Course Description EE Dept.

Math 101: Calculus I
This course is designed to cover the basic concepts and methods of Calculus. It includes limits, continuity, and differentiability of functions of a single variable: polynomial, exponential, trigonometric, hyperbolic, and their inverses· Applications: related rates, local linear approximation, differentials, curve sketching and optimization problems. During the semester students will learn to recognize and express the mathematical ideas graphically, numerically and in writing. The course material will be presented in lectures (4 hrs./week). Problem solving techniques will be developed in tutorials (1hr./ week).

PHYS 101: General Physics I
The topics covered include particle kinematics and dynamics; Newton laws, conservation of energy and linear momentum; rotational kinematics; rigid body dynamics; conservation of angular momentum; gravitation; simple harmonic motion; the static and dynamics of fluids. The course material will be presented in lectures (3 hrs./week). Problem solving techniques will be shown in tutorials (1 hr./ week). The understanding of concepts will further be strengthened by laboratory work (3 hrs./ week).

CHEM 101: General Chemistry
The course is designed to give students a foundation in chemistry by providing an introduction to the following areas: atomic theory; physical and chemical properties of gases, liquids, solids, and their solutions; properties of some elements and their compounds, etc. The course laboratory will include some qualitative and quantitative measurements to formulate and analyze chemical reactions. The course material will be presented in lectures (3 hrs./week). The understanding of concepts will further be strengthened by laboratory work (3 hrs./ week).

ENGL 101: INTRODUCTION TO ACADEMIC WRITING
Students are exposed to different genres of reading material, such as encyclopedias, magazines, newspapers and websites. They are taught strategies for dealing with each genre independently and effectively. The writing component teaches argumentation and such rhetorical modes as definition writing, description, exemplification, causal analysis and comparison. Students are taught the writing process and introduced to paragraphing, cohesion, conciseness, unity and the use of specific details. They are alerted to common errors in grammar and sentence structure. The vocabulary component is based on the Academic World List, a corpus of vocabulary items based on the most frequently occurring lexis in a broad range of academic texts. In addition, students are expected to give short talks on a variety of topics.

Math 102: Calculus II
This course is a continuation of Math 101. Topics covered include definite and indefinite integrals of functions of a single variable. Fundamental Theorem of Calculus. Techniques of integration. Applications of the definite integral to area, volume, arc length and surface of revolution. Improper integrals. Sequences and series: convergence tests, integral, comparison, ratio, and root tests.

Alternating series. Absolute and conditional convergence. Power series. Taylor and Maclaurin series, Parametric function. The course material will be presented in lectures (3 hrs./week). Problem solving techniques will be developed in tutorials (1 hr./ week).

PHYS 102: General physics II

This course is a continuation of PHYS 101. Topics covered include Coulomb's law; the electric field; Gauss' law; electric potential and energy; capacitors and dielectrics; D.C. circuits; the magnetic field; Ampere's and Faraday's laws. Students will learn the concepts and applications underlie the working of household appliances, electric motors, power generation, all types of monitoring screens, printers, MRI machines etc. The course material will be presented in lectures (3 hrs./week). Problem solving techniques will be developed in tutorials (1 hr./ week). The understanding of physical concepts will further be strengthened by a set of standard experiments carried out through the laboratory work (3 hrs./ week).

ENGL 102: An Introduction to Report Writing

In this course, the student will acquire hands-on experience with electrical circuits discussed in EE 201. Experiments include Ohm's law, Kirchhoff's laws, series and parallel resistors, voltage divider, superposition, Thevenin equivalent circuit, transformer operation, three-phase systems and series RC and RL circuits.

ENGL 201: Technical Writing

Students write a 1500-word themed, source-based report on a problem-solution topic related to their majors. They are taught the APA style of documentation and advanced internet research skills. Instruction focuses on a process-based approach which includes audience analysis, narrowing and focusing a report topic, citation methods and referencing, document design, paraphrasing, summarizing, and writing an abstract. Additional instruction is given on advanced presentation skills for their research reports. In the second half of the course, students are taught the job application process involving cover letters, résumés and interviews leading to important aspects of business correspondence, such as letter format, style, tone and two important business letters (inquiry and complaint).

