Course Description

Legend

Course Title [A – B – C]	Course #:	Prereq.:

A: Theoretical hrs
B: Practical hrs
C: Credit hrs

*: Or C-requisite

Energy and Environment [3 – 0 – 3]	Course #:0906331	Prereq.: 0300131
Energy systems and environment; conventional and renewable energy sources. The impact of RE in reducing CO_2 emissions. Consequence of pollution growth; air, water, soil, thermal, noise pollution- cause and effect; causes of global, regional and local climate change; pollution control methods; environmental laws on pollution control. Sustainability: global warming; green house, gas emissions, impacts, mitigation; externalities. The effect of future energy systems.		
Simulation and Prediction [3 – 0 – 3]	**Course #:0906370**	**Prereq.: 0904303**
Principles of prediction and simulation, random number generators, basic probability distributions, Monte Carlo method for simulation, Simulation models of energy systems. Simulation languages.		
Simulation and Prediction lab [0 – 3 – 1]	**Course #:0906371**	**Prereq.: 0906370***
A series of experiments which demonstrate the principles of simulation using simulation programs for energy systems.		
Engineering Economics and Management[3 – 0 – 3]	**Course #:0906540**	**Prereq.: 0906331**
This course is designed to present engineering students the major concepts and techniques of engineering economic analysis that are needed in the decision-making process. The emphasis of this course is on the analytical analysis of money and its impact on decision making. It will emphasize the systematic evaluation of the costs and benefits associated with proposed technical projects. The student will be exposed to the concept of "time value of money" and the methods of discounted cash flow. Students are prepared to make decisions regarding money as capital within a technological or engineering environment. Engineering management relies on the knowledge of engineering economics to be able to evaluate projects from a financial perspective. Optimizing financial performance of a project is a key responsibility of the engineer in the decision-making process.		
Energy Engineering Software [3 – 0 – 1]	**Course #:0906401**	**Prereq.: 4th year**
The PV System, Sketch up, outo-CAD, Stad-Pro, CFD and Solid work programming languages are intended to be given in this course. Moreover, MATLAB for special topics in electrical engineering (signal processing, controls, electric circuits), Graphical user interface (GUI) building in MATLAB is included as well.		
Nuclear Reactions [3 – 0 – 3]	**Course #:0906410**	**Prereq.: 0300122**
Energetic and kinetics of nuclear reactions and radioactive decay, fission, fusion, and reactions of low-energy neutrons; properties of the fission products and the actinides; nuclear models and transition probabilities; interaction of radiation with matter.		
Renewable Energy systems [3 – 0 – 3]	**Course #:0906453**	**Prereq.: 0904462+0906331**
Introduction to energy .Climate change and future of energy. Survey of energy technologies including : biomass energy ,biofuels and fuel cells ,geothermal , hydroelectric , nuclear , solar and wind energy . Energy sources , units and conversion . Energy efficiency .Energy production and uses of both conventional and renewable sources . Electrical power systems concepts and grid integration techniques.		

Wind Energy [3 – 0 – 3]	Course #:0906454	Prereq.: 0905341+0906453
Introduction to wind and wind power history. Structure of the wind turbine. Impact of tower height. Maximum rotor efficiency. Introduction to wind turbine generators. Turbine aerodynamics (how wind power works) Average power in the wind. Wind turbine electrical capacity. Wind power probability density function, Weiball and Rayleigh statistics. Wind farms. Specific wind turbine performance calculation. Environmental concerns: noise , view , landscape.		

Wind energy Lab [0 – 3 – 1]	Course #:0906455	Prereq.: 0906454*
This course investigates the basics of aerodynamic characteristics of wind, dynamic behavior of wind turbine rotors and the generated wind energy.		

Power Plants Lab [0 – 3 – 1]	Course #:0906533	Prereq.: 0904569*
A series of experiments which demonstrate the principles of electrical and thermal power plants.		

