B. SC. PROGRAM CURRICULUM 2016-2020

Course Prerequisites

a. Prerequisites List – Core Courses

Course		Prerequisite		
SEMESTER 1				
LH 131	English for Special Purposes (1)	**None**		
BA 123	Mathematics (1)	**None**		
BA 113	Physics (1)	**None**		
CC 111	Introduction to Computers	**None**		
ME 151	Eng. Drawing & Projection	**None**		
BA 141	Engineering Mechanics (1)	**None**		
IM 111	Industrial Relations	**None**		
SEMESTER 2				
LH 132	English for Special Purposes (2)	LH 131	English for Special Purposes (1)	
BA 124	Mathematics (2)	**BA 123**	Mathematics (1)	
BA 114	Physics (2)	**BA 113**	Physics 1	
CC 112	Structured Programming	CC 111	Introduction to Computers	
IM 112	Manufacturing Technology	**none**	none	
BA 142	Engineering Mechanics (2)	BA 141	Engineering Mechanics (1)	YEAR 1
BA 118	Chemistry	**none**	none	
SEMESTER 3				
LH 231	Technical Report Writing	LH 132	English for Special Purposes (2)	
CC 216	Digital Logic Design	CC 111	Introduction to Computers	
BA 223	Mathematics (3)	BA 124	Mathematics (2)	
ME 274	Material Science	**BA 114** **BA 142**	Physics 2 Engineering Mechanics (2)	
CC 213	Programming Applications	**CC 112**	Structured Programming	
EE 231	Electrical Circuits (1)	**BA 124**	Mathematics (2)	
SEMESTER 4				
BA 224	Mathematics (4)	**BA 223**	Mathematics (3)	
ME 231	Thermo-dynamics	BA 114	Physics (2)	
EE 232	Electrical Circuits (2)	**EE 231**	Electrical Circuits (1)	
EE 211	Electrical Measurements & Inst. (1)	**EE 231**	Electrical Circuits (1)	
EE 331	Electrical & Magnetic field. (1)	**EE 231** **BA 223**	Electrical Circuits (1) Mathematics (3)	
EG 211	Energy Resources & Conversion	**EE 231**	Electrical Circuits (1)	YEAR 2

Course		Prerequisite		
SEMESTER 5				
BA 323	Mathematics (5)	**BA 224**	Mathematics (4)	
EC 335	Electronics Fundamentals	**EE 231**	Electrical Circuits (1)	
EE 321	Electrical Machines (1)	EE 232	Electrical Circuits (2)	
EG 362	Fluid Mechanics	ME 231	Thermo-dynamics	
EG 311	Power System Analysis (1)	EE 232 EE331	Electrical Circuits (2) Electrical & Magnetic Field 1	
NE 264	Scientific Thinking	**none**	None	
SEMESTER 6				
BA 327	Statistics & Numerical Methods	**None**	None	
EG 312	Power System Analysis (2)	EG 311	Power System Analysis (1)	
EE 322	Electrical Machines (2)	EE 321	Electrical Machines (1)	
ME 355	Theory of Machines	BA 142	Engineering Mechanics (2)	
ME 431	Heat Transfer	ME 231	Thermo-dynamics	YEAR 3
EE 421	Power Electronics (1)	EC 335	Electronics Fundamentals	
SEMESTER 7				
EC 462	Photo voltaic Electronics	EE 421	Power Electronics (1)	
EE 545	High Voltage Engineering	EG 312	Power System Analysis (2)	
EG 422	Solar Thermal Energy	ME 431	Heat Transfer	
EE 423	Power Electronics (2)	EE 421	Power Electronics (1)	
CC 462	Programmable devices & smart meters	CC 216	Digital Logic Design	
EE 418	Automatic Control Systems	EE 322	Electrical Machines (2)	
SEMESTER 8				
EG 423	Combustion Engines	ME 431	Heat Transfer	
NE 364	Engineering Economy		51 Cr.Hr	
EG 412	Fundamentals of Photovoltaic	**EC 462**	Photo voltaic Electronics	
EG 413	Energy Environmental Aspects	EG 211	Energy Resources & Conversion	
EE 424	Electrical Drives	EE 423 EE322	Power Electronics (2) Electrical machines (2)	
EE 442	Power System Protection	EG 312	Power System Analysis (2)	
IM400EG	Practical Training	None	None	YEAR 4

Course		Prerequisite		
SEMESTER 9				
EG 501	Project (1)		132 Cr. Hr.	
EE 547	Utilization of Electrical Energy	EG 312	Power System Analysis (2)	
EG 521	Wind Energy (1)	ME 431 **EG 362**	Heat Transfer Fluid Mechanics	
EG 512	Energy Efficiency	EG211	Energy Resources & Conversion	
ME 425	Power Plant Technology	ME 431	Heat Transfer	
EG 5XX	Elective Course (Group A)	None	None	
SEMESTER 10				
EG 502	Project (2)	EG 501	Senior Project (1)	
EG 514	Wind Energy (2)	EG 521 EE 423	Wind Energy (1) Power Electronics (2)	
EE 531	Economics of Energy Generation and Operation			
EG 5XX	Elective Course (Group A)			**YEAR 5**
EG 5XX	Elective Course (Group B)			
EG 5XX	Elective Course (Group C)			

