10. Function of two random variables

Chapter #4: Estimation theory
1. Introduction
2. Estimation of the parameters of a given law
3. Maximum likelihood estimation
4. Bayes' estimation
5. Mean Square Estimation

Chapter #5: Decision theory
1. Introduction
2. Hypothesis tests
3. Tests concerning means and variances

4. Choice of samples size for testing means
5. Goodness-of-fit test
6. Test for independence

Chapter #6: Linear regression

1. Introduction
2. Linear regression
3. Confidence limits test of significance
4. Choice of regression model
5. Adequacy of the model

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

Probability & Statistics for Engineers & Scientists; 9th Edition; Ronald Walpole and Raymond H. Mayer

Semestre: 4
Unité d'enseignement: UEF 4.1
Matière : Linear Systems I
VHS: 60h00(Cours: 2h30, TD: 1h30)
Crédits: 5
Coefficient: 3

Course Objectives:

This course is designed to have students develop abstract reasoning and acquire knowledge about the application of linear algebra to the analysis of linear systems.

Course Prerequisite(s):

Calculus and Linear Algebra courses

Course Outline:

- **Continuous-Time Signals and Systems:** Properties, basic signals, transformations, interconnections
- **Continuous-Time Linear Time-Invariant Systems:** Impulse response, convolution integral, properties
- **Fourier Series:** Response to continuous-time complex exponentials, Fourier series expansion, properties
- **Fourier Transform:** Fourier transform, inverse, properties
- **Laplace Transform:** Region of convergence, inverse, properties, unilateral Laplace transform and initial-value problems
- **Transfer Function Description:** Poles , zeros, stability, minimum phase
- **State Space Description:** States, state solution, canonical forms, stability, observability, controllability, minimal realization
- **Conversion between Descriptions:** From state space to transfer function, from transfer function to state space

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Signals and Systems, A.V. Oppenheim and A. Willsky, Prentice-Hall
2. Linear System Theory and Design, C.T. Chen, HRW

Semestre: 4
Unité d'enseignement: UEF 4.2
Matière : Active Devices II
VHS: 67h30 (Cours: 3h00, TD: 1h30)
Crédits: 6
Coefficient: 3

Course Objectives:

Students will acquire further knowledge about active devices and will be able to analyze circuits based on them. They will discover the importance and the diverse applications offered by the discrete and integrated semiconductor components.

Course Prerequisite(s):

DC / AC Circuits and Active Devices I.

Course Outline:

- **Power Amplifiers:** Power efficiency and maximum power efficiency for the different Classes of amplifiers (Common emitter class A power amplifier, Transformer coupled class A, Class B complementary symmetry (Class B push pull))
- **Field-Effect Transistors (FET's):**
  JFET description (p and n-channel), operation, voltage-current characteristics, JFET circuits biasing. Metal-Oxide-Semiconductor FET's (MOSFET's), description (p and n-channels, depletion and enhancement modes), operation, voltage-current characteristics and parameters, MOSFET circuit's analysis and design (Logic gates using MOSFET's).
- **FET Amplifiers Small Signal Low Frequency Analysis and Design:** FET AC small signal model (common drain, common source and common gate amplifiers),
- **Differential amplifiers:** The long-tailed pair, Different modes of operation, common mode rejection ratio, types of differential amplifier (with emitter resistor, with a current source, with current mirror..).
- **Operational Amplifiers (Op-amps) and theirs Applications:** Op-amps description, input modes and parameters (gain, impedances), Offset voltage, Ideal op-amp, Op-amp with feedback (negative and positive feedbacks), Op-amp applications: (Voltage comparator, followers, inverting and non inverting amplifiers, summer, difference amplifier, differentiator, integrator, Schmidt trigger, voltage regulators, Active Filters (active low-pass, high-pass, band-pass and band-stop filters)).
- **Silicon Controlled Rectifiers (SCR) and other Devices:** SCR description, operation, voltage-current characteristics and parameters, SCR applications, other semiconductor devices.

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. R. BOYLESTAD and L. NASHELSKY, *'Electronic Principles and Circuit Theory'*, 9th ed.
2. T. FLOYD, '*Electronic Devices'*, 9th ed.