Solar pv Energy systems [3 – 0 – 3]	Course #:0906552	Prereq.: 0906453
Earth -Sun geometry; sun position and energy. Potential of solar radiation. Photovoltaic (pv) energy : semiconductor materials, PN-junction, solar cell under illumination, current / voltage characteristics of solar cells, equivalent circuit of solar cells, technologies of solar cells, modules, DC/AC Inverter. Photovoltaic (pv) and hybrid power systems. Solar thermal energy: concentrating solar power plants, solar collectors, pipes, thermal storage, and solar thermal systems.		

Solar pv Energy Lab [0 – 3 – 1]	Course #:0906553	Prereq.: 0906552*
A series of experiments which demonstrate the principles of solar energy and solar energy systems and components (on-grid and off-grid systems). Measurement of parameter affecting solar energy.		

Graduation Project (1) [3 – 0 – 1]	Course #:0906580	Prereq.: 0906444
Students (individually or in teams) are assigned to engineering problems which may be theoretical, experimental or both and contains a major design component. The students study the problem assigned and its theoretical background, set the approach, conduct a literature review, make the problem analysis and preliminary design and write a proposal including a cost estimate and time table for implementation over the second semester.		

Graduation Project (2) [3 – 0 – 3]	Course #:0906581	Prereq.: 0906580
Continuation of Project I. The students carry out detailed design, construction and testing (if any), write a comprehensive report on the work as per the format posted on the department web site. The report should include, where applicable, economical and environmental assessments. The project work is presented by the students to an examination panel who judge the work.		

Turbo machinery [3 – 0 – 3]	Course #:0905541	Prereq.: -------
Definitions, basic laws, dimensional analysis, velocity triangles for impulse and reaction blades. Performance characteristics, thermodynamics applications on axial flow compressors and turbines; radial flow gas turbines; centrifugal compressors; cascades. Theory of the propeller. Wind turbines. Various gas turbine cycles, and to hydraulic turbines.		

Nuclear Energy Engineering [3 – 0 – 3]	Course #:0906511	Prereq.:0906410
Introduction to nuclear energy. Atomic and nuclear physics; interaction of radiation with matter. Nuclear reactor operation; reactor components, nuclear cycles, neutron diffusion and moderation. Reactor shielding. Fuel reprocessing and waste disposal. Reactor licensing and safety. Economics and environmental concerns.		