Math 201: Differential Equations

This course covers the following topics: classification of differential equations, first order differential equations, higher order linear differential equations, linear systems of algebraic equations, first order linear systems of ordinary differential equations, Laplace transforms, and their application on initial value problems.

Math 202: Calculus III

This course is a continuation of Math 102. Topics covered include different aspects of vector fields: vector fields in two and three dimensions, operations on vectors such as scalar and vector products, gradient, divergence, and curl of vector fields. Basic of analytic geometry: Lines and planes in three dimensions, surfaces Equations of the tangent plane and normal line to a surface. Vector-

valued functions and connecting them with single variable functions. Concepts of motion and curvature. Line and surface integrals, multiple integrals. Green and Stokes Theorems. The course material
will be presented in lectures (3hrs./week). Problem solving techniques will be developed in tutorials (1 hr./ week).

Math 204: Linear Algebra
This course topics cover: linear equations, matrix algebra, vector spaces, eigenvectors, orthogonality and least squares, symmetric matrices and quadratic forms.

STAT 342: Statistical Methods for Engineers
This course provides probabilistic modeling and quantitative engineering methods. It focuses on the application of quantitative data analysis methods in all the engineering fields. The course also emphasizes the use of engineering applications and advanced statistical tools and techniques for the data analysis, problem-solving, and decision-making.

CS 141: Introduction to Computing for Engineers
The course provides an introduction to computing logic, algorithmic thinking, and programming constructs using MATLAB, a programming language and computing environment. Knowledge obtained in this course will enable students use computer as an instrument to solve computing problems. Topics include an introduction to programming in MATLAB, including matrix operations, functions, arrays, loops and structures, working with data files and plotting. No previous programming experience is required.

ENGG 103: Introduction to Engineering Drawings
This course includes an introduction engineering drawing course. This is a laboratory course and both hand sketching and computer-aided design (CAD) are the two main tools to formulate and convey design intent. Therefore, this course is planned to introduce sufficient classical tools, which would help the student to visualize three-dimensional objects and develop orthographic projection drawings. The course topics are arranged in sequence starting from: the basic concepts of geometrical constructions & engineering curves proceed to the principles of projection techniques. Some fundamentals of computer graphics will be introduced through an introduction to the basic of computer-aided design (CAD) techniques using the software AutoCAD.

ENGG 304: Introduction to Engineering Economy
The purpose of this course is to teach students (1) the basic principles, concepts, and methodology of engineering economy; and (2) to help them develop proficiency with these methods and with the process for making rational decisions regarding situations they are likely to meet in professional practice.

ENGG 401: Engineering Management
An overview of engineering industry, contracts, contract documents and professional liabilities, tendering process, planning and scheduling, resource leveling, time and cost control, labor cost and productivity, and risk management.

EE 201: Electric Circuits I
Analysis of electrical networks incorporating passive and active elements. Basic laws and techniques of analysis. Transient and forced response of linear circuits. AC steady state power and three-phase circuits Periodic excitation and frequency of response. Computer analysis tools. Design projects are implemented and tested in the laboratory. Laboratory reports with revisions are required for each project.

EE 203: Electric Circuits I Lab
In this course, the student will acquire hands-on experience with electrical circuits discussed in EE 201. Experiments include Ohm's law, Kirchhoff's laws, series and parallel resistors, voltage divider, superposition, Thevenin equivalent circuit, transformer operation, three-phase systems and series RC and RL circuits.

EE 202: Electric Circuits II
Introduction to the analysis of AC single-phase and AC three-phase circuits, design methods for analog linear circuits, and Laplace Transform. The Laplace Transform in Circuit Analysis. Transient analysis of first and second order circuits. Frequency response of frequency selective circuits: concept of transfer function, resonance, bode plots, introduction to filters and network analysis in the s-domain. Mutual inductance and transformers. Two-Port networks.