Semestre: 4
Unité d'enseignement: UEF 4.2
Matière : Digital Systems II
VHS: 45h00 (Cours: 3h00)
Crédits: 4
Coefficient: 2

Course Objectives:

The course is to provide students with an in-depth knowledge of standard combinational and sequential systems. A modular approach to design larger systems will be emphasized and the HDL-based approach will be used.

Course Prerequisite(s):

Basic Programming and Digital systems I with VHDL

Course Outline:

- **Sequential logic circuits:** Latches, Flip-Flops, Counters, Registers at SSI and MSI levels
- **HDL implementation of sequential Circuits:** Process, sequential statements
- **Standard combinational modules:** Decoders, Encoders, MUXs, DEMUXs.
- **HDL implementation of standard combinational modules**
- **Finite State Machines (F.S.Ms):** Synthesis of Mealy and Moore machines
- **HDL implementation of F.S.Ms**
- **Semiconductor memories:** RAM, ROM, EEPROM,…
- **Programmable Logic Devices:** PAL to FPGA
- **Data Acquisition and Interfacing**: ADCs and DACs

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Fundamentals of Digital Logic with VHDL By S. Brown & Z. Vranesic
2. Digital Design with CPLD Applications & VHDL By R. K. Dueck

Semestre: 4
Unité d'enseignement: UEF 4.2
Matière : Electric Machines
VHS: 67h30 (Cours: 3h00, TD: 1h30)
Crédits: 4
Coefficient: 3

Course Objectives:

Understand the principles and theory of the different types of electrical machines and be able to analyze and quantify their performance in the steady state regime.

Course Prerequisite(s):

Calculus, AC Circuits, Electro-magnetic Field Theory

Course Outline:

- **Magnetic Circuits:** Magnetic Concepts, Magnetic Circuits, Leakage Flux, The Magnetization Curve.
- **Transformers:** Types of Transformer, Elements of Transformer, Faraday's Law and Lenz' Law, Magnetic Fluxes of Transformer, The Ideal Transformer, A circuit Model of the Iron-core Transformer,-The Approximate Transformer Circuit Models, Relative Magnitudes of the Circuit-Model Constants: Transformer Voltage Regulation, Computing Transformer Efficiency
- **Synchronous Machines:** Construction of a Synchronous Machine, Cylindrical-Rotor theory Versus Salient-Pole Theory, The Magneto-motive-Force MMF Field of the Rotor, The Rotating MMF of the Stator Armature Winding, The Circuit Model of the Synchronous Machine, Relative Magnitudes of Synchronous Machine Impedances, Power and torque as related to power Angle, Operation as Motor, Operation as Synchronous Condenser, Alternator.
- **Induction Machines**: Induction Machines Principles, The Concept of Slip, The Frequency of Rotor Voltages and Current, The Induction Motor under Load, Circuit Model of the Induction Machine, Losses, Power Flow, and Efficiency Air Gap: The Magic Quantity, Separation of Mechanical Load from Rotor Copper Loss in the Circuit Model, Torque-Speed Characteristics, Identification Tests, Starting Induction Motors, Speed Control of Induction Motors.
- **Direct Current DC Machines:**DC Machines Principles, Construction of DC Machines, The Generated Voltage of DC Machines, Circuit Model of a DC Machines, Developed Torque, Field Excitation, Wound-pole Machines, Speed Control of Shunt and Permanent-Magnet (PM) Motors, DC Motor Starting and Braking, Armature Reaction and commutation, Characteristics of Series and Compound DC Motors, Self-Excited DC Generators, Armature Winding for Commutator Machines
- **Special Machines:** Basic principle of operation and Characteristics.

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

Semestre: 4
Unité d'enseignement: UEM 4.1
Matière :Active Devices II Lab
VHS: 30h00(TP: 2h00)
Crédits: 2
Coefficient: 1

Course Objectives:

Upon completion of this unit, students must be able to verify experimentally the characteristics of semiconductor devices (discrete and integrated) and to implement microelectronic circuits.The lab emphasizes circuit design and testing skills.