Department Restricted Electives			
Group A			
EC 532	Electronics and renewable Energy Systems	EC 462	Photo voltaic Electronics
EG 525	Bio Energy	EG 211	Energy Resources & Conversion
EG 516	Advanced PV module systems	EG 412	Fundamentals of Photovoltaic
EG 524	Fuel planning & alternative fuels	EG 211	Energy Resources & Conversion
EG 517	Green Buildings	EG 412	Fundamentals of Photovoltaic
EG 515	Selected topics in Renewable energy	EG211	Energy Resources & Conversion
EG 523	Sea water Desalination	ME 431	Heat Transfer
EG 511	Control Application of Energy system	EE 418	Automatic Control Systems
EG 513	Renewable Energy Network Interface	EG 412	Fundamentals of Photovoltaic
EG 532	Introduction to Nuclear Engineering	ME 231 ME 431	Thermo-dynamics Heat Transfer

Course		Prerequisite	
EG551	basics of radiation protection	EG 211	Energy Resources & Conversion
Group B			
ME 465	Computational Fluid Dynamics	ME 431	Heat Transfer
ME 455	Computer aided Design	ME 355	Theory of Machines
ME 464	Hydraulic and pneumatic systems	EG 362	Fluid Mechanics
EG 533	Nuclear Fuel Cycle	EG 532	Introduction to Nuclear Engineering

Chapter 3

Courses Summary Description

Brief description of all courses including the number of credit hours and prerequisites.

Basic and Applied Science (BA)

BA 113 – Physics (1)

Cr.3. Prerequisite: None

Introduction to static electricity and Coulomb's law - Introduction to static electricity and coulomb's law - Electric field. - Electric potential. – Capacitors - Electric current, ohm's law resistors in series and parallel - Kirchhoff's rule - Introduction to theory of magnetism and different applications - Electromagnetic induction - Optics and waves (nature of light, properties of light waves) - Young's double slit 'polarization of light waves.

BA 114 – Physics (2)

Cr.3. Prerequisite: BA113

Introduction to thermodynamics - Reversibility and reversible work - First law of thermodynamics' Non-flow equation - Steady flow equation - Working Fluid (steam, perfect gas) - Reversible processes.(constant volume, constant pressure, constant temperature, adiabatic) - Reversible process (polytrophic) - Second law of thermodynamics - Heat transfer.

BA 118 - Chemistry

Cr.2. Prerequisite: None

Electrochemical reactions and cells, volumetric analysis (practical) - Principles of corrosion, titrate technique, determinate of acidity (practical) - Metals and corrosive environments, determinate of alkalinity and chloride (practical) - Forms of corrosion uniform, galvanic and differential aeration cell, determination of hardness (practical) - Pitting, stress corrosion cracking and intergranular corrosion forms, determination of dissolved oxygen (practical) - Atmospheric and erosion corrosion, spectrophotometer analysis (practical) - Coating and inhibitors as protection methods, determination of nitrite and nitrate (practical) - Cathodic protection, determination of phosphate and silica (practical) - Classification of fuel, properties of liquid fuel, determination of some heavy metals (practical) - Combustion of fuel, determination of fluorine and chlorine (practical) - air supply and exhaust gases, determination of turbidity (practical) - Classification of lubricants advantages and disadvantages of different types, oil analysis determination of viscosity and T.B.N (practical) - Properties of lubricants and additives, determination of insoluble and saltwater (practical) - Nature of impurities in water, soft and hard water effect of

using impure water on boilers performance, determination of acidity and water content (practical) - Water treatment, determination of ph (practical) - Air and water pollution, determination of TDS and salinity(practical).

BA 123 – Mathematics (1)

Cr.3. Prerequisite: None

Basic techniques and rules of differentiation - Trigonometric function: properties, basic identities and their derivatives - Inverse of trigonometric and their derivatives - Logarithmic functions: their properties, basic identities and derivatives - Exponential functions: their properties, basic identities and derivatives - Derivative of hyperbolic functions and their inverse - Parametric differentiation and implicit differentiation - The Nth derivative - L' Hopital rule - Partial differentiation - Maclaurin's expansion. - Physical application - Curve sketching - Conic sections - General revision.

BA 124 – Mathematics (2)

Cr.3. Prerequisite: BA123

Definition of indefinite integrals and table of famous integrals - Simple rules of integration and the fundamental theorem of calculus - Fundamental theorem of calculus and integration by parts - Integration by parts and integration of rational functions - Integration of rational functions - Integration of trigonometric powers - Trigonometric substitution and 7th week exam - Integration of quadratic forms and the reduction formulas - Definite integration - Area and volume - Area, volume and length of curve - Average of a function, numerical integration - Matrix Algebra - Solution of systems of linear equations.

BA 141 – Engineering Mechanics (1)

Cr.3. Prerequisite: None

Rectangular components of a force - Parallelogram law - Equilibrium of particle – springs and cables - Moment of force - Free body diagram - Equilibrium of rigid body - Trusses "joint method – zero – force members" - Trusses "method of section" – Frames – Friction - Mass Moment of Inertia - Virtual work.