Generation, transmission& distribution of energy[3 – 0 – 3]	Course #:0906534	Prereq.: 0904432
Introduction to modern power systems. Synchronous generators. Auxiliary systems at power generating station. Voltage regulation in power systems. Power transmission systems. Electric power distribution systems, and equipments. Single and three phase distribution systems. Electric power storage technology and conversion systems .Power system operation and control.		
Energy efficient design[3 – 0 – 3]	**Course #:0906523**	**Prereq.: 0906 453**
Efficiency of systems involving energy generation, storage and distribution. Principles of integrated energy-efficient design. Application of codes and standards. Energy modeling and simulation. Energy efficient design of heating, cooling, ventilating and lighting in space. Architectural features of passive solar buildings. Application of renewable resources and net-zero designs. Life-cycle economic analysis.		
Biomass Energy Systems[3 – 0 – 3]	**Course #:0906532**	**Prereq.: 0906453**
This course will introduce a range of biomass energy sources, including forestry, wastes and crops, as well as various technologies for capturing the stored chemical energy in biomass: direct combustion, pyrolysis, anaerobic digestion, gasification, fermentation, landfill gas and cogeneration.		
Energy Economics and Management[3 – 0 – 3]	**Course #:0906540**	**Prereq.: 0906331**
Energy management principles; energy conservation; energy auditing; analysis; formulation of energy management options; economic evaluation, implementation & control; energy conservation techniques – conservation in energy intensive industries; steam generation, distribution systems, and electrical systems; integrated resource planning; demand-side management; cogeneration; total energy schemes; thermal insulation; energy storage; economic evaluation of conservation technologies; analysis of typical applications. Application of the principles and practices of energy management to improve energy efficiency, sustainability, and renewable resource usage.		
HVAC systems[3 – 0 – 3]	**Course #:0906541**	**Prereq.: 5th year**
Review of relevant thermodynamics and heat transfer topics, psychrometric, thermal comfort, air conditioning processes, inside and outside design conditions, heating load calculations, infiltration, cooling load calculations, solar gain, heating systems design, hot air systems, baseboard heating, case studies and design projects. Review of Psychrometric processes, air requirements, ventilation requirements, description of different HVAC systems, analysis and design of the all-air system, room air distribution, duct design, selection of fans and pumps, design of piping systems for all-water systems, selection of boilers, control systems and zoning.		
Solar Thermal energy systems[3 – 0 – 3]	**Course #:0906559**	**Prereq.: 0906453**
Solar radiation: extraterrestrial and available. Radiation characteristics of opaque materials .Radiation characteristics through glazing. Flat-plate collectors. Energy storage .System thermal calculations. Solar process economics. Solar heating: water and building. Solar cooling. Simulations in solar process design		
Design of renewable energy systems[3 – 0 – 3]	**Course #:0906560**	**Prereq.: 0906454+0906552**
The operating principles of solar cells . The strengths and weaknesses of the dominant commercial cell technologies. Different trends in commercial cell technology and the corresponding manufacturing processes and environment. The impact of various processing and device parameter on performance and product reliability. Insight given into complete production processes for both screen- printed solar cells and buried contact solar cells with in-line quality control procedures. Introductory issues related to the production of electricity from wind power . The study of the atmospheric science necessary to locate wind turbines for the understanding of experimental date. The study of design and control will allow for comprehensive knowledge of all subcomponents of a wind turbine . Sizing and citing of wind turbines . connection between wind turbines and smart grids.		

Design of Green Buildings[3 – 0 – 3]	Course #:0906562	Prereq.: 5th year
Passive solar building explores the use of solar energy to passively heat and cool buildings. Topics include solar radiation, building heating and cooling loads, energy efficient design and construction, passive solar heating, proper implementation of thermal mass, and passive cooling.		
Geothermal Energy Systems[3 – 0 – 3]	**Course #:0906558**	**Prereq.: 0905321+0905341**
Geology of geothermal regions and resources .Single-flash steam power plants .Double-flash steam power plants. Dry-steam power plants .Binary cycle power plants .Hybrid geothermal systems .Total-flow systems. Environmental impact of geothermal power plants .Using ground-source heat pump systems for heating and cooling.		
Hydro- electric energy systems[3 – 0 – 3]	**Course #:0906563**	**Prereq.: 0906453**
Introduction to hydro- resource power production. Hydropower in history. Physics of hydrology. Power , head, flow-rate. Turbine hydrodynamics: Francis , Kaplan , Pelton , Turgo , cross-flow. System components : generators, governors, penstocks ,spillways, valves , gates , trashracks .Large-scale and microhydroelectric system . Pumped storage. Economic , environmental considerations.		
Fuel Cells and Hydrogen Production Technology[3 – 0 – 3]	**Course #:0906561**	**Prereq.: 0906453**
Overview of the various types of fuel cells followed by a detailed discussion of the proton-exchange membrane (PEM) fuel cell fundamentals: thermodynamic relations, kinetics, and overall design and performance characteristics of PEM fuel cells. Hydrogen production technology: hydrogen systems modeling, hydrogen applications, life-cycle analysis methods, hydrogen production from hydrocarbons, hydrogen delivery and storage systems and safety.		
Programmable Logic controllers(PLC) [3 – 0 – 3]	**Course #:0906569**	**Prereq.: 0904470**
Historical background. PLCs vs relays control systems. Numbering systems and Boolean functions. PLC structure and memory map. PLC scan. Programming digital input/ output combinations . Sequential PLC control. Programming PLC timers and counters. PLCs analog interfacing.		
Special Topics in Energy Engineering [3 – 0 – 3]	**Course #:0906582**	**Prereq.: 5th year**
This course covers emerging and advanced topics in the field of energy engineering. The contents may vary depending on the topic.		
Railways technology for mechanical Engineering[3 – 0 – 3]	**Course #:0905500**	**Prereq.: 5th year**
Introduction to railways technology, principles of electrification, traction, signaling, telecommunication and control.		
Engineering Mathematics [3 – 0 – 3]	**Course #:0904201**	**Prereq.: 0300102**
Vectors and the geometry of space: dot product, cross product. Lines and planes in space. Vector functions: derivatives and integrals. Function of two or more variables: partial derivatives, gradient, divergence, Curl. Lagrange's multipliers. Multiple integral. Double integrals in polar coordinates; triple integrals; triple integrals in cylindrical and spherical coordinates; change of variables in multiple integrals.		
Electrical circuits [3 – 0 – 3]	**Course #:0904200**	**Prereq.: 0300122**
The electric circuit components. Atoms, current, voltage, and resistance. Types of resistors. Ohm's low. Power and energy. Energy losses and voltage drop. Series, parallel, and series-parallel, wye- delta resistive circuits. Kirchhoff's current and voltage laws. Circuit analysis methods (mesh analysis and nodal analysis). Circuit theorems (Thevenin's and Norton's theorems, superposition principle and maximum power transfer). Capacitors and Inductors characteristics, connections and types. Natural and forced response analysis of RL and RC circuits. Sine wave characteristics. **Compplex** numbers. Arithmetic of complex numbers. Resistance, impedance and reactance in complex form. Phasor relationship of circuit elements. Sinusoidal steady-state analysis of RL, RC and RLC circuits. AC power analysis. Three-phase circuits. Sinusoidal form of Fourier series.		

