COURSE STRUCTURE
AND
DETAILED SYLLABUS
for

M.Tech Two Year Degree Course

in

ELECTRICAL POWER ENGINEERING

(EPE)

(Applicable for the batches admitted from 2015-2016)

SREENIDHI INSTITUTE OF SCIENCE & TECHNOLOGY
(An Autonomous Institution approved by UGC and affiliated to JNTUH)
Yamnampet, Ghatkesar, R.R.District-501 301.

b.Tech (Electrical Power Engineering)

Course Structure and Syllabus - Academic Year: 2015 - 2016

I Year - I Semester

Code	Subject	L	T	P	Credits	Marks	
						Int.	Ext.
5X101	Power System Dynamics	3	1	--	3	25	75
5X102	Optimization & Control	3	1	--	3	25	75
5X118	Reactive Power Compensation & Management	3	1	--	3	25	75
5X104	Computer Methods in Power Systems	3	1	--	3	25	75
	Elective – I	3	1	--	3	25	75
	Elective – II	3	1	--	3	25	75
5X174	Research Methodology	2	--	-	2	25	75
5X171	Power System Simulation Lab – I	--	--	4	2	25	75
5X172	Literature Review and Seminar - I	--	--	3	1	100	--
5X173	Comprehensive Viva-I	-	-	-	1	100	--
Total Credits		**20**	**6**	**7**	**24**	**400**	**600**

I Year - II Semester

Code	Subject	L	T	P	Credits	Marks	
						Int.	Ext.
5X211	Power System Stability	3	1	--	3	25	75
5X212	Advanced Power System Protection	3	1	--	3	25	75
5X213	Flexible AC Transmission Systems	3	1	--	3	25	75
5X214	Power Quality	3	1	--	3	25	75
	Elective – III	3	1	--	3	25	75
	Open Elective	3	1	--	3	25	75
5X273	Power System Simulation Lab – II	--	--	4	2	25	75
5X274	Literature Review and Seminar-II	--	--	3	1	100	--
5X275	Project Seminar – I (Abstract)	-	-	3	2	100	--
5X276	Comprehensive Viva	--	--	--	1	100	
Total Credits		**18**	**6**	**7**	**24**	**475**	**525**

Elective – I: Any one subject to be selected

Code	Subject
5X105	High Voltage DC Transmission
5X106	Distribution Planning & Automation
5X107	Breakdown Phenomenon in Insulation
5X118	Advanced Control Systems
5X119	Control of Electrical Drives
5P140	Java Programming

Elective – II: Any one subject to be selected

Code	Subject
5X108	High Voltage Engineering
5X109	Energy Conversion Systems
5X110	Advanced Operation and Control
5X120	Digital Control Systems
5X121	Smart Electric Grid
5RC17	Database Management Systems

Elective – III: Any one subject to be selected

Code	Subject
5X215	Soft Computing Techniques
5X216	Restructuring in Electrical Power Systems
5X217	Extra High Voltage AC Transmission
5X222	Real Time Control of Power Systems
5X223	Switched Mode Power Conversion
5P141	Computer Networks

Open Elective: Any one subject to be selected

Code	Subject
5ZC03	Banking Operations, Insurance and Risk Management
5H233	Ethics, Morals, Gender Sensitization, and Yoga
5T216	Embedded and Real time control
5ZC11	Logistics & Supply Chain Management

II Year - I Semester

Code	Subject	L	T	P	Credits	Marks	
						Int.	Ext.
5X377	Project Seminar-II (Design & Development)	-	-	-	4	100	-
5X378	Project work (Part – I) (Project Status Report) (Excellent/ Good/ Satisfactory/ Un-Satisfactory	--	--	--	20	Grading	--
Total Credits		--	--	--	**24**	**100**	--

II Year - II Semester

Code	Subject	L	T	P	Credits	Marks	
						Int.	Ext.
5X478	Project Seminar-III (Implementation)	--	--	--	2	100	--
5X479	Pre-submission Seminar (Final)	-	-	-	2	100	-
5X480	Project work and Dissertation (Excellent/ Good/ Satisfactory/ Un-Satisfactory)	--	--	--	20	--	Grading
Total Credits		--	--	--	**24**	**200**	--

L - Lectures; T - Tutorial; P - Practical; C - Credits

I Year – I Sem. M.Tech (EPE)

Code: 5X101 **POWER SYSTEM DYNAMICS**

L	T	P	C
3	1	-	3

UNIT I – BASIC CONCEPTS:
Power System stability status of operation and system security, system dynamics problems, system model analysis of steady State Stability and transient stability, simplified representation of Excitation control.