BA 142 – Engineering Mechanics (2)

Cr.3. Prerequisite: BA141

Kinematics of a particle – Rectilinear Kinematics - Curvilinear Motion –Projectile Motion - Force & Acceleration (Kinetics) - Work & Energy of a particle (Kinetics) - Rotation of a Rigid Body about a fixed Axis - General Plan Motion - Relative Motion (Velocity) - Relative Motion (Acceleration) - Planar Kinetics of Rigid Body – Equation of Translation Motion - Equation of Rotational Motion - Equation of General Plane Motion - Work and Energy.

BA 223 – Mathematics (3)

Cr.3. Prerequisite: BA124

Solving first order differential equations: Separable of variables and Homogeneous equation - Solving first order differential equations: Exact and Linear equations - Solving first order differential equations: Bernoulli's equation and revision on first order differential equations - Solving second order homogeneous differential equations with constant coefficients, method of undetermined coefficients - Solving second order non-homogeneous differential equations with constant coefficients, method of variation of parameters - Continue method of variation of parameters, solving second order differential equations with variable coefficients (Euler's equation), Laplace transform: Basic definition, First shifting theorem, Laplace transform: Transform differentiation and integration, Unit step function, second shifting theorem, and convolution theorem - Inverse Laplace transforms - Solving differential equations by using Laplace transform - Fourier series: Fourier series for functions of period 2P - Fourier series for even and odd functions - Fourier series for harmonic functions.

BA 224 – Mathematics (4)

Cr.3. Prerequisite: BA223

Vector Algebra / Dot and cross product and Applications - Partial Differentiation / and Derivatives of vector functions - Gradient / Divergence/ curl/ Laplacian - Line Integrals / line Integrals Independent of the path / Exactness - Conservative vector fields - Double Integrals in Cartesian and polar coordinates / Green's Theorem - Surface Integrals / Stokes' Theorem - Triple Integrals / Divergence (Gauss' Theorem) - Review on Integrals Theorems - Complex numbers and functions / forms of representation - Analytic functions/ Harmonic functions - Line complex integrals / Cauchy's Integrals Theorem - Zeros and poles of Analytic functions/ Residues and their evaluation - Residue Theorem / Application to Real Integral - Introduction to Fourier Integrals and Transforms.

BA 323 – Mathematics (5)

Cr.3. Prerequisite: BA224

Taylor's and Power series methods for solving ordinary differential equations - Differential equation with variable coefficients, ordinary and singular points, solution about ordinary points – Solution about singular points: Regular singular points, the method of Frobenius, Case I. - The method of Frobenius , Case II and Case III. - Gamma and Beta functions - Lengendre differential equation and Legendre polynomials - Bessel differential equation. - Bessel function of the 1st kind – Boundary value problems, partial differential equations and the method of separation of variables- Heat equation, heat transfer in a bar - Wave equation, vibration of a string - Laplace equation and potential fields - Conformal mappings, Complex functions as mappings - Bilinear transformations, linear fraction transformation - Schwarz Christoffel transformation.

BA 327 – Statistical & Numerical Methods

Cr.3. Prerequisite: none

Probability / Statistics – Probability : Events , Sample Spaces and Probability , conditional Probability , Independent Events , Bay's theorem ; Discrete Probability Distribution; Continuous Probability Distribution ; Special Distributions – Numerical Methods/ Roots of Equations : Bracketing Methods (The Bisection and The False – Position Methods) , Open Methods (Simple Fixed Point Iteration ; The Newton-Raphson Method ; The Secant Method) , Curve Fitting : Interpolation (Newton's Divided-Difference Interpolating polynomials; Lagrange Interpolating Polynomials; Inverse Interpolation).

Computer Engineering (CC)

CC 111 – Introduction to Computers

Cr.3. Prerequisite: None

Introduction to the World of Computers Input and Output - The System Unit: Processing and Memory - Storage and Input/Output Devices - System Software and Application Software - Program Development, Programming Languages, and Flow charts - Visual Basic 1 - Visual Basic 2 - Visual Basic 3 - Web page design using HTML 1 - Web page design using HTML 2 - Communications and Networks 1 - Communications and Networks 2 - Ethics, Computer Crime, Privacy, and other Social Issues.

CC 112 – Structured Programming

Cr.3. Prerequisite: CC 111

Overview of Programming and Problem Solving - C Syntax and Semantics - I/O Formatting and Arithmetic - Conditions and Logical Expressions - Selection Control Structures - Repetitions (Part 1) - Repetitions (Part 2) - Functions (Part 1) - Functions (Part 2) - Arrays (Part 1) - Arrays (Part 2) -Programming applications – problem solving Tech (Part 1) - Programming applications – problem solving Tech(Part 2).

CC 213 – Programming Applications

Cr.3. Prerequisite: CC 112

Revision of structured programming constructs: selection, repetition, and Functions - Revision of one dimensional array - Searching and sorting - Two dimensional arrays – Pointers – Strings – Structures – Unions – Recursion - Text Files - Binary Files - Bitwise Operators/ I/O Interfacing - Advanced Applications.