Course Prerequisite(s):

Students must have used measuring equipment, implemented and tested DC/AC electrical circuits

Course Outline:

- Class B power amplifiers
- Field effect transistors characteristics
- FET amplifiers
- Differential amplifiers
- Basic operational amplifiers
- Operational amplifiers applications
- Silicon controlled rectifiers

AssessmentMethod: Continuous

Textbook(s) and/or other required material:

1. R. BOYLESTAD and L. NASHELSKY, 'Electronic Principles and Circuit Theory', 9th ed.
2. T. FLOYD, 'Electronic Devices', 9th ed.

Semestre: 4
Unité d'enseignement: UEM 4.1
Matière : Digital Systems II Lab
VHS: 30h00 (TP: 2h00)
Crédits: 2
Coefficient: 1

Course Objectives:

To develop skills in designing and implementing large digital systems using discrete fixed- function ICs and modern CAD tools & HDLs

Course Prerequisite(s):

Basic Programming and Digital Systems I with VHDL

Course Outline:

- Design and Implementation of latches and flip-flops
- Design and implementation of digital counters
- Design and implementation of registers and shift registers
- Applications of standard combinational modules
- Finite state machines
- Semiconductor Memories
- Data acquisition & distribution systems (ADCs, DACs)

AssessmentMethod: Continuous

Textbook(s) and/or other required material:

1. Fundamentals of Digital Logic with VHDL By S. Brown & Z. Vranesic
2. Digital Design with CPLD Applications & VHDL By R. K. Dueck

Semestre: 4
Unité d'enseignement: UEM 4.1
Matière :Electric Machines Lab
VHS: 15h00 (TP: 1h00)
Crédits: 2
Coefficient: 1

Course Objectives:

The machines Lab experiments will provide students with a first hand chance to get familiar with basic machines. The course covers practical experiments on the real and apparent powers, the power factor, the transformers, the alternator and the DC machines. Besides, the lab will focus on the safety precautions and rules.

Course Prerequisite(s):

Electrical Engineering I and II, Calculus and Physics II

Course Outline:

- The Wattmeter
- Phase angle, real and apparent power
- Capacitive reactance
- Reactive reactance
- Watt, Var, Volt-Ampere and power factor
- Vectors and phasors
- The single phase transformer
- Three phase transformer connections
- The Three phase alternator
- The asynchronous motor
- The DC motor

AssessmentMethod: Continuous

Textbook(s) and/or other required material:

1. Introduction to Electrical Machines and Transformers» G. McPherson
2. Lab-Volt laboratory manual

Semestre:4
Unité d'enseignement: UET2.2
Matière : Information and Communication Techniques
VHS: 15h00 (Cours: 1h00)
Crédits: 1
Coefficient:1

Course Objectives:

This course is intended for third-year students in electrical and electronic engineering.
Its objective is to familiarize them with the use of information and communication techniques for pedagogical purposes, aiming to optimize their training in the field.
It involves managing theoretical knowledge, conducting bibliographic research through appropriate methodological means in this sector, and maximizing the benefits of their education and future professional skills.
Mastery of these technological tools is essential and aligned with their training profile.

Course Prerequisite(s):

None

Course Outline:

- **General introduction - definition of ICT**
- **Presentation of different information and communication technologies**
- **Challenges of ICT and economic importance**
- **Development of ICT and their integration into the new information society: ethical issues and social transformations**
- **Utilization of ICT resources for the profitability of the electronics sector and its enhancement for future professional skills**
- **Deployment of ICT in Algeria. Examples and illustration**
- **Presentation of some sites related to pedagogical scenarios. (Directed work for support)**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material: None

Semestre: 5
Unité d'enseignement : UEF 5.1
Matière 1: Linear Systems II
VHS: 67h30 (Cours: 3h00, TD: 1h30)
Crédits: 6
Coefficient: 3

Course Objectives:

The main objective of this course is to provide students with an understanding of the methods and techniques for the design and analysis of discrete linear systems.