UNIT II – MODELING OF SYNCHRONOUS MACHINE:
Synchronous machine Park's Transformation, Transformation of flux linkages, Transformation of stator voltage equations and rotor equations. Analysis of steady state performance, per unit quantities, Equivalent circuits of synchronous machine, determination of parameters of equivalent circuits.

UNIT III- EXCITATION SYSTEM:
Excitation System Modeling, excitation Systems block Diagram system representation by state equations.

UNIT IV: DYNAMICS OF A SYNCHRONOUS GENERATOR CONNECTED TO INFINITE BUS:
System model synchronous machine model, stator equations, rotor equations, synchronous machine model with field circuit and with field circuit and one equivalent damper winding on q axis (model 1.1), and calculation of Initial conditions.

UNIT V – ANALYSIS OF SINGLE MACHINE SYSTEM:
Small signal analysis with block diagram representation, characteristic equation and application of Routh – Hurwitz compensator analysis of single machine infinite bus system with and without PSS.

UNIT VI – APPLICATION OF POWER SYSTEM STABILIZERS:
Basic concepts in applying PSS, Control signals, structure and turning of PSS washout circuit, dynamic compensator analysis of single machine infinite bus system with and without PSS.

TEXT BOOKS:
1. Power system dynamics - K.R. Padiyar, B.S.Publications 3rd edition, Hyderabad

REFERENCES:
1. Power System Control and Stability - P.M. Anderson and A.A.Fouad, John Wiley sons.

I Year – I Sem. M.Tech (EPE)

Code: 5X102 **OPTIMIZATION AND CONTROL**

L	T	P	C
3	1	-	3

UNIT I - CLASSICAL OPTIMIZATION TECHNIQUES :
Introduction, single variable optimization, multi variable optimization with no constraints, multi variable with equality constraints, multi variable optimization with inequality constraints.

UNIT II - LINEAR PROGRAMMING (SIMPLEX METHOD):
Introduction, Application of linear programming, standard form of a linear programming problem, Geometry of linear programming problems, definitions and theorems, solutions of a system of linear simultaneous equations, Pivotal reduction of a general system of equations, motivation of the simplex method, Simplex algorithm, Introduction to two phases of the simplex method.

UNIT – III - NON-LINEAR PROGRAMMING:
Unimodel function, Elimination methods, Fibonacci Method, Golden Section Method, Direct Search Method, Univariate Method, Powell's method of conjugate directions, steepest decent method, Davidon and Fletcher Powell method.

UNIT IV - NON-LINEAR SYSTEMS:
Types of non – linearities, limit cycle, jump phenomenon, singular points.
Phase plane analysis – Method of Isoclines, Stability analysis – Liapunov's stability and Instability theorems. Stability analysis of linear continuous time invariant systems. Liapunov's second method, Generation of Liapunov's functions.

UNIT V – CALCULUS OF VARIATION:
Functional, Variations, Fixed end Point problem, variable end point problem.

UNIT – VI – OPTIMAL CONTROL:
Pontryagin's theorem, Hamiltonian theorem, Linear Quadratic Regulator, Matrix Ricatti Equation, Algebraic Ricatti Equation.

TEXT BOOKS:
1. Engineering Optimization - S.S.Rao, Publications: New Age International (P) Ltd. Publishers.
2. Modern Control Engineering - Ogata. K. Prentice Hall
3. Modern Control Systems Theory - M.Gopal, New Age International

REFERENCES:
1. Modern control Engineering – D.Roy Chowdary, PHI publications.

I Year – I Sem. M.Tech (EPE)

Code: 5X118 REACTIVE POWER COMPENSATION & MANAGEMENT

L	T	P	C
3	1	-	3

UNIT-I: LOAD COMPENSATION
Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads-examples.