Electrical circuits lab [0 – 3 – 1]	Course #:0904203	Prereq.: 0904200*
DC circuits: Ohm's law; KVL and KCL; network theorems; transient analysis of RL; RC; and RLC circuits; impedance concept and techniques; power and P.F; series and parallel resonance; three phase circuits; Transformers; magnetically coupled circuits; filters; troubleshooting.		
Electronics [3 – 0 – 3]	**Course #:0904204**	**Prereq.: 0904200**
Properties of semiconductor materials; doping technique; p-n junction; diode: forward and reverse biasing; VI static characteristics; small and large-signal models; types and applications; bipolar junction transistors (BJT): construction; connections and biasing; applications; small signal models; ratings; and applications; field-effect transistors (FET): construction types; VI characteristics; ratings and applications.		
Electronics lab [0 – 3 – 1]	**Course #:0904205**	**Prereq.: 0904204***
Diode characteristics; rectification; clipping and clamping; BJT characteristic and applications; FET characteris (BJT); ac Analysis FET; ac Analysis for multistage Amplifier(FET); troubleshooting projects.		
Signals and systems [3 – 0 – 3]	**Course #:0904300**	**Prereq.: 0905201+0904200**
Classification of signals and systems. Linear Time-Invariant (LTI) systems: convolution and impulse response, Fourier series, Fourier transform and Energy and power spectral densities Laplace transform. Transfer function. Discrete time systems: convolution and impulse response. Introduction to the Z-transform.		
Probability and random variables [3 – 0 – 3]	**Course #:0904303**	**Prereq.: 0904300**
Probability principles and set theory. One and Multiple random variables. Probability density function. Special probability density functions, cumulative distribution function Joint distribution functions. Conditional distributions. Moments. Random process. Stationary and ergodicity. Spectral analysis of random signals. Response of linear systems to random signals.		
Numerical analysis [3 – 0 – 3]	**Course #:0904304**	**Prereq.: 0905201**
Error analysis. Solution of equations in one variable. Numerical solution of a set of linear and nonlinear equations. Curve fitting and interpolation. Numerical integration and differentiation. Numerical solution of ordinary differential equations.		
Electrical machines[3 – 0 – 3]	**Course #:0904362**	**Prereq.: 0904200**
This course consists of a review of magnetic fields and circuits. It includes single and three phase transformers, electromechanical energy conversion, DC-machines (DC-generators and DC-motors), starting DC-motors and speed control, AC-machines (single and three phase induction motors) and three phase synchronous machines.		
Electrical machines lab [0 – 3 – 1]	**Course #:0904363**	**Prereq.:0904362**
This course covers laboratory experiments on single and three phase transformers, electromechanical energy conversion, DC-machines (DC-generators and DC-motors), starting DC-motors and speed control, AC-machines (single and three phase induction motors) and three phase synchronous machines.		
Measurements and instrumentation [3 – 0 – 3]	**Course #:0904374**	**Prereq.: 0904204**
Basic concepts, general measurement system, analysis of experimental data, units and error analysis, statistical analysis, Electromechanical indicating instruments, DC/AC meter construction; loading effect; insertion loss, Bridges measurements. A/D converter and D/A converter digital instruments, Oscilloscope, CRT spectrum analyzer and calibration, Transducers and sensors as input Elements to Instrumentation system: photo-electric transducers, photoconductive cell, photodiodes, and photovoltaic cell. Capacitive and inductive transducers. Transducers and sensors: passive and self generating transducers.		