EE 222: Electronic Circuits I
Physical electronics are underlying the operation of electronic devices. Semiconductors, the basis of electronics will be thoroughly explained. Diodes, diodes models and diode circuits are the basic electronic components that are introduced in this course. Transistors, transistor models and transistors circuits are also discussed. DC and frequency analysis of transistor amplifiers are described. Compound transistor configuration are introduced with some computer analysis tools. Design projects are implemented and tested in the laboratory.

EE 224: Electronic Circuits I Lab
Physical electronics are underlying the operation of electronics devices. Semiconductor theory will be the base of this course. Diodes, diode models, and diode circuits are the basic electronic components that are introduced in this course. Transistors, transistors models and all transistor circuits are also considered as basic components.
DC, small signal, and frequency analysis of transistor amplifiers are described. Compound transistor

configuration are introduced with some computer analysis tools. Design projects are implemented and tested in the laboratory.

EE 231: Logic Circuits Design
Representation of digital information. Number systems & codes. Logic gates. Boolean algebra. Karnaugh maps. Analysis, design, and evaluation of combinational systems, decoder, multiplexers, adders and sub tractors, PLAs. Type of flip-flop. Memory concept. Counters, registers, and sequential logic circuits.

EE 233: Logic Circuits Design Laboratory
In this lab, students learn how to design, build and troubleshoot digital logic circuits. Students work with ready-to use modules and also build circuits using discrete components such as TTL Integrated Circuits (ICs). The experience gained in this lab is indispensable for students working on senior design projects. Students also learn to simulate their design using Multisim before implementing the circuit in hardware.

EE 311: Electromagnetic Fields
In this course students will review to mathematics scalar and vector calculus and then learn about Electrostatic fields; Coulomb’s law; Gauss’s law and divergence; Electric potential; Dielectrics and capacitance; Poisson's and Laplace's equations; Charge images; Current density and conductors; Magneto static fields; Biot-Savart and Ampere's laws; Curl and Stoke's theorem; Magnetic materials and circuits; Self and mutual inductances and Energy in static fields.

EE 312: Electromagnetic Waves
In this course students will learn how to utilize Maxwell’s equations in Time varying fields; Faraday's law. Transformer and motional emfs; Displacement current; Maxwell's equations and time harmonic fields; Wave equation; Power transfer and Poynting vector; Plane wave propagation in free space, in lossy dielectrics and in good conductors; Polarization; Reflection of plane wave at normal and oblique incidence; Transmission line Theory; Impedance matching,

EE 321: Electronic Circuits II
This course focuses on the frequency-based analysis and design of linear amplifiers networks. Considering The effect of feedback and stability in tuned and amplifier networks and surrounding interference such as noise and frequency
compensation. The applications encompass active filters, oscillators, and phase lock loops and nonlinear operations such as multiplication, sampling, and analog-to-digital conversion.

EE 323: Electronic Circuits II Lab
Analysis and design of linear amplifiers. The effect of feedback in tuned, video, and operational amplifiers. Noise, stability, and frequency compensation. Applications encompass active filters, oscillators, phase lock loops and nonlinear operations such as multiplication, sampling, and analog-to-digital conversion.

EE 326: Microprocessor & Microcontroller
Introducing and practicing Intel 8086 Microprocessor hardware and software Models, instruction sets, assembly language programming and debugging. The course will emphasize on the use of professional emulators and software's, such as, debugging tools (DEBUG and Turbo Debagger) and assemblers (TASM or MASM)/ Memory and input/output mapping. Input and output instructions. Input/output Interfacing. Introduction to interrupts and Intel 8051 microcontroller.

EE 328: Microprocessor and Microcontroller Applications Lab
The objective of the course is to expose to the students to the architecture and instruction set of typical 16-bit and 8-bit microprocessor and microcontroller that are based on intel 8086 and 8051 architecture respectively. The students will engage in understanding programming and debugging the executable content of a program within the microprocessor. The student will experiment input and output mapping, instructions and interfacing. Additionally, the microcontroller is introduced, and interrupts will be examined in terms of programming and execution. Further, the students will be exposing their knowledge in microprocessor/controller on the Infinite Technologies boards practically.

EE 341: Signals and Systems
Representation of signals in the time and frequency domains. Fourier series. Fourier and Laplace transform methods for analysis of linear systems. Introduction to state space models. Introduction to sampling and discrete systems analysis via z transforms.