UNIT-II: STEADY – STATE REACTIVE POWER COMPENSATION IN TRANSMISSION SYSTEM
Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples.
Transient state reactive power compensation in transmission systems:
Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation –compensation using synchronous condensers – examples

UNIT-III: REACTIVE POWER COORDINATION
Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency –Harmonics, radio frequency and electromagnetic interferences.

UNIT-IV: DEMAND SIDE MANAGEMENT
Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels.
Distribution side Reactive power Management:
System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks.

UNIT-V: USER SIDE REACTIVE POWER MANAGEMENT
KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations.

UNIT-VI: REACTIVE POWER MANAGEMENT IN ELECTRIC TRACTION SYSTEMS AND ARC FURNACES:
Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations- furnaces transformer –filter requirements – remedial measures –power factor of an arc furnace.

REFERENCE BOOKS:
1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982.
2. Reactive power Management by D.M.Tagare, Tata McGraw Hill,2004.

I Year – I Sem. M.Tech (EPE)

Code: 5X104 COMPUTER METHODS IN POWER SYTEMS

L	T	P	C
3	1	-	3

UNIT – I - INCIDENCE AND NETWORK MATRICES:
Algorithm for formation of network matrices. Three phase networks, balanced networks, Algorithm for formation for 3-phase bus impedance matrix. Modifications for changes in network.

UNIT – II - SHORT CIRCUIT STUDIES:
Short circuit calculations using Z_{Bus}, balanced 3-phase network with Z_{Bus}, Calculation of fault currents 3-phase to ground fault, line to ground fault, line to line fault.

UNIT – III - LOAD FLOW STUDIES:
N-R method in polar and rectangular coordinate system, convergence characteristics, decoupled and fast decoupled load flow, load flow using $Z_{Bus.}$

UNIT – IV:
Differential equations, numerical solutions, Euler Method, R.K. Method

UNIT – V - TRANSIENT STABILITY STUDIES:
Introduction, Swing equation, Machine equations, Power Systems equations, solution techniques. Example of Transient stability calculations.

UNIT – VI – LOAD FREQUENCY CONTROL:
Two area systems, uncontrolled and controlled cases, PID controllers, State space model, application of optimal control theory, tie line bias control.

TEXT BOOKS:
1. Computer methods in power system analysis- Glenn Stagg and A. El-Abiad.
2. Modern Power System Analysis- D.P. Kothari, I.J.Nagrath, Tata Mc.Graw Hill

REFERENCES:
1. Operation Control in Power Systems- P.S.R.Murty, B.S. Publications, 2nd edition.

I Year – I Sem. M.Tech (EPE)

Code: 5X107 BREAKDOWN PHENOMENONS IN INSULATION (ELECTIVE-I)

L	T	P	C
3	1	-	3

UNIT-I

Introduction: Electric stress and Electric strength, Breakdown mechanisms, Estimation and control of electric stress, Field sketching, High voltage measurements.

UNIT-II

Mechanisms of Spark Breakdown in Gases: Basic process in gas breakdown-Primary process-secondary process, Mechanisms of breakdown-Townsend Mechanism, breakdown in electronegative gases, Time lags of spark breakdown,

UNIT-III

Breakdown Characteristics In Gases: Phenomenon in uniform fields, Phenomenon in non uniform fields, Surface flashover, dielectric recovery.

Electrical Properties Of High Vacuum: Pre-breakdown conduction, Factors effecting the breakdown voltage, Breakdown hypotheses, Vacuum breakdown criterion, Flashover across solid insulators.

UNIT-IV

The Electrical Conduction And Strength Of Pure Liquids: pure liquids, purification, test cells, natural conduction, induced conduction, process of conduction, breakdown phenomenon and electric strength of liquids, breakdown process.

UNIT-V

Breakdown Of Commercial Liquid And Liquid- Solid Dielectrics: breakdown due to gaseous inclusions, breakdown due to liquid globules, breakdown due to solid particles, deterioration due to internal discharges, electrochemical deterioration.

UNIT-VI

Intrinsic and Related Forms Of Breakdown in Solids: definition of intrinsic strength, theories of intrinsic strength, its measurements, comparison of theory with experiment, current problems in measurement of intrinsic strength.

