Programme Détaillé par Matière

EE171: Mathematics I (Calculus I)

Course Information:

Semester: I	**Unit**: UEF11	**Credit Hours:** 5	**Coefficient:** 3
Lecture: 2 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 52.5

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, Trig functions, Irrational Functions
- **Improper Integrals:** Limits, Hospital's Rule, Indeterminate Forms
- **Infinite Series:** Convergence, Tests, Power series, Taylor's series

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

EE173: Chemistry I

Course Information:

Semester: I	**Unit**: UEF11	**Credit Hours:** 5	**Coefficient:** 3
Lecture: 2 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 52.5

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:

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

EE175: Physics I (Mechanics)

Course Information:

Semester: I	**Unit**: UEF11	**Credit Hours:** 5	**Coefficient:** 3
Lecture: 2 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 52.5

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, 6th Ed.
2. Physics for Scientists and Engineers, R. A. Serway, J. W. Jewett, 6th Ed.

EE175L: Physics I Lab

Course Information:

Semester: I	**Unit:** UEF11	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

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

EL103: English I

Course Information:

Semester: I	**Unit**: UET11	**Credit Hours:** 8	**Coefficient:** 12
Lecture:18 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 324

Course Objectives:

The objectives of this course are to:

- Learn the essentials of English grammar; particularly the rules used in the scientific and technical literature
- Ask and understand questions, understand lectures, take notes and make oral presentations
- Comprehend general technical and scientific texts and be able to write coherent paragraphs
- Learn scientific discourse and terminology specifically for electricity and electronics

Course Prerequisite(s):

High school English program + Placement test

Course Outline:

Grammar

- Parts of speech
- Statements: Affirmative , negative , interrogative statements
- Prepositions
- Phrasal verbs
- Comparisons
- Tenses
- Modals
- Clauses

Listening and Speaking

- The sounds of English
- Simple questions
- Complex questions
- Listing for general comprehension
- Listening for details
- Listening to lectures
- Note-taking

- Oral presentation

EL103: English I (Continued)

Reading and Writing

- Learning dictionary skills
- Reading for general comprehension
- Scanning
- Skimming
- Writing simple sentences
- Writing compound and complex sentences

English for Science and Technology

- Learning dictionary skills
- Properties and shapes
- Measurements
- Basic electricity concepts
- Basic electricity terminology
- Basic electronics concepts
- Basic electronics terminology
- Electricity and Electronics discourse

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Rapid review of English Grammar ; Mastering American English
2. http://www.fortunecity.com/bally/durrus/153/gramtoc.html
3. http://www.englishmedialab.com/grammar.html
4. Active listening, listening comprehension and note-taking
5. http://www.real-english.com/
6. http://australianetwork.com/
7. http://www.breakingnewsenglish.com/
8. Basic English for science writing scientific English
9. http://www.about.com/
10. http://iteslj.org/links/ESL/Reading
11. Basic English for science , Basic Electricity

EE121: Office Suite

Course Information:

Semester: I	**Unit**: UET11	**Credit Hours:** 2	**Coefficient:** 1
Lecture:1.5 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 45

Course Objectives:

A course designed to help students become computer literate. The course provides the knowledge and skills required to perform functions common to all Microsoft Windows applications with an emphasis on the common functionality between the three main Microsoft Office applications: Microsoft Word, Excel and PowerPoint.

Course Prerequisite(s):

Basic use of Microsoft Windows

Course Outline:

- Getting Started with Windows XP
- Creating Documents with MS Word
- Creating Documents with MS Word
- Formatting and Organizing Text with MS Word
- Using Graphics and Tables with MS Word
- Creating a Worksheet and Analyzing Data with Excel
- Getting Started with Microsoft PowerPoint
- Designing a PowerPoint Presentation
- Preparing a presentation

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

None

EE172: Mathematics II (Calculus II)

Course Information:

Semester: II	**Unit**: UEF21	**Credit Hours:** 4	**Coefficient:** 2
Lecture:1.5 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

Course Objectives:

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.