CC 216 – Digital Logic Design

Cr.3. Prerequisite: CC 111

Number systems - binary arithmetic and codes - logic gates - Boolean algebra and logic simplifications - Design and realization of combinational circuits - Functions of combinational circuits logic - Flip-Flops - analysis design and realization of counters - analysis and realization of shift registers - Computer aided engineering.

CC 444 – Programmable Devices and Smart Meters

Cr.3. Prerequisite: CC 216

Field Programmable Devices, such as Field Programmable Gate Arrays (FPGAs) and Complex Programmable Logic Devices (CPLDs) are widely used for rapid prototyping and quick response-time designs. The objective of this course is to introduce the student to digital design using Field Programmable ICs, and to provide an understanding of the underlying technologies and architectures of these Integrated Circuits. Smart Meters Systems and their applications in energy are also considered.

Electronics Engineering (EC)

EC 335– Electronics Fundamentals

Cr.3. Prerequisite: EE231

Semiconductors - p-n junction - diode current components - junction capacitance - junction diode as a circuit element - special p-n junctions - bipolar junction transistor and field effect transistor: structure-operation – I-V characteristics - large and small analysis.

EC 435– Photo voltaic Electronics

Cr.3. Prerequisite: EE421

Principles of solar cell operation, structure, electrical and optical characteristics, equivalent circuit, Crystalline silicon solar cells, Thin film technologies for PV, Energy production by a PV array, Energy balance in stand ‹alone PV systems, Standards, calibration and testing of PV modules and solar cells, PV system monitoring.

Electrical Engineering (EE)

Control Courses Group

EE 211 – Electrical Measurements & Instrumentation

Cr.3. Prerequisite: EE 231

Accuracy of measurement and error analysis – Absolute and secondary instruments and indicating instrument – Moving coil and moving iron instruments – Dynamometer type instruments– Induction type instruments– Wattmeter of Measuring of power and power factor – Bridges (DC) – Bridges (AC)– Current and potential transformers – Oscilloscopes.

EE 418 – Automatic Control Systems

Cr.3. Prerequisite: EE 321

Introduction to open loop and closed loop control systems– Control system classification– Block diagram– System transfer function and signal flow graph– Standard input signal– Time domain specifications– Modeling of some physical systems– Time response of first and second order systems– Importance of feedback, sensitivity to parameter variations– System stability and effect of disturbance– Error analysis and error constants– Root locus techniques– Frequency domain analysis (Nyquist- Bode) Analog controllers– Controller tuning.

Machines and Drives Courses Group

EE 321– Electrical Machines (1)

Cr.3. Prerequisite: EE 232

Definition of the magnetic terms, magnetic materials and the B-H curve– Magnetic circuits principles– Electromechanical Energy Conversion Principles– Force and torque equations in magnetic circuits– Construction of a DC machine– EMF and torque equations in dc machines– Armature windings and commutator design– Armature reaction and compensation techniques– Self excitation of dc generators– External characteristics of dc generators– Kinds of losses and efficiency of dc machine– Torque and speed characteristics of dc motor– Speed control of dc motor– Starting of dc motors– DC Motor electrical braking technique.

EE 322 – Electrical Machines (2)

Cr.3. Prerequisite: EE 321

Single phase transformer, Construction , principle of operation – No load conditions, leakage reactance and equivalent circuit, voltage regulation, losses and efficiency, impedance– Auto transformer– Principle of three phase machines, Construction of 3-phase stator, and general layout of three phase two pole full and short pitched winding, distribution and pitch factor– MMF of one-phase and three-phase windings– Synchronous and rotor speed theory of action of three phase induction motor– Three phase induction motors power flow, EMF and equivalent circuit– Torque speed characteristics and starting– Effect of slip and stator voltage on the performance.

EE 421 – Power Electronics (1)

Cr.3. Prerequisite: EC335

Power electronics and characteristics, basic of power electronics, thyristors gating circuits, commutation techniques– Single phase and three phase converters (controlled and uncontrolled).

EE 423 – Power Electronics (2)

Cr.3. Prerequisite: EE 421

MOSFET Power Transistor– Chopper principles and classification– the buck and the boost regulator– the buck and the cuk regulator– single phase AC voltage controllers principles– three phase full wave AC voltage controllers– Three phase full wave AC voltage controllers– Cycloconverters– principles and performance of PWM inverters– three phase inverters, other kinds of inverters, applications.

EE 424 – Electrical Drives

Cr.3. Prerequisite: EE 423

DC Drives: single phase separately excited dc motors drives– three phase drive– dual converter– reversible drives– armature current reversal– field current reversal– closed-load/control– chopper drives– principles of: power control– regenerative brake control rheostat brake control– two/four quadrant chopper drives and multiphase choppers. AC drives: induction motor drive– stator voltage and frequency control– current control– voltage, current and frequency control– closed-loop control– synchronous motor drive with closed-loop control.