EE 342: Digital Signal processing
Discrete-time signals and systems. The z-transform. Digital filters; stability, frequency response, canonic realizations and state equations. Fourier methods for discrete signal representation; Fourier transform of sequences, the discrete Fourier transform, and the FFT. Design of linear digital filters in time and frequency domains. Spectrum analysis and filtering via the FFT.

EE 351: Electric Machines
Concept of a three-Phase Circuits and Balanced systems; introduction to the Per-Unit Systems; Magnetic Circuits, mmf, reluctance, flux; Concept of single-phase transformers; Introduction to the single and three-phase transformers. Concept of AC Machinery; fundamentals of synchronous machines; the three-phase synchronous generator: operation, parallel operation; concept of three-phase asynchronous motors; introduction to DC Machines: DC Generator and DC Motor.

EE 356: Introduction to Modern Power Systems
This course presents a review of electric power systems circuits and electromagnetic concepts. Electric power generations, transformers, autotransformers, three-winding transformers, transmission line parameters are covered. Calculation of transmission line parameters and electric power components modeling are included. Evaluation of steady state operation of transmission

lines, power factor correction, reactive power compensation, line capability, power flow analysis, steadystate and transient stability, and symmetric fault analysis are covered.

EE 358: Electric Machines and Power Systems Lab

In this course, the student will acquire hands-on experience with electrical machines and power systems networks that are discussed in EE 351 and EE 356. It has two parts:

- Electric Machines Experiments: magnetic circuits and Transformer characteristics and Electric machines DC characteristics, Experiments on AC machines synchronous and asynchronous characteristics.
- Power Systems Experiments: generation, transmission and distribution of Electric power, operation, and management. Sustainable energy sources such as photovoltaics, solar-thermal power, wind farms, and their grid integration. Modern power system monitoring/control, fault analysis, and transient stability analysis using computer tools ETAP.

EE 394: Summer Field Experience II

Summer Field Experience training is approved by the electrical engineering department on the condition that the training is on electrical engineering field or any of its discipline, the training site is blacklisted before by the electrical engineering department, and that the paperwork is completed by the student and the organization in compliance with the UPM Summer Training Manual.

EE 408: Professional Ethics for Electrical Engineers

This course introduces students to principles of professional engineering practice, ethical conduct, applicable laws, sustainable development, and equity. Exploring and relating the applications of ethics in engineering in academic and professional careers. This development widens the vision of students towards society change and structure. Consider such questions: How do the societal functions of engineers and the practical application of technologies relate to basic moral and intellectual values? What moral obligations are implied by the uses of technology? What are the ethical duties of engineers in the practice of their careers?

EE 429: Power Electronics

Power electronics is the technology associated with the efficient conversion, control, and conditioning of electronic power by static means from its available input form into the desired electrical output form. First, power electronic devices and solid-state drive packages are introduced. Different converters (rectifier and inverter) circuits are studied, they comprise the power and control for these drive packages. This includes power electronics circuits, power semiconductor devices, and converter topologies. The student will learn analysis and design techniques for switch mode converters using the buck, boost, and buck-boost topologies. The course will emphasize complex theoretical analysis and computer simulation tools as course project.

EE 456: Power Distribution Systems
This course will provide the fundamental principles of the electric power delivery system with emphasis on distribution systems. Components of distribution system shall be discussed: substations, switchgear, feeders, sub transmission lines, primary and secondary systems; K factors, Voltage drop and power losses consideration; application of capacitors in distribution system. The performances of type A step-voltage regulator and type B step-voltage are compared and the generalized constants for single-phase step-voltage regulators are analyzed. Symmetric fault current calculation, power distribution systems protection shall be discussed with the system reliability and power quality issues.

EE 458: Smart Electric Power Grid
The course will provide students with a working knowledge of fundamentals, design, analysis, and development of Smart Electric Power Grid. The course offers an introduction to the basic concepts of power systems along with the inherent elements of computational intelligence, communication technology and decision support system. The automation and computational techniques needed to ensure that the Smart Grid guarantees adaptability and capability of handling new systems and components are discussed. The interoperability of different renewable energy sources is included to ensure that there will be minimum changes in the existing legacy system. Standards and requirements needed for designing new devices, systems and products for the Smart Grid are discussed.