Course Prerequisite(s):

Mathematics I

Course Outline:

- **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:**

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

EE174: Mathematics III (Linear Algebra)

Course Information:

Semester: II	**Unit**: UEF21	**Credit Hours:** 6	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

Course Objectives:

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.

Course Prerequisite(s):

Differential and Integral Calculus

Course Outline:

- **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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

EE176: Chemistry II (Organic Chemistry)

Course Information:

Semester: II	**Unit**: UEF21	**Credit Hours:** 4	**Coefficient:** 2
Lecture:1.5 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

Course Objectives:

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

Course Prerequisite(s):

Chemistry I serves as an important support to understand organic structures.

Course Outline:

- **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
- **Heterofunctionnal Hydrocarbons** : Amides, Amines, Halides and chlorinated

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

EE178: Physics II (Electricity and Magnetism)

Course Information:

Semester: II	**Unit**: UEF21	**Credit Hours:** 6	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

Course Objectives:

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

Course Prerequisite(s):

Differential and Integral Calculus, Physics I

Course Outline:

- **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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

EE122: Introduction to C Programming

Course Information:

Semester: II	**Unit**: UEM21	**Credit Hours:** 3	**Coefficient:** 2
Lecture:1.5 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 40.5

Course Objectives:

The aim of this course is to introduce the rudiments of programming to the students. Students will become familiar with problem solving techniques and algorithm development and implementation using computers.

Course Prerequisite(s):

None

Course Outline:

- **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

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

EE176L: Physics II 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 laboratory physics experiments are designed to enhance the students' skills in performing experiments (Verification of laws, data recording and data analyzing).

Course Prerequisite(s):

Calculus, Physics I and Physics II

Course Outline:

- 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

Assessment Method: Continuous

Textbook(s) and/or other required material:

Physics Laboratory Booklet

EL104: English II

Course Information:

Semester: II	**Unit**: UET21	**Credit Hours:** 3	**Coefficient:** 2
Lecture: 6 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 90

Course Objectives:

At the end of this unit, students should be able to:

- Understand technical lectures, to understand and interpret graphs and to give oral presentations.

- Comprehend general technical and scientific texts and be able to write coherent texts and lab reports.

Course Prerequisite(s):

To have completed successfully listening and speaking I

Course Outline:

- Understanding oral discourse (lectures)
- Drawing conclusions
- Expressing opinions
- Interpreting data (graphs , figures , pie charts)
- Taking notes
- Giving oral presentations
- Types of sentences (review)
- Types of paragraphs
- Paragraph organization
- Connectors
- Academic essay
- Advanced reading skills

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

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

EE102: Electrical Engineering I

Course Information:

Semester: II	**Unit**: UED21	**Credit Hours:** 3	**Coefficient:** 2
Lecture:1.5 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 40.5

Course Objectives:

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.

Course Prerequisite(s):

High school calculus

Course Outline:

- **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

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, 10th edition

EE271: Mathematics IV (Ordinary Differential Equations)

Course Information:

Semester: III	**Unit**: UEF31	**Credit Hours:** 4	**Coefficient:** 2
Lecture:1.5 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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 nonlinear 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

EE273: Physics III (Vibrations and Waves)

Course Information:

Semester: III	**Unit**: UEF31	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

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

EE241: Active Devices I

Course Information:

Semester: III	**Unit**: UEF32	**Credit Hours:** 6	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

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 theirs Applications:** Diode description, operation and voltage-current characteristics (under no bias, forward bias and reverse bias), Diode models, Diode circuit analysis and applications: Rectifiers (Half wave and full wave), Power supply filters and regulators, Diode limiting 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, BJT amplification action, DC operating point, BJT biasing circuits, maximum and optimum swings, Q_{pt} stability analysis, coupling and bypass capacitors, load lines, BJT as a switch
- **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, Multi-stage amplifier
- **Power Amplifiers:** Amplifier power efficiency, Classes of amplifiers, Power amplifiers maximum power efficiencies : - Common emitter class A power amplifier– Transformer coupled class A - Class B complementary symmetry – Class B push pull

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.