Measurements and instrumentation Lab[0 – 3 – 1]	Course #:0904375	Prereq.: 0904374*
Error and accuracy; AVO meters; bridges; potentiometers; calibration; transducers characteristics and applications; Temperature sensors; Proximity Switches.		
Power electronics [3 – 0 – 3]	**Course #:0904428**	**Prereq.: 0904204**
Introduction to PE, applications of PE, classification of Power conditioners; Power semiconductor devices: classification; V-I and switching characteristics; basic drive circuits and applications; line commutated converters; single-phase rectifiers: half-wave and full-wave rectifiers with freewheeling diodes; 3-phase half-wave and full-wave rectifiers; single-phase and 3-phase controlled and uncontrolled rectifiers; performance of rectifiers circuits; introduction to AC/AC controllers; phase voltage controller; cycloconverters; basics of DC-to-DC converters (choppers). Basics of DC-to-AC converters (inverters).		
Power electronics lab [0 – 3 – 1]	**Course #:0904429**	**Prereq.: 0904428**
Power semiconductor devices: power transistors: (BJT; MOSFET; IGBT); thyristors; characteristics of drive circuits. Converters (rectifiers; choppers; AC controllers) and inverters.		
Electrical power system analysis [3 – 0 – 3]	**Course #:0904462**	**Prereq.: 0904362**
Power system components and single line diagram. Phasors, analysis of three phase balanced power systems, power factor correction. per-unit system; transmission lines: short; medium and long; equivalent circuits and RLC parameters; cables; sequence networks of synchronous machines and power transformers; load flow; symmetrical components; symmetrical and asymmetrical fault analysis.		
Electrical power system lab [0 – 3 – 1]	**Course #:0904463**	**Prereq.: 0904462**
Equivalent circuits of transmission lines; voltage regulation; reactive power compensation; line losses; various types of loads. Power system simulators; equivalent circuits of power system components; control of real and reactive power; steady state and transient state in power system. Practical relay protection of generators transformers and transmission lines.		
Communications (1) [3 – 0 – 3]	**Course #:0904456**	**Prereq.: 0904300**
Review of Fourier transform and filters. Amplitude modulation (AM, DSB, SSB, VSB). Angle modulation (FM, PM). Sampling, Quantization, PCM, DPCM, DM. Multiplexing. Line coding. Baseband channel and ISI. Digital modulation (PSK, ASK, FSK, and M-ary). Power spectra of digital signals. Synchronization.		
Control theory [3 – 0 – 3]	**Course #:0904470**	**Prereq.: 0904300**
Open and closed-loop (feedback) systems; examples of feedback control systems; review of complex variables; Laplace transform and transfer functions of basic elements; modeling of: electrical; mechanical; hydraulic and pneumatic systems; linearization of nonlinear systems; systems block diagram and signal flow graphs; transfer function; block diagram reduction techniques; Mason's gain formula; sensitivity of open and closed loop control systems; time response analysis and performance indices of first and second order systems; dominant poles of high order systems. Routh-hurwitz stability criterion; steady-state error coefficients; design and effects of basic control actions: proportional; integral and derivative; Bode diagrams and Nyquist stability criterion; gain and phase margins.		
Control lab [0 – 3 – 1]	**Course #:0904471**	**Prereq.: 0904470*.**
Open and closed loop process control systems and servomechanisms. The effect of gain; integral and derivative feedback on control systems. PLC programming through practical activities related to power system. Data acquisition using NImy RIO.		