Circuits Courses Group

EE 231 – Electrical Circuits (1)

Cr.3. Prerequisite: BA 124

Basic d-c circuit elements , series and parallel network –Ohm's law and 1st & 2nd kirchoff's laws –Nodal analysis –Mesh analysis – Basic network theorems " source transformation , super position , Thevenin's theorem and Norton's theorem, max. power transfer" – Alternating current fundamentals and a-c generation – R.M.S value and average value, form factor and crest factor– Phasor concept – Relation between current and voltage in resistors , capacitors and inductor, Response of R-L and R-C circuits – Sinusoidal response of series R.L.C circuit – Series resonance.

EE 232 – Electrical Circuits (2)

Cr.3. Prerequisite: EE 231

AC series circuit and series response revision, parallel circuit and Δ to Y-simplification– Source transformation, superposition the node voltage method and the mesh current method– Thevenin theorem– Complex power and maximum power calculations– Three phase voltage sources– Analysis of the balanced Y-Y circuit– Analysis of the Y-Δ & Δ-Y circuit and Δ-Δ a circuit– Complex power calculation in three phase– Unbalanced and four wire three phase loads– Unbalanced Y loads with neutral (wire disconnected) or having Zo– Inductances and capacitors, series-parallel combinations– The natural response for R-L circuit– The natural response of R-C circuit– General solution of step response of R-L and R-C circuit– Sequential switching.

EE 331 – Electric & Magnetic Fields (1)

Cr.3. Prerequisite: BA 223 & EE231

Vector analysis and coordinate systems– Coulomb's law and Electric field intensity– Electric flux density , Gauss's law and Divergence theorem –Energy and potential (Electrostatics)–Conductors, Dielectric , and capacitance– Poisson's and la place's equations.

EE 547 –Utilization of Electrical Energy

Cr.3. Prerequisite: EG 312

Illumination; properties of light, quantities and units, inverse sq. Law and cosine law– Types of lamps and their characteristics– Road lighting– Elec. Heating and welding methods– Dielectric heating, induction heating, arc induction & resistance furnaces– Direct Energy Conversion – Traction, lifts– UPS Standby power systems– Batteries– fuel cells– solar cells– Elec. safety engineering.

EE 545 – High Voltage Engineering

Cr.3. Prerequisite: EG 312

Generation of D. C. high voltage– Generation of A. C. high voltage– Generation of impulse voltage and currents– Measurements of high voltages– Sources of transient in power system– Travelling waves– Lattice diagram– Gaseous, liquid and solid Insulations study– Surge arresters– High voltage circuit breakers– Gas insulated switcher (GIS)– Insulation coordination– Testing and HVDC studies.

EE 442 – Power Systems Protection

Cr.3. Prerequisite: EG 312

General principles of protection– Types of relays and construction of over current relays– Instrument transformers – Fuses and Circuit breakers – Over-current relay settings – Directional relays– Protection of lines and distance protection Differential protection– Protection of transformers– Protection of motors– Protection of generators.

Energy Engineering (EG)

EG 211 – Energy Resources & Conversion

Cr.3. Prerequisite: EE 231

Conventional methods of energy conversion: Introduction, Sources of energy, Electrical power systems. Electromechanical energy conversion, Electric motors and generators, Faraday's law, Lorenz forces, The basic electric generator, The basic electric motor, Magnetically single excited systems, Magnetically multi ‹excited systems, Dynamic energy conversion equations, Conservative fields, Coupled magnetic fields, Torque and stored energy in magnetic fields, Multi ‹fed rotating systems, Electrostatic systems, Renewable methods of energy conversion.

EG 311 – Power System Analysis (1)

Cr.3. Prerequisite: EE 232 & EE 331

Elements of power system– Operating voltage choice– Parameters of overhead trans. lines (R, L&C)– Representation of O.H.T.L. (Short T.L.)– Representation of O.H.T.L. (Medium T.L.)– Representation of O.H.T.L. (Long T.L.)– Voltage regulation – Single line diagram of power system– The per unit system– Bus admittance matrix– Bus impedance matrix– Power flow equations– Gauss- Seidel power flow solution– Newton Raphson power flow solution

EG 312 – Power System Analysis (2)

Cr.3. Prerequisite: EG311

Transients in R-L Series Circuits– Internal voltage of loaded machines under faults conditions– Fault calculation using Z bus– The selection of circuit breakers– The symmetrical components of unbalanced phasors– Power in terms of symmetrical components– Sequence circuits of Y & Δ impedance– Unsymmetrical faults on power systems and single line to ground faults– Line to line faults and double line to ground faults– The stability problem– Rotor dynamics and swing equation– The power equation and synchronizing power coefficients– Equal-area criterion of stability– Step-by-step solution of the swing curve– Factors affecting transient stability.

EG 362 – Fluid Mechanics

CR: 3. Prerequisite: ME 231

Introduction - Physical properties of fluids – Fluid statics – Forces on submerged surfaces and buoyancy – Introduction to fluids kinematics – Dynamics of incompressible flow – Flow and velocity measurement – Similitude and dimensional analysis – Flow through pipes – Pumps (Types and performance)

EG 412 – Fundamentals of Photovoltaics

Cr.3. Prerequisite: EG 422 & EE 423

Introduction - Photo-voltaic (PV) cells description, equivalent circuit and characteristics equation - PV panel structure, parameters and variables determination - PV panel efficiency and voltage regulation calculations - Array design and energy conversion (Field study) - PV grid connection - PV power electronics (Interface Topology) - PV maximum power tracking (Mechanical & sensor-less) .