Thermal Breakdown Chemical and Electro Chemical Deterioration: thermal breakdown, chemical deterioration-oxidation, chemical stability, hydrolysis, leaching of chemically active substances, incompatibility of materials, electrochemical deterioration-nature, electrochemical effects in insulation with and without moisture.

TEXT BOOKS:

1. High Voltage Engineering – by E.KUFFEL and W.S.ZAENGL, Pergamon press, Oxford 1984.
2. High Voltage Engineering – by M.S.Naidu and V.Kamaraju, Tata Mc Graw Hill Publishing Company Limited, New Delhi – 2001.

I Year – I Sem. M.Tech (EPE)

Code: 5X105 **HIGH VOLTAGE D.C. TRANSMISSION (ELECTIVE-I)**

L	T	P	C
3	1	-	3

UNIT – I -BASIC CONCEPTS:
Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

UNIT – II -ANALYSIS OF HVDC CONVERTERS:
Choice of Converter configuration – analysis of Graetz circuit – characteristics of 6 Pulse & 12 Pulse converters –Cases of two 3 phase converters in star –star mode – their performance.

UNIT – III -CONVERTER & HVDC SYSTEM CONTROL:
Principal of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

UNIT-IV -POWER FLOW ANALYSIS IN AC/DC SYSTEMS, REACTIVE POWER CONTROL IN HVDC:
Modeling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC load flow – P.U. System for d.c. quantities-solution of AC-DC Power flow-Simultaneous method-Sequential method
Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

UNIT-V - CONVERTER FAULT & PROTECTION:
Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines- Radio interference. Multi terminal DC system, series and parallel operations, advantages.

UNIT – VI -HARMONICS- FILTERS:
Generation of Harmonics –Characteristics harmonics, calculation of AC Harmonics, Non- Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics. Types of AC filters, Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS:
1. HVDC Power Transmission Systems: Technology and system Interactions – K.R.Padiyar, New Age International (P) Limited.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao.

REFERENCES:
1. HVDC Transmission – J.Arrillaga.
2. Direct Current Transmission – E.W.Kimbark, John Wiley & Sons.
3. Power Transmission by Direct Current – E.Uhlmann, B.S.Publications

I Year – I Sem. M.Tech (EPE)

Code: 5X106 DISTRIBUTION PLANNING & AUTOMATION
(ELECTIVE – I)

L	T	P	C
3	1	-	3

UNIT I - DISTRIBUTION AUTOMATION AND THE UTILITY SYSTEM:
Introduction to Distribution Automation (DA), control system interfaces, control and data requirements, centralized (Vs) decentralized control, DA System (DAS), DA Hardware, DAS Software.

UNIT II - DISTRIBUTION AUTOMATION FUNCTIONS:
DA capabilities, Automation system computer facilities, management processes, Information management, system reliability management, system efficiency management, voltage management, Load management.

UNIT III - COMMUNICATION SYSTEMS FOR DA:
DA communication requirements, Communication reliability, Cost effectiveness, Data rate requirements, Two way capability, Ability to communicate during outages and faults, Ease of operation and maintenance, Conforming to the architecture of data flow

UNIT – IV - COMMUNICATION SYSTEMS USED IN DA:
Distribution line carrier (Power line carrier), Ripple control, Zero crossing technique, telephone, cable TV, Radio, AM broadcast, FM SCA, VHF Radio, UHF Radio, Microwave satellite. Fiber optics, Hybrid Communication systems, Communication systems used in field tests.

UNIT V - TECHNICAL BENEFITS:
DA benefit categories, Capital deferred savings, Operation and Maintenance savings, Interruption related savings, Customer related savings, Operational savings, Improved operation, Function benefits, Potential benefits for functions, function shared benefits, Guide lines for formulation of estimating equations parameters required, economic impact areas, Resources for determining benefits impact on distribution system, integration of benefits into economic evaluation.

UNIT VI: ECONOMIC EVALUATION METHODS:
Development and evaluation of alternate plans, Select study area, Select study period, Project load growth, Develop Alternatives, Calculate operating and maintenance costs, Evaluate alternatives.
Economic comparison of alternate plans, Classification of expenses and capital expenditures, Comparison of revenue requirements of alternative plans, Book Life and Continuing plant analysis, Year by year revenue requirement analysis, short term analysis, end of study adjustment, Break even analysis, Sensitivity analysis computational aids.