EE221: Digital Systems I with VHDL

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

Course Objectives:

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

Course Prerequisite(s):

Basic Programming

Course Outline:

- **Number Systems and Data Representation:** Integer and floating point numbers
- **Boolean Algebra:** Axioms, theorems, standard and canonical forms
- **Minimization Techniques:** Karnaugh map and Quine-McCluskey
- **Introduction to CAD tools & VHDL:** FPGA design flow, VHDL basics
- **NAND-NAND & NOR-NOR Networks:**
- **Combinational Circuits :** Arithmetic and Logic Circuits, binary and BCD adders, subtractors using complements, ALU
- **Combinational Circuits in VHDL:**
- **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

EE203: Electrical Engineering II

Course Information:

Semester: III	**Unit**: UEF32	**Credit Hours:** 6	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

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 voltagesource, 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, 10th edition

EE241L: Active Devices I Lab

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

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 test circuits.

Course Outline:

- Diode characteristics
- Diode applications
- Special-purpose diodes
- Bipolar Junction Transistors (BJT) Characteristics
- BJT biasing
- Class A amplifiers
- Class B power amplifiers

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.

EE221L: Digital Systems I With VHDL Lab

Course Information:

Semester: III	**Unit**: UEM31	**Credit Hours:** 2	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 3 hrs/week	**Semester hrs:** 36

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
- Design and implementation of combinational circuit using schematic capture design entry
- Design and implementation of combinational circuit using VHDL design entry
- Implementation of an ALU using VHDL

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

EE203L: Electrical Engineering II Lab

Course Information:

Semester: III	**Unit**: UEM31	**Credit Hours:** 2	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 3 hrs/week	**Semester hrs:** 36

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

EE281: Introduction to Engineering Economics

Course Information:

Semester: III	**Unit**: UET31	**Credit Hours:** 1	**Coefficient:** 1
Lecture:1.5 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 22.5

Course Objectives:

This course gives students an overview of the economics concepts and methods employed in effective engineering decisions. It will help them develop the required skills in economic analysis, make sound economic and financial decisions and improve the efficient use of available resources in engineering projects.

Course Prerequisite(s):

None

Course Outline:

- **General Introduction**: Role of engineering economy in decision making
- **Fundamental Concepts of Engineering Economics:** Concept of value and utility, consumer goods and producer goods, economic aspects of exchange, the economy of organization, classifications of cost, price is determined by the supply and demand, the law of diminishing returns, depreciation
- **Elementary Examples of Economy Studies**: Design and economy, economy of material selection, standardization and simplification, the selection of personnel, economy of resource input, considering qualitative and quantitative knowledge, the appropriate combinations of elements
- **Economic Analysis of Alternatives:** Present Worth Analysis (PWA) of equal life alternatives, PWA of different life alternatives, pay back period analysis, life cycle cost
- **Evaluating Replacement Alternatives:** The general nature of replacement analysis, evaluation of replacements involving sunk costs, replacement analysis for unequal lives, The economic life of an asset, replacement analysis based on economic life, examples of replacement analyses
- **Break even and Minimum Cost Analysis:** Break even alternatives , two alternatives, minimum cost analysis, minimum cost analysis multiple alternatives
- **Value Analysis – Value Engineering:**

Assessment Method: Continuous + Final Exam

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

EE262: Electromagnetic Field Theory

Course Information:

Semester: IV	**Unit**: UEF41	**Credit Hours:** 6	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

Course Objectives:

This course will provide students with the theoretical background of electromagnetic fields and wave phenomena. Upon completion of this course students should be able to solve Maxwell's equations for specific regular geometries, understand general electromagnetic wave propagation and analyze a given problem using the electromagnetic field theory.