EG 413 – Energy Environment Aspects

Cr.3. Prerequisite: EG211

An overview of environmental laws and regulations. Environmental standards for air quality, water and land. Regulatory approval process for new energy projects. Base-Line Study and Environmental Impact Assessment. Environmental review of new energy projects. Pollution prevention methodology and techniques. Separation and recycle streams. Process modification, integration, analysis and control. Risk assessment.

EG 422 – Solar Thermal Energy

Cr.3. Prerequisite: ME431

Study of solar thermal energy, its intensity in outer space and the calculation of the solar intensity on earth with different models. Availability and usability of solar energy. Study of solar angles, Shades and the equation of time. Theory of the flat plate collector, transmission through glass, heat loss calculations and definitions of all parameters involved in collector performance.

EG 423 – Combustion Engines

Cr.3. Prerequisite: ME431

Types of internal combustion engines, Engine parts,P-V diagram and the effect of valve timing, Spark ignition vs compression ignition, Engine charging and volumetric efficiency, Fuel properties, Thermodynamics of combustion, Engine Energy Balance, Octane and cetane ratings ,Review, Engine Performance, Classification of Gas Turbine Engines, Gas Turbine Performance, Gas turbine cooling

EG 512 – Energy Efficiency

Cr.3. Prerequisite: EG 312

Energy efficiency and electricity :(Energy saving regulations- Active and passive energy efficiency- energy monitoring and information systems) - Diagnosis through electrical measurement: (Electrical measurements- Voltage and current -Collecting relevant electrical data for specific objectives) - Energy saving opportunities (Motor-related savings opportunities- Lighting- Power factor correction)- Distributed Generation Issues.

EG 514 – Wind Energy (2)

Cr.3. Prerequisite: EG 521 & EE 423

Energy in the Wind Stream (Basic calculations- Wind turbines power characteristics) - Squirrel-Cage Induction Generators- Wound-Rotor Induction Generators- Doubly-Fed Induction Generators- Permanent-Magnet Synchronous Generators- Wind Power in Power Systems: Current Status of Wind Power in Power Systems- Characteristics of Wind Power Generation- Generators and Power Electronics for Wind Turbines: Overview of wind turbine topologies- Overview of power control concepts- State-of-the-art power electronics (Soft-starter- Capacitor bank- Rectifiers and inverters- Frequency converters)

EG 521 – Wind Energy (1)

CR: 3. Prerequisite: *ME 431 & EG 362*

The course covers the fundamentals of wind energy from mechanical engineering point of view. This includes an introduction to wind energy, types of wind turbines, fundamentals of wind turbines aerodynamic and wind turbines design standards.

Industrial and Management Engineering (IM)

IM 111 – Industrial Relations

Cr.2. Prerequisite: None

Types of industries and production techniques – Management and organization structure –Production planning and control – Industrial cost estimation techniques – Industrial economy and breakeven analysis – Accidents at work – rules and regulations – Hazards classification, prevention, and personal safety – Fire hazards identification and prevention – Chemical hazards and prevention – accident reporting – Quality control and labour relations – Science, engineering, and technology – Industrial revolutions.

IM 112 – Manufacturing Technology

Cr.2. Prerequisite: None

Production of steel and cast iron – Forming operations – Heat treatment operations – Cutting tools – Mechanics of metal cutting and turning operations – Cutting fluids – Sand casting – Centrifugal casting, die casting and aspects of the casting process – Gas and Electric arc welding – Electric resistance and pressure welding and aspects of the welding process – Standards of measurements – Measuring Instruments – Measuring methods.

IM 400 – Practical Training

Cr.0. Prerequisite: None.

This course is a non-credit course and is a college graduation requirement. Students are asked to undertake a minimum of four weeks of practical training in off-campus sites recommended by the college and the department in order to pass this course. Students are required to submit a recognition letter from the site where they received their training; in addition, a report and a presentation are submitted. Course is a Pass/Fail course.

Mechanical Engineering (ME)

ME 151 - Engineering Drawings & Projection

CR: 2. Prerequisite: None

Drawing practices and techniques (Exercises on geometrical construction) - Methods of object projection (Exercises on geometrical construction – Exercises on object projection) - Orthogonal projection (Exercises on orthogonal projection) - Missing views, dimensioning and free hand sketching (Exercises on projection and free hand sketching) - Sectioning and conventions (Exercises on sectional views) - Intersection of geometrical surfaces and development (Exercises in intersection of geometrical surfaces and development) - Standard metal sections and metal structures (Exercises on metal structures) - Compound metal sections and welds (Exercises on metal structures) - Isometric projection & Surface intersections (Exercises on Isometry and surface intersections) - Perspective projection (Exercises on Perspective projection) - Computer Aided drafting using AutoCAD (General Introduction) - Drawing and editing commands in AutoCAD - Writing texts, Dimensioning and viewing commands.

ME 231- Thermodynamics

CR: 3. Prerequisite: BA 114

Heat Engine Cycles - Steam Plant - Heat Transfer – Combustion - Practical Analysis of Combustion Products - Positive Displacement Machine.