EE 459: Renewable Energy
This course explores society's present needs and future energy demands, examine conventional energy sources, including fossil fuels and nuclear energy, and then focus on alternate renewable energy sources; it provides an overview of the latest technologies and developments in renewable energies, as well as the diversity of their applications. It will explore society's present needs and future energy demands, focus on alternate renewable energy sources such as wind power, solar energy: Solar Cells and Photovoltaic Systems; hydro energy conservation methods: types of hydraulic turbines; brief introduction on geothermal, biomass, and Marine Energy; Energy storage.

EE 461: Control Systems
In this course students will learn how to analyze linear feedback systems and design feedback control systems. The course covers: Modeling of controlled systems using differential equations, transfer functions and state space representation; Analyzes of the first and the second order systems in terms of stability, transient and steady state performance in the time and the frequency domains; and Design of feedback control systems.

EE 463: Control Systems Lab
In this course, the student will acquire hands-on experience with electrical circuits discussed in EE 201. Experiments include Ohm's law, Kirchhoff's laws, series and parallel resistors, voltage

divider, superposition, Thevenin equivalent circuit, transformer operation, three-phase systems and series RC and RL circuits.

EE 464: Control Systems Application
Introducing and practicing the engineering standards in control components selection and design. Fundamentals of industrial transducers and actuators are given. Problem definition and techniques for stimulation of ideas are given. Students learn the analysis and design of different control problems with special emphasis on concepts and design creativity. They acquire the basic skills of how to approach and deal with different requirements to analyses and to design real time applications.

EE 468: Digital Control Systems
Introduction to the analysis and design of discrete-time feedback control systems. Topics include mathematical representation of physical systems with linear difference equations, z-transforms, transfer functions, sampling, A/D and D/A converters, sampled-data systems, discrete equivalent systems, transient specifications, steady-state tracking errors, stability, controller design, quantization effects.

EE 469: Programmable Logic Controllers
This course introduces the fundamentals of programmable logic controllers (PLCs) and their applications. It provides the knowledge and skills needed to understand hardware, basic methods of programming, and programming techniques. The course focuses on the major components of PLC hardware structure, the types of input/output devices and their functions, logical operators, ladder diagrams, and how they work together to solve control problems. Students perform real and simulated hands-on experiments which enhance their skills in using SIMATIC STEP 7 PLC and IOFactory.

EE 471: Communication Systems
Communication of information over noisy channels. Fourier transform review, spectral analysis, and sampling. Amplitude, phase, and frequency modulation of a sinusoidal carrier. Time and frequency division multiplexing. Random processes and analysis of communication of systems in noise. Elements of digital communication systems.

EE 473: Communication Systems Lab
This Lab covers a wide range of experiments in analog and digital communication systems including Amplitude Modulation types and demodulation, angle modulation and demodulation, sampling and quantization, and Pulse code modulation encoder and decoder. Lab experiments emphasis on design aspects and performance analysis of different systems, techniques and methods in modern communication systems.

EE 491: Capstone Project I
Discussion of the design process; project statement, specifications, project planning, scheduling and division of responsibility, ethics in engineering design, safety, environmental considerations, economic constraints, liability,
manufacturing, and marketing. Projects are carried out using a team-based approach. Written progress reports, a proposal, an interim project report, a final report, and oral presentations are required.

EE 492: Capstone Project II
Design of a device, circuit, system, process, or algorithm. Team solution to an engineering design problem as formulated in EE491, from first concepts through evaluation and documentation. Written progress reports, a final report, and an oral presentation are required.

EE484: Introduction to Artificial Intelligence
Introduction to artificial intelligence, Intelligent agents, solving problems by searching, Game playing, logical agents and first order logic, learning from observations, Learning in neural and belief networks, Practical language processing, Fuzzy logic and reasoning, Perception and pattern recognition, Artificial neural networks. Applications in image processing,
robotics, and projects.