Course Prerequisite(s):

Linear Algebra and Linear systems I courses

Course Outline:

- **Signals and Systems:** Discrete-time signals, properties, transformations, basic signals, systems; properties, interconnection
- **Discrete Linear Time-Invariant Systems:** Impulse response, convolution sum, properties, graphical convolution
- **Fourier Analysis of Discrete-Time Periodic Signals:** Response to discrete-time complex exponentials, Fourier series expansion, properties
- **Fourier Analysis of Discrete-Time Aperiodic Signals:** Discrete-time Fourier transform, properties, the DFT
- **The Z-Transformation:** The Z-transform, the inverse, properties, the unilateral z-transform
- **Sampling:** The sampling theorem, aliasing and applications, signal reconstruction
- **Discrete-Time Models:** Zero order hold modelling, transfer function model, state space model

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Signals and Systems, A.V. Oppenheim and A. Willsky, Prentice-Hall
2. Signals and Systems, MIT lecture notes, http://ocw.mit.edu

Semestre: 5
Unité d'enseignement: UEF 5.1
Matière : Electromagnetic Field Theory
VHS: 67h30 (Cours: 3h00, TD: 1h30)
Crédits: 5
Coefficient: 3

Course Objectives:

This course aims to provide a comprehensive knowledge of the theoretical background of electromagnetic (EM) fields. After completing the course, the students should be able to differentiate different types of coordinate systems and use them for solving the problems of EM field theory, describe time varying fields, solve Maxwell's equations and describe EM waves' propagation in free space.

Course Prerequisite(s):

Differential and Integral calculus and physics II

Course Outline:

- **Review on Vector Analysis and Coordinate Systems**
- **Line and surface integral, Divergence and Stokes's theorem**
- **Electric and Magnetic fields**
- **Maxwell equations in differential and integral forms: Ampere circuital law, Faraday's law, Gauss's laws for the electric and magnetic fields**
- **Uniform plane waves**
- **Polarization of Electromagnetic (EM) Waves**
- **Propagation of EM waves in free space**

AssessmentMethod: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Hayt, William H., and Buck, John, A. Engineering Electromagnetics, McGraw-Hill Education, 9th Edition, 2018.
2. 2. Sadiku, Matthew, Elements of Electromagnetics, Oxford University Press, 7th Edition, 2018.
3. 3. Cheng, David K., Fundamentals of Engineering Electromagnetics, Pearson, 1st Edition, 2019.

Semestre: 5
Unité d'enseignement: UEF 5.2
Matière : Computer Architecture
VHS: 45h00 (Cours: 3h00)
Crédits: 4
Coefficient: 3

Course Objectives:

This course provides students with a complete knowledge of the different components of a computer (CPU, memory devices and interfaces), interaction of those components and how to make them work through the execution of programs.

Course Prerequisite(s):

Students should have successfully completed Digital Systems I and II

Course Outline:

- **Introduction:** Review of Digital I and Digital II with VHDL examples, Presentation of a computer model, introduction to BIOS and operating system
- **Data Representation:** Binary representation (Integers, reals and characters)
- **Basic Computer Architecture:** Introduction to different memory and interface devices, addressing memory and I/O maps, presentation and description of the basic elements of a central processing unit, interruption processing
- **Micro Architecture:** MIPS micro-architecture, single-cycle processor, multi-cycle processor, pipelined processor, advanced micro architecture, VHDL processor examples
- **Assembly Language Programming:** Instruction format, machine language instruction types(R-type, I-type, J-type) addressing modes, assembler, compiler, program examples
- **Memory Organization:** Memory devices, non-interleaved memory organization, interleaved memory organization, cache memory, mass storages (Mag tapes, hard disks, CDs, flash disks, virtual memory)
- **Input-Output Organization:** Interface circuits, parallel interface circuits, serial interface circuits, communication protocols
- **Microprocessor Architecture:** 8 bits microprocessors, 16 bits microprocessors, 32 bits microprocessors; 64 microprocessors
- **Large System Architecture:** Parallel systems, N-cube systems, systolic systems, neyral systems

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Computer Architecture, Carter Nicholas, Mc Graw Hill, 2008.
2. Computer System Architecture, M. Morris Mano, Mc Graw Hill, 2008.

Semestre: 5
Unité d'enseignement: UEF 5.2
Matière : Power Electronics
VHS: 67h30 (Cours: 3h00, TD :1h30)
Crédits: 6
Coefficient: 3

Course Objectives:

The objective of this course is to provide fundamental understanding on modern power semiconductor devices and circuits. Students will acquire competencies in the design and analysis applications in power electronic systems and learn how to use the Pspice software.

Course Prerequisite(s):

Differential and Integral Calculus, Electrical Engineering I and II

Course Outline:

- **Introduction**: Power electronics and its applications, functions of power electronics circuits, power semiconductor devices, characteristics and specifications of power switches, RMS values and harmonic content of non sinusoidal waveforms, peripheral effects
- **Power Semiconductor Diodes and Circuits:** Semiconductor physics basics, diode characteristics, power diode types, diodes with RC and RL loads, diodes with LC and RLC loads, free wheeling diodes, recovery of trapped energy with a diode.
- **Rectification:** Single phase half wave rectifier, performance parameters, single phase half wave rectifier with RL load, single phase full wave rectifier with RL load, three phase bridge rectifier with RL load, rectifier circuit design, DC filter design, effects of source and load inductance, review questions and worked examples
- **Controlled (SCR) rectification:** Single phase full wave SCR rectifier with RLE load, three phase full wave SCR rectifier with RLE load, inversion operation worked examples
- **AC Voltage controllers:** ON OFF control, Phase control, Single phase bidirectional controllers with R load, Single phase bidirectional controllers with RL load, AC VC with PWM control, Review questions and worked examples
- **DC to DC converters:** Principle of step down operation, step down chopper with RL, RLE load, principle of step up operation, step up chopper with R load, performance parameters, worked examples
- **Inverters:** Operation, performance parameters, single phase and three phase inverters, voltage control of single phase inverters, introduction to pulse resonant inverters, introduction to multilevel inverters
- **Protection of Power Devices and Circuits:** Switching loss calculation, cooling and Heat sink design, Snubber circuits, reverse recovery transients, supply and load side transients, voltage protection by Selenium Diodes and MOV, current protections, electromagnetic interference
- **Case study**

AssessmentMethod: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Power Electronics by Muhammad H. Rashid
2. Power Electronics by Mohan et al.
3. http://www.pspice.com

Semestre: 5
Unité d'enseignement: UEF 5.2
Matière : Process Control and Instrumentation
VHS: 45h00 (Cours: 3h00)
Crédits: 4
Coefficient: 2

Course Objectives:

This course is designed to provide students with the fundamentals of instrumentation and intelligent sensors used in process control.

Course Prerequisite(s):

Calculus, Physics and Electronics courses

Course Outline:

- **Introduction:** Elements of process control, block diagrams, setpoint, errors,…
- **Signal Conditioning:** Principles, Bridge circuits, Op amps circuits in instrumentation: voltage follower, differential amplifier, integrator, summer,…
- **Transducers:** Thermal: thermistors, rtd's, thermocouples; Mechanical: displacement, position, motion, strain gages; Pressure and flow transducers; Optical transducers: photocells, photo-detectors
- **Controller Principles:** Process characteristics; Parameters, Controller modes: P, I and D actions; Composite control modes: PI, PD , PID; Process loop tuning: Ziegler-Nichols methods, Electronic controllers using op amps
- **Final Control Operation:** Actuators: pneumatic and hydraulic; Final control elements

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

Process Control Instrumentation Technology, C.D. Johnson, Prentice-Hall

Semestre: 5
Unité d'enseignement: UEM 5.1
Matière : Power Electronics Lab
VHS: 37h30 (TP: 2h30)
Crédits: 2
Coefficient: 1

Course Objectives:

Design and analysis of power electronic circuits and circuit operation simulation with PSPICE

Course Prerequisite(s):

Electronic circuits and Power Electronics courses

Course Outline:

- Half wave rectifier circuits R load and RL load and free wheeling diode effect on circuit performance
- Full wave single phase rectifier circuits with R load and RL load
- Controlled rectification : R load and RL load performance calculations
- Single Phase AC Voltage control using 2 back to back SCRs or a TRIAC. R and RL loads and performance calculations
- Step down chopper with R and RL load, performance characteristics
- Single phase Inverter: R load and RL load

Assessment Method: Continuous

Textbook(s) and/or other required material:

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

Semestre: 5
Unité d'enseignement: UEM 5.1
Matière : Process Control and Instrumentation Lab
VHS: 22h30 (TP: 1h30)
Crédits: 2
Coefficient: 1

Course Objectives:

This course is designed to implement different sensors used in process control.