Programmable Logic Control (PLC) lab[0 – 3 – 1]	Course #:0904474	Prereq.: 0904470*
Ladder diagram , programming PLC using statements list ,PLC programming for practical applications and industrial automation using timers , counters , mathematical and logic functions, and data operations such as move , rotate , INC , DEC and others. Practices include Sequential processes , motor control stations , traffic control schemes and other similar activities.		
Power system protection [3 – 0 – 3]	**Course #:0904566**	**Prereq.: 0904462**
Principles; elements and requirement; Voltage & Current transformers; electromechanical; static and numerical relays; over current and earth fault protection; differential and distance protection; protection of power system elements: Generator; transformer; bus-bars; lines and motors; testing and maintenance of protection components.		
Power plants [3 – 0 – 3]	**Course #:0904569**	**Prereq.: 0904462**
Introduction to power generation systems; steam power plants; boilers, steam generators and turbines; diesel power plant; gas turbine power plant; nuclear power plants; hydro-electric power plant; electrical generation systems: generators, excitation system, power plant economics, unit commitment, economic dispatch.		
Advanced Engineering Mathematics [3 – 0 – 3]	**Course #:0905201**	**Prereq.:0300102**
Linear algebra, matrix algebra, Eigenvalues and Eigenvectors, first, second and higher order ordinary differential equations, systems of differential equations and Laplace transforms.		
Dynamics [3 – 0 – 3]	**Course #:0905311**	**Prereq.:0300121**
Kinematics of particles, planar kinematics of rigid bodies, kinetics of particles and planar rigid bodies, equations of motion, work and energy, impulse and momentum and introduction to vibrations.		
Thermodynamics (1) [3 – 0 – 3]	**Course #:0905321**	**Prereq.:0300121**
The concept of a thermodynamic system, properties of pure substances, work and heat, the first law of thermodynamics, the first law analysis for a control volume, the second law of thermodynamics, entropy and the second law analysis for a control volume.		
Thermodynamics Lab [0 – 3 – 1]	**Course #:0905323**	**Prereq.:0905321***
Boyle's law, Bomb calorimeter (measurement of calorific value), first law of thermodynamics (Joule experiment: work to heat and turbine shaft power), characteristic of the power turbine, specific fuel consumption, turbine efficiency, calculate the exhaust velocity of nozzle, Marcet boiler (study the relation between pressure and temperature), vapour compression refrigeration cycle (demonstration of the effect of air in a cooling system and effect of evaporation and condensation temperature in the cooling rate and in the heat transfer at the condenser) and two-stage reciprocating compressor.		
Fluid Mechanics (1) [3 – 0 – 3]	**Course #:0905341**	**Prereq.: 0905311**
Fluid properties, fluid statics, fluid kinematics, fluid dynamics, conservation laws and Bernoulli's equation: applications, momentum and energy principles and pipe flow.		
Fluid Mechanics Lab [0 – 3 – 1]	**Course #:0905440**	**Prereq.: 0905341 ***
Viscosity and density measurements, Venturimeter and orifice meter, laminar and turbulent flow, centre of pressure, stability of floating body, impact of a jet, Pelton's turbine, centrifugal pumps, series and parallel pumps, centrifugal fan, flow in pipes and pipe fittings and open channel flow.		