TEXT BOOK:
1. IEEE Tutorial Course “Distribution Automation” IEEE Working Group on “Distribution Automation”

I Year – I Sem. M.Tech (EPE)

Code: 5X118 **ADVANCED CONTROL SYSTEMS**
(PROFESSIONAL ELECTIVE-I)

L	T	P	C
3	1		3

Objective:
This subject deals with state space, describing function, phase plane and stability analysis including controllability and observability. It also deals with modern control and optimal control systems.

UNIT – I STATE SPACE ANALYSIS
State Space Representation, Solution of State Equation, State Transition Matrix, Canonical Forms – Controllable Canonical Form, Observable Canonical Form, Jordan Canonical Form.

CONTROLLABILITY AND OBSERVABILITY
Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability form Jordan canonical form and other canonical forms.

UNIT – II DESCRIBING FUNCTION ANALYSIS
Introduction to nonlinear systems, Types of nonlinearities, describing functions, describing function analysis of nonlinear control systems.

PHASE-PLANE ANALYSIS
Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

UNIT-III STABILITY ANALYSIS
Stability in the sense of Lyapunovs, Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for the Linear and Nonlinear continuous time autonomous systems.

UNIT – IV MODAL CONTROL
Effect of state feedback on controllability and observability, Design of State Feedback Control through Pole placement. Full order observer and reduced order observer.

UNIT-V CALCULUS OF VARIATIONS
Minimization of functional of single function, Constrained minimization. Minimum principle. Control variable inequality constraints. Control and state variable inequality constraints. Euler Lagrangine Equation.

UNIT-VI OPTIMAL CONTROL
Formulation of optimal control problem. Minimum time, Minimum energy, minimum fuel problems. State regulator problem. Output regulator problem. Tracking problem, Continuous-Time Linear Regulators.

TEXT BOOKS:
1. Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition,1996.

REFERENCE BOOKS:
1. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
2. Control Systems Engineering by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.
3. Digital Control and State Variable Methods – by M. Gopal, Tata Mc Graw-Hill Companies, 1997.
4. Systems and Control by Stainslaw H. Zak , Oxford Press, 2003.

I Year – I Sem. M.Tech (EPE)

Code: 5X119 **CONTROLS OF ELECTRICAL DRIVES**

(ELECTIVE – I)

L	T	P	C
3	1	-	3

UNIT-I: Introduction of Electrical Control of Machines:
Manual control – Magnetic control – Magnetic control – Semi-automatic and Automatic control of Modern machinery – Development of Control Circuits – Two wire and Three wire control – Remote control – Interlocking of drives.

UNIT-II: Control Circuit Components
Symbols for control components – Fuses, Swiches and Fuse Switch units. Moulded – Case Circuit Breaker (MCCB) and Miniature Circuit Breaker (MCB) – Contactors – Types of contactors – Contactor ratings.

UNIT-III: Relays
DC Series current relay – Frequency responsive relay – Latching relay – Over load relays – Bimetallic Thermal over load relay – time delay relay (Timers) – Motor drivers Electronic timer – Phase failure relay – Push button switches – Types, Limit switch – Float switch.

UNIT-IV: Control of Three –Phase Induction Motors:
Motor current at start and during acceleration – Automatic starters – Increment Resistor type starter – Automatic Auto- transformer starter – Open circuit and closed circuit transition – Par winding motor starters Two step and Three step starting – Automatic Star-Delta starters Open circuit and closed circuit transition – Starters for multi-speed motors. Starters for Wound rotor motors – Control circuit using contactor and flux delay relays.

UNIT-V: Control of DC Motors:
Principles of acceleration – Types of starters for automatic acceleration – Control circuits for DCL, Current limit acceleration starters – Reviewing of DC Motors – Control circuit for direct reversing and forward stop reverse operation – Jagging operation of DC motor – Control circuits for braking action.

UNIT-VI: Control of stepper motors:
Control circuit for Stepper motor – Block diagram of typical step motor control – Types of drive circuits – simple power drive circuit – L/R drive Bi-level drive – Chopper drive – Linear constant current drive – Bipolar drives for Stepper motor – H type and L/R type bipolar drives – Bipolar Chopper drives. Trouble shooting in control circuits – Trouble spots – General procedure for trouble shooting.