ME 274 - Materials Science

CR: 3. Prerequisite: BA 114 and BA 142

Classification of Engineering Materials – General Introduction - Atomic Bonding in Solids - The Crystalline Structure of Materials - Properties, Testing, and Inspection of Engineering Materials - Introduction to Thermal Equilibrium Diagrams -Non-Destructive Testing - Heat Treatment of Metals -Corrosion: An Introduction.

ME 425 – Power plant technology

CR: 3. Prerequisite: ME 431

Thermodynamics Review (1st , 2nd laws of thermodynamics) - Steam Formation - Steam Properties and Process - Simple Rankine Cycle – Modified Rankine Cycle –Reheat and Regeneration Cycle – Steam Turbine, Steam Generator and Steam Condenser – Power Plant Control – Simple Gas Turbine Cycle – Gas Turbine Cycle with Reheat, Intercooling and Regeneration – Combined Cycle Power Plant – Nuclear Power Plant – Renewable Power Generation, Solar Energy – Wind Energy – Geothermal Energy.

ME 431- Heat Transfer

CR: 3. Prerequisite: ME 231

Review of Heat Transfer - Steady State Conduction in One Dimension - General Conduction Equations – Steady State Conduction in Two Dimensions - Principles of connections - Empirical Relations for Forced Connection - Natural Convection Systems - Radiation Heat Transfer - Design of surface heat exchangers - Design of compact heat exchangers.

ME 355- Theory of Machines

CR: 3. Prerequisite: BA 142

Types of motion – Velocity analysis – Acceleration analysis – Dynamic force analysis – Balancing of rotating masses– Balancing of reciprocating masses – Kinetic energy storage and flywheel – Gear geometry – Gear trains –Gyroscopic couples

Language, Humanities and Social Science (LH)

LH 131 - ESP I

Cr.2. Prerequisite: None

Orientation - Personal Computing - Portable Computers - The process of academic writing - An overview of paragraph writing - Suffixes - Programming and Languages - Graded workshop - Unity and Coherence - Writing workshop - Computer Software - Computer Networks - Graded workshop - Computer Viruses- Computers in the Office.

LH 132 - ESP II

Cr.2. Prerequisite: LH 131

Orientation - Computers in Education - Paragraph writing (Concrete Support I) - Computers in Medicine - Essay writing (Analysis) - Graded workshop - Robotics - Summary writing - Virtual Reality - Machine Translation - Graded workshop - CVs & letters of application - Interviewing skills - Multimedia.

LH 231 - Technical Report Writing

Cr.3. Prerequisite: LH 131, LH 132

Orientation - Overview of technical report writing - Background reports - Process reports - Instructions and manuals - Primary research reports - Feasibility reports - Report format - Dictionary skills - Paraphrasing - Summarizing - Further practice on summarizing and paraphrasing - Discussion of report outlines - Presentation skills (CD viewing I) - Quotations and source documentation - Report writing workshop - Use of visual aids in technical writing - Presentation skills (CD viewing II) - Report writing workshop - Mini presentations - Report writing workshop - Rehearsals - End of term presentations.

Non-Engineering (NE)

NE 264 – Scientific Thinking

Cr.3. Prerequisite: None

Thinking Patterns Development - Nature and postulates of scientific thinking - Meaning and objective of Science - Scientific values and directions - Science, non-science and other-than science - Engineering and Technology - Properties of science - Mental operations used in science and Scientific Guessing - Types of deductions and Representation - Research methods in natural sciences: definitions, Experiments, Observations, Scientific postulates and their conditions - Verification of scientific postulates - General methods of problems solving - Creative and critical Thinking - Fluency types – Flexibility - Originality and Basics of Brain Storming.

NE 364 – Engineering Economy

Cr.3.Prerequisite: 51 Credit Hours.

Introduction and overview – Cost concepts and the economic environment – Principles of money, time relations – Concept of economic equivalence – Cash flow diagrams interest formulas and uniform series – Cash flow diagrams uniform gradient series and geometric sequence – Nominal and effective interest rates continuous compounding and continuous cash flows – Applications of engineering economy methods of investment assessment – Comparing alternatives useful life is equal to the study period – The imputed market value technique – Depreciation historical methods and cost recovery systems.

Elective Courses (Group A)

EC 532 – Electronics and Renewable Energy Systems

CR: 3.Prerequisite: EC 435

Elements of control of renewable energy plants, different techniques of control of renewable energy plants, fundamentals of Nano-technology and its applications on energy systems, programmable ships and application on DC/AC conversion and electronic devices of remote sensing for energy environmental parameters.

EG525 – Bio Energy

CR: 3.Prerequisite: EG 211

Overview of bioenergy systems from resource, conversion technologies to final product. Bioenergy conversion technologies and systems for heat, power, and bio-fuels. Cogeneration and polygeneration. Innovative cycles (such as biomass integrated gasification combined cycles, biomass air turbines, humid air turbines etc) for biomass resources. Evaluation of the bioenergy system performance. Economic and environmental assessments of bioenergy systems.