Course Prerequisite(s):

Calculus, Physics and Electronics courses

Course Outline:

1) Design of PI and PID controller for the pressure process
2) Design of PI and PID controller for the level process
3) Design of PI and PID controller for the flow process
4) Design of PI and PID controller for the temperature process
5) Tuning of controllers
6) Study of complex control system

Assessment Method: Continuous

Textbook(s) and/or other required material:

Process Control Instrumentation Technology, C.D. Johnson, Prentice-Hall

Semestre: 5
Unité d'enseignement: UED 5.1
Matière : Printed Circuit Board Design and Technologies
VHS: 22h30 (Cours: 1h30)
Crédits: 1
Coefficient: 1

Objectifs de l'enseignement:

Printed Circuit Boards (PCB) are widely used by electronics and electrical engineers in different applications. Generally, the first step in a given electronic card production is making the PCB. This course provides the skills necessary to effectively design and implement a PCB. The course covers all the necessary aspects to design a PCB from an idea to a product by describing the steps involved in PCB Design and Fabrication process.

Connaissances préalables recommandées :

Experimental Labs of fundamental courses (Electricity, Active devices, Digital).

Some chemistry and physics principles.

Contenu de la matière:

1. Introduction to PCB: (02 Semaines)

Definition and Relevance of PCB, Background and History of PCB, Classes of PCB Design. PCB Design Process: (02 Semaines)

PCB design rules and constraints, Steps involved in layout design, Designing of Multi-layer Boards, Design for manufacturability.

2. PCB Fabrication & Assembly: (04 Semaines)

Steps involved in fabrication of PCB, PCB Fabrication techniques-single, double sided and multilayer, Etching: chemical principles and mechanisms, PCB component assembly processes, Soldering, Inspection and electrical testing.

3. PCB design Software tools: (03 Semaines)

Give in general the best PCB design software programs : KiCad, EasyEDA, Eagle..

4. PCB design: Practical examples + Projects for the students (04 Semaines)

Mode d'évaluation:

Quizes: 50% ; Project: 50%.

Références bibliographiques :

1. D. L. Jones, "*PCB Design Tutorial*", June 29th 2004, *https://www.scs.stanford.edu/~zyedidia/docs/pcb/pcb_tutorial.pdf.*

2. M.I. Montrose*, "Printed circuit board design techniques for EMC compliance (A handbook for designers)",* IEEE Press series on electronics technology, 2000.

Semestre: 6
Unité d'enseignement: UEF 6.1
Matière : Linear Control Systems
VHS: 67h30 (Cours: 3h00, TD: 1h30)
Crédits: 5
Coefficient: 3

Course Objectives:

To acquire knowledge about the methods and techniques for the analysis and design of linear feedback systems

Course Prerequisite(s):

Students must have taken the Linear Systems I and Process Control courses

Course Outline:

- **Mathematical Models of Systems:** System modelling, Laplace transform, differential equations of systems, transfer function, block diagram and state flow graph representations
- **State Space Representation** : state variables, state space from differential equations, transfer function from state space, time response and state transition matrix
- **Performance of Feedback Systems :** Performance of 2^{nd} order system, steady-state error of feedback system, performance indices, s-plane root location and transient response, simplification of linear system
- **Stability of Linear Feedback Systems:** Concept of stability, Routh-Hurwitz criterion, relative stability, stability of state space systems
- **The Root Locus Method:** Concept, procedure, sensitivity, PID controller
- **Frequency Response Method:** Frequency response plots, frequency domain performance indices)
- **Stability in Frequency Domain:** Mapping contours in s-plane, Nyquist criterion, system bandwidth, stability of control system with delays
- **Design of Feedback Control System:** Cascade compensation networks, phase-lead, phase-lag compensation using Bode plot, root locus, deadbeat response design

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Modern Control Systems, R,C. Dorf, R, H. Bishop, Prentice-Hall
2. Automatic Control systems, B,C Kuo, Golnaraghi

Semestre: 6
Unité d'enseignement: UEF 6.1
Matière : Communication Principles
VHS: 45h00 (Cours: 3h00, TD : 1h30)
Crédits: 5
Coefficient: 3

Course Objectives:

In this course, students must learn basic signal processing in order to understand modulation theory. This includes both CW and pulse modulation. At the end of the course, an introduction to noise calculation will be given.