TEXT BOOKS:

1. Bhattacharya S. K. and Brijider Singh, Control of Electrical Machines, New Age International Publishers, New Delhi, 1996.
2. Athani V. V. Stopper Motors – Fundamentals, Applications and Design, New Age International Publishers, New Delhi, 1997.

I Year – I Sem. M.Tech (EPE)

Code: 5P140 **JAVA PROGRAMMING**
(ELECTIVE-I)

L	T	P	C
3	1	0	3

Course Outcome :

- Understand the concept of OOP as well as the purpose and usage of principles of inheritance, Identify classes, objects, members of a class and the relationships among them needed for a specific problem.
- Understand and implement concepts of polymorphism, encapsulation and method overloading.
- Create Java application programs using sound OOP practices (e.g., interfaces and APIs) and proper program structuring (e.g., by using access control identifiers, automatic documentation through comments)
- Students understand and implement error exception handling and multi-threading.
- Students learn to create GUI and write programs for event-handling using various user interface components on applets.

UNIT-I

History of Java, Java buzzwords, data types, variables, simple java program, scope and life time of variables, operators, expressions, control statements, type conversion and costing, arrays,, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, overloading methods and constructors, string handling, String Tokenizer.

Objective: On the completion of the unit, a student should be able to: i) Write ,compile and execute simple java programs ii) Understand the syntax of classes and objects creation in java iii) Explain the differences between classes and objects iv) differentiate methods and constructors v) Understand constructor and method overloading vi) Understand how to handle strings in java

UNIT-II

Inheritance –Definition, single inheritance, benefits of inheritance, Member access rules, super class, polymorphism- method overriding, Dynamic method dispatch, using final with inheritance, abstract class, Base class object.

Objective:
On the completion of the unit, a student should be able to: i) Explain the benefits of inheritance ii) Understand how to access members of super class from subclass iii) Differentiate static and dynamic polymorphism iv) Understand the usage of final keyword in inheritance v) Understand the use of abstract class

UNIT-III

Interfaces: definition, variables and methods in interfaces, differences between classes and interfaces, usage of implements and extends keyword, uses of interfaces.
Packages: Definition, types of packages, Creating and importing a user defined package.
Applications using interface
Applications using packages
Objective:
On the completion of the unit, a student should be able to: i) Understand uses of interfaces and packages ii) Understand how to implement multiple inheritance in java iii) Explain the difference between classes and interfaces iv) Create and import packages

UNIT-IV

Exception handling -exception definition, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating user defined exceptions.
Multi-Threading:-Thread definition, types of multitasking, uses of multitasking, thread life cycle, creating threads using Thread class and Runnable interface, synchronizing threads, daemon thread.
Applications of multithreading.
Objective:
On the completion of the unit, a student should be able to: i) Understand benefits of exception handling ii) Handle built-in and user defined exceptions iii) Understand the uses of multi-threading iv) Create multi-threaded programs using either Thread class or Runnable interface v) Know how to synchronize threads

UNIT-V

Advantages of GUI over CUI ,The AWT class hierarchy, Component, Frame, user interface components- labels, button, scrollbars, text components, check box, check box groups, choices, lists panels – scrollpane, menubar, graphics, layout, managers –boarder, grid, flow and card layouts.
Applications: developing calculator, developing feedback form, developing biodata.
Objective:
On the completion of the unit, a student should be able to: i) understand the advantages of GUI over CUI ii) Write GUI programs

UNIT-VI

Event handling: Delegation event model, closing a Frame, mouse and keyboard events, Adapter classes.
Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.
Applications: Developing of simple advertisements.

Objective:
On the completion of the unit, a student should be able to: i) Able to handle events using delegation event model ii) Write applet programs

TEXT BOOKS

1. Java; the complete reference, 6th editon, Herbert schildt, TMH.
2. Introduction to Java programming 6th edition, Y. Daniel Liang, pearson education.

REFERENCES

1. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, 7th Edition, Pearson Education.
2. Core Java 2, Vol 2, Advanced Features, Cay.S.Horstmann and Gary Cornell,7th