EG 511 – Control Application of Energy Systems

Cr.3. Prerequisite: EE418

Control problems in energy system– An introduction to Modeling of turbines and synchronous machine using state space approach– Linearized simulation on model in the s-domain of one machine connected to infinite-bus system– Dynamic performing of the controlled one machine / infinite - bus system Excitation control problem : definition and control configuration of classical and modern systems– Transfer function model excitation system Excitation system compensation (power system stabilizer) Effect excitation system on generator steady – state stability limit and dynamic stabilization– Generation control problem: definition and element modeling– Power factor-control of isolated system using PID controller– Power factor-control of two area system.

EG 513 – Renewable Energy Network Interface

Cr.3. Prerequisite: EE412

Concept of Distributed Generation, Interconnection standards, Type of interface, static synchronous generators, Power quality issues, control of active power and voltage regulation, current control mode vs. voltage control mode, Wind power interface: direct connection, back-to-back converters, matrix converters, Fuel cell and photo voltaic interface topologies.

EG 523 – Water Desalination

CR: 3. Prerequisite: ME 431

Introduction on the water resources and the need for water desalination , Treatment of water plants , An overview of desalination techniques, Single effect evaporation with vapor compression techniques, Forward feed and parallel feed multiple effect evaporation, Economic analysis of desalination processes

EG 516 – Advanced PV Module System

CR: 3. Prerequisite: EG 412

Apply arid tied PV system design, Identify optimum sites for solar electric systems IV curve tracer and shading line systems, Calculate inverter efficiency, Calculate tilt angle and inter-low shading, Design and wiring diagram, A complex commercial scale system

EG 517 – Green building

CR: 3. Prerequisite: EG 412

Introduction to the green building movement, The scope of green building, Energy conservation and efficiency , Renewable energy, Building durability , Water efficiency

EG 515– Selected Topics in Renewable Energy

CR: 3. Prerequisite:EG 412 & EG 514

Specialized topics in renewable energy systems will be selected and presented

Elective Courses (Group B)

ME 465- Computational fluid dynamics (CFD)

CR: 3.Pre-requisite: EG 362 and ME 431

Introduction – The finite difference method (FDM) – Solution of fluid flow problems using FDM with MATLAB – The finite element method (FEM) - Solution of fluid flow problems using FEM with MATLAB (PDE Tool) – The finite volume method (FVM) - Solution of fluid flow problems using FVM with MATLAB – Thermo-fluid problems using the FVM with FLUENT software.

ME 455 - Computer Aided Design

CR: 3. Prerequisite: ME 355

Introduction to computer aided drafting and analysis – 2D and 3D Drafting (parametric solid modeling) – Introduction to the software "Solid Edge" – 2D and 3D parametric modeling – Introduction to finite element analysis – The finite element software "FEMAP" – Application to different machine element problems – Simulation of dynamic systems – MATLAB analysis and graphics – Application to different Mechanical, Hydraulic and Thermal systems (MATLAB 'Simulink') – Introduction to optimization – System and element optimum design problems.

ME 464- Hydraulic and pneumatic systems

CR: 3.Prerequisite:-EG 362

Introduction to Fluid Power System - Hydraulic Fluids and Transmission Lines -Hydraulic Pumps - Fluid Power Actuators (Cylinders, Rotary Actuators, Motors) - Control Components of Hydraulic Systems - Accumulators and Pressure Intensifiers - Hydraulic Circuit Design and Analysis

Elective Courses (Group C)

IM 423 – Operations Research

Cr.3. Prerequisite: 90 Credit Hours.

Introduction to linear programming – Development of linear programming models – The graphical and simplex method – Transportation and assignment methods – Network models and analysis (minimal spanning tree, shortest route, and maximal flow) – Critical path method – Probabilistic approach, project evaluation and review technique (PERT) – Project crashing.

IM 535 – International Operations Management

Cr.3. Prerequisite: 126 Credit Hours.

International business environment – Cultural and legal environment – Political environment – Economic environment facing business – International trade theories – Governmental influence on trade – Regional economic integration – Factor mobility and foreign direct investment – The foreign exchange market – The determination of exchange rates – Global manufacturing and supply chain management.

EG 531 Energy System Laws and regulations

Cr.3. Prerequisite: none.

This course aims to acquaint students with an understanding of the relationship between the law and the energy sector. The course designed to provide students with insight into the policies, players, and stakes involved in this highly complex area. The merging interests in this area of law touch upon social, political and environmental issues. Students will focus on energy regulation and public utility concepts, competition theory, resource efficiency efforts, social responsibility and environmental issues, integrated infrastructure planning, and public and private partnerships.

EG 518–Energy Economics and Planning

CR: 3. Prerequisite: EG 521 & ME 355

Load curves, Variation in demand, Load diversity. Power plant layout, Main equipment, Auxiliaries, Bus ،bar arrangements. Power plant economics: Capital cost, Operating cost, Fixed charge rate, Selection of plant and size and unit size, Operation and economics of spinning reserve, economic analysis of a transmission system, tariffs, power factor, all ،thermal generation allocation problem, hydro ،thermal coordination, new energy resources. Transmission access fees assessment and calculations.