Course Prerequisite(s):

The student must have taken a preliminary course on signals and systems

Course Outline:

- **Introduction and Basic Terminology of Communication**
- **Review of Signals and Systems:** Classifications of signals, representation of signals using rotating phasors, Fourier series, Fourier transform, impulse function.
- **Linear Time Invariant Systems:** Basic definitions, impulse response, transfer function, Distortionless transmission, Bandpass signals and bandpass systems
- **Introduction to Modulation: Classification of modulations according to carrier type**
  - **CW Modulation "Linear Modulation" (for both analog and digital messages):** DSB AM, mixing, superheterodyne concept, spectrum analyzer; DSB SC, Carrier recovery problem, SSB, VSB, QAM (for digital communication)
  - **CW modulation Exponential Modulation:** Return to the definition of frequency and phase, FM and PM definitions, Relationships between the modulations, Narrowband PM and FM, Sinusoidal modulating waveform, Carson's rule, FM through LTI systems, FM through memorilessnon linear systems, FM production, FM demodulation: Slope demodulator and PLL demodulation
- **Pulse Modulation:** The sampling theorem, PAM, PDM, PPM, PCM and quantization noise
- **Introduction to Noise Analysis in Electronic Systems:** Thermal noise, shot noise, signal to noise ratio, noise figure

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Communication Systems: An Introduction to Signal and Noise in Electrical Communication, A.B. Carlson, P.B. Crilly and J.C. Rutledge, Mc Graw Hill, 2002

Semestre: 6
Unité d'enseignement: UEF 6.2
Matière : Energy Systems
VHS: 45h00 (Cours: 3h00)
Crédits: 4
Coefficient: 2

Course Objectives:

This course is designed to familiarize students with the generation, transmission and distribution of electric power over an electrical power system.

Course Prerequisite(s):

Electrical Engineering I and II, Calculus and Power Electronics

Course Outline:

- **Introduction to Electric Energy System:** Definition, historical development of energy systems, basic structure of energy systems.
- **Steam Power Plant:** Power steam plant and general layout, Main parts of steam power plant, Excitation system and governing system.
- **Hydroelectric Power Plant:** Hydroelectric power plant site selection, Classification of hydroelectric power plants, Main components of hydroelectric power plant, flow duration curve.
- **Gas-turbine Power Plant:** Simple gas – turbine plant, The efficiency of gas – turbine power plant, Advantages of gas – turbine power plant.
- **Renewable Energy Sources:** Introduction, Solar energy source, Wind energy source, Other clean energy sources.
- **Transmission Line Parameters:** Introduction, Series impedance of transmission lines, Shunt capacitance of transmission lines.
- **Circuit Models of Transmission Lines:** The short transmission line, ABCD model, the medium-length TL, the long transmission line.
- **HVDC Transmission Lines and FACTS:** Introduction, advantages and disadvantages of HVDC transmission, types of HVDC links, main components of HVDC transmission system, FACTS components.
- **Distribution System:** Comparison of various distribution systems, conductor size, distribution system schemes
- **Substations:**, types of substations, substation equipments

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Weedy, B. M. Electric Power Systems, Third edition, John Willy & Sons, Inc. New York
2. William D. Stevenson, Elements of Power System Analysis, Third edition, McGraw-Hill
Miller, Robert H., Power system operation, 2nd edition, McGraw-Hill Inc.

Semestre: 6
Unité d'enseignement: UEF 6.2
Matière : Microprocessor Systems Design
VHS: 45h00 (Cours: 3h00)
Crédits: 4
Coefficient: 2

Course Objectives:

Give students a comprehensive treatment, both hardware and software, of a commercially available 8-bit Microprocessor with an emphasis on practical applications.