Course Prerequisite(s):

Differential and Integral calculus and physics II

Course Outline:

- Vector algebra, vector operators, coordinate systems and vector calculus
- Electrostatic field theory, Magnetostatic field theory
- Line and surface integral, Divergence and Stokes's theorem
- Establishment of the Maxwell's equations: Ampere circuital law, Faraday's law, Gauss law for the electric field, Gauss law for the magnetic field
- Maxwell's equation in integral form, Maxwell's equation in differential form, Maxwell's equation in a sinusoidal time varying field
- The wave equation in free space, conducting media, other media and their solutions
- Uniform plane wave concept, expressions of the field solution of the wave equations, Polarisation of the waves
- Energy flow and the Poynting vector
- Boundary conditions
- Reflections and refractions of electromagnetic waves, Total internal reflection, Brewster's angle
- Introduction to radiation theory

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Elements of Engineering Electromagnetic, Narayana Rao
2. Electromagnetic Waves and Radiating systems, Jordan

EE252: Linear Systems I

Course Information:

Semester: IV	**Unit**: UEF41	**Credit Hours:** 6	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

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

EE242: Active Devices II

Course Information:

Semester: IV	**Unit**: UEF42	**Credit Hours:** 6	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

Course Objectives:

Students will acquire a 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:

- **Field-Effect Transistors (FET's):** FET description (p and n-channel), operation, voltage-current characteristics and parameters, JFET circuits biasing, JFET small signal low frequency model, JFET amplifier small signal low frequency analysis (common drain, common source and common gate amplifiers), Metal-Oxide-Semiconductor FET's (MOSFET's), description (p and n-channels, depletion and enhancement modes), operation, voltage-current characteristics and parameters, MOSFET circuits analysis and design
- **Silicon Controlled Rectifiers (SCR) and other Devices:** SCR description, operation, voltage-current characteristics and parameters, SCR applications, other semiconductor devices
- **Multiple-Transistor Circuits:** Darlington amplifier, common mode rejection ratio, difference amplifier with constant current source, difference amplifier with emitter resistor, difference amplifier using FET
- **Operational Amplifiers (Op-amps):** 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, analog computer, Schmidt trigger, voltage regulators
- **Active Filters:** Basic filter response characteristics, Bode plots, active low-pass, high-pass, band-pass and band-stop filters

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.

EE222: Digital Systems II with VHDL

Course Information:

Semester: IV	**Unit**: UEF42	**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 to provide students with an in depth knowledge of standard combinational and sequential systems. A modular approach to design larger systems will be emphasised and the HDL-based approach will be used.

Course Prerequisite(s):

Basic Programming and Digital systems I with VHDL

Course Outline:

- **Sequential Logic Circuits:** Flip-Flops, Counters, Registers at SSI and MSI levels
- **VHDL Description of Sequential Circuits:** Process, sequential statements
- **Standard Combinational Modules:** Decoders, MUX, DEMUX, ENC
- **VHDL Description of Standard Combinational Modules:**
- **Finite State Machines (F.S.Ms):** Synthesis of Mealy and Moore machines
- **VHDL Description 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

EE331: Electrical Machines

Course Information:

Semester: V	**Unit**: UEF52	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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

EE242L: Active Devices II Lab

Course Information:

Semester: IV	**Unit**: UEM41	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

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:

- Field effect transistors characteristics
- FET amplifiers
- Silicon controlled rectifiers
- Difference amplifiers
- Basic operational amplifiers
- Operational amplifiers applications
- Active filters

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.

EE222L: Digital Systems II with VHDL Lab

Course Information:

Semester: IV	**Unit**: UEM41	**Credit Hours:** 2	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 3 hrs/week	**Semester hrs:** 36

Course Objectives:

To develop skills in designing and implementing large digital systems using a modern CAD tools & VHDL

Course Prerequisite(s):

Basic Programming and Digital Systems I with VHDL

Course Outline:

- Design and implementation of sequential circuits using

- Discrete IC (74xxx) series

- Using VHDL

- Standard combinational modules: Applications
- Finite state machines
- Semiconductor memories
- Data acquisition & distribution systems

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

EE331: Electrical Machines Lab

Course Information:

Semester: V	**Unit**: UEM51	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

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

Assessment Method: Continuous

Textbook(s) and/or other required material:

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

EE321: Computer Architecture

Course Information:

Semester: V	**Unit**: UEF51	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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.