Course Prerequisite(s):

Digital Systems I and II, Basic Programming and Computer Architecture

Course Outline:

- **Overview of Microprocessor-Based Systems:**
- **The Programming Model:**
- **Addressing Modes:**
- **Instruction set and programming techniques:**
- **Hardware Architecture and Interfacing (Using buffers and registers):**
- **Stacks and Subroutines:**
- **Interrupts:** Maskable and non-maskableinterrupts
- **Programmable Interface Devices :** The PPI and Applications
- **Programmable Timers and Counters:**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. The Z80 Microprocessor Architecture, Interfacing, Programming and Design By R. Gaonkar

Semestre: 6
Unité d'enseignement: UEM 6.1
Matière : Microprocessor System Design Lab
VHS: 45h00 (TP: 3h00)
Crédits: 2
Coefficient: 1

Course Objectives:

To develop the ability to use and design industrial and practical applications using an 8-bit microprocessor and peripherals.

Course Prerequisite(s):

Digital Systems I and II, Basic Programming and Computer Architecture

Course Outline:

- Familiarity with the development board
- Programming techniques and addressing modes
- I/O (Buffer / Register) interfacing
- Subroutines and Delay Loops
- Stepper (or DC) motor speed / position control
- Interfacing the ADC and DAC: Applications (T° and waveform generation)
- Interfacing a matrix keyboard and displays

Assessment Method: Continuous

Textbook(s) and/or other required material:

1. The Z80 Microprocessor Architecture, Interfacing, Programming and Design By R. Gaonkar

Semestre: 6
Unité d'enseignement: UEM 6.1
Matière : Linear Control Systems Lab
VHS: 30h00 (TP: 1h30)
Crédits: 2
Coefficient: 1

Course Objectives:

Practical implementation of the concepts acquired in the Linear Control Systems course.

Course Prerequisite(s):

Students must have taken the Active Devices, Linear Systems I and Process Control courses

Course Outline:

- Familiarization with Control System Lab. Equipment
- Modeling characteristics of DC motors, tacho-generators, input/output potentiometers, op amps
- Simple feed-forward open loop motor speed control system
- Simple closed loop motor speed control system
- Simple closed loop motor position control system
- PID motor speed control system
- Deadbeat control system

Assessment Method: Continuous

Textbook(s) and/or other required material:

Laboratory hand-outs

Semestre: 6
Unité d'enseignement: UEM 6.1
Matière : Communication Principles Lab
VHS: 30h00 (TP: 1h30)
Crédits: 2
Coefficient: 1

Course Objectives:

This is an accompanying set of laboratory experiments to the communication principles course. These laboratory experiments are used to demonstrate the different modulations and demodulations seen in the course.

Course Prerequisite(s):

Students must be familiar with the use of laboratory equipment

Course Outline:

- Signals in time and frequency. Use of the spectrum analyser
- AM modulation.
- AM and DSB modulator
- AM demodulator
- FM Spectra
- FM modulator
- FM demodulation (PLL)
- Pulse Modulation

Assessment Method: Continuous

Textbook(s) and/or other required material:

Communications Lab. Manuel, Clay and Doumi

Semestre: 6
Unité d'enseignement: UEM 6.1
Matière : Project
VHS: 45h00 (TP: 3h00)
Crédits: 5
Coefficient: 3

Course Objectives:

The project provides an important opportunity for students to study, plan and implement a project from an initial idea. They must show their ability to:

- Analyse the proposed project and prepare a clear planning schedule,
- Implement and test the project,
- Write a clear and instructive academic report about the project,
- Give a convincing presentation about the project and defend their work.

Note: ***The course may include an internship in a socio-economic environment.***
(***Remarque :*** ***Le Module peut inclure un stage en milieu socio-économique***).

Assessment Method: Continuous

Semestre: 6
Unité d'enseignement: UET 6.1
Matière : Entrepreneurship and business management
VHS: 22h30 (Cours: 1h30)
Crédits: 1
Coefficient: 1

Course Objectives:

The objectives of this course are to introduce students to issues related to the management functions of planning, organizing, motivating, and controlling and to the concepts of operations and production management.

Course Prerequisite(s):

Introduction to Engineering Economics

Course Outline:

- **Fundamental Aspects:** Planning, Organizing and Staffing, Directing and Leading, Controlling
- **Maintenance, Operations/Production Management:** Maintenance Management, Scheduling and Control with PERT, CPM and GANT, Scheduling and Capacity Planning with Linear Programming

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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