EE311: Communications Principles

Course Information:

Semester: V	**Unit**: UEF51	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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 memoriless non 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

EE323: Microprocessor Systems Design

Course Information:

Semester: V	**Unit**: UEF51	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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-maskable interrupts
- **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

EE232: Power Electronics

Course Information:

Semester: IV	**Unit**: UEF42	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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**

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.
3. http://www.pspice.com

EE351: Linear Systems II

Course Information:

Semester: V	**Unit**: UEF52	**Credit Hours:** 6	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 1.5 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 67.5

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

EE353: Process Control and Instrumentation

Course Information:

Semester: V	**Unit**: UEF52	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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:

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

EE311L: Communications Principles Lab

Course Information:

Semester: V	**Unit**: UEM51	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

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:

1. Communications Lab. Manuel, Clay and Doumi

EE232L: Power Electronics Lab

Course Information:

Semester: IV	**Unit**: UEM41	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

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

EE323L: Microprocessor Systems Design Lab

Course Information:

Semester: V	**Unit**: UEM51	**Credit Hours:** 2	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 3 hrs/week	**Semester hrs:** 36

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

EE312: Communications Circuits

Course Information:

Semester: VI	**Unit**: UEF61	**Credit Hours: 4**	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

Course Objectives:

At the end of the course, the student must master basic electronic circuits used in communication such as passive coupling networks, oscillators, mixers and modulators, small signal IF and RF amplifiers and power amplifiers

Course Prerequisite(s):

Students must have a good knowledge of elementary electronic circuits and networks. They must also know the basic modulations.

Course Outline:

- **Review of electronic devices and biasing**
- **Passive coupling networks, Q transformations, transformer like networks**
- **Non linear controlled sources:** Piecewise linear, square law, exponential, differential, effect of series resistance, resistively biased BJT
- **Sinusoidal oscillators**
- **Receiver circuits:** Super heterodyne principle, mixers (passive and active), rf amplifier design (noise and interferences), if amplifier design (y parameter design procedures)
- **Transmitter circuits:** Power amplifiers (class A, B and C)

Assessment Method: Continuous + Final Exam

Textbook(s) and/or other required material:

1. Communication Circuits: Analysis and Design, K. K. Clarke and D. T. Hess, Addison-Wesley, Reading, Mass. 1971.

EE332: Energy Systems

Course Information:

Semester: VI	**Unit**: UEF61	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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
3. Miller, Robert H., Power system operation, 2nd edition, McGraw-Hill Inc.

EE352: Linear Control Systems

Course Information:

Semester: VI	**Unit**: UEF61	**Credit Hours:** 4	**Coefficient:** 3
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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

EE312L: Communications Circuits Lab

Course Information:

Semester: VI	**Unit**: UEM61	**Credit Hours:** 2	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 3 hrs/week	**Semester hrs:** 36

Course Objectives:

This is an accompanying set of laboratory experiments to the communication circuit course. At the end of the course, the student should be able to design typical communication circuits such as oscillators, modulators, amplifiers.

Course Prerequisite(s):

The student must absolutely know basic lab procedures and should have a working knowledge of a SPICE based software

Course Outline:

- Low frequency single BJT amplifier
- Wien bridge oscillator
- LC oscillators
- Crystal oscillators
- Mixer circuits
- Transmitter circuits

Assessment Method: Continuous

Textbook(s) and/or other required material:

1. Communications Circuits lab. Manual, A. Dahimène

EE352L: Linear Control Systems Lab

Course Information:

Semester: VI	**Unit**: UEM61	**Credit Hours:** 1	**Coefficient:** 1
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 1.5 hrs/week	**Semester hrs:** 18

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

EE392: Project

Course Information:

Semester: VI	**Unit**: UEM62	**Credit Hours:** 12	**Coefficient:** 4
Lecture: 0 hrs/week	**Recitation:** 0 hrs/week	**Lab:** hrs/week	**Semester hrs:**

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.

Course Prerequisite(s):

Course Outline:

None

Assessment Method: Continuous

Textbook(s) and/or other required material:

None

EE382: Engineering Management

Course Information:

Semester: VI	**Unit**: UED61	**Credit Hours:** 3	**Coefficient:** 2
Lecture: 3 hrs/week	**Recitation:** 0 hrs/week	**Lab:** 0 hrs/week	**Semester hrs:** 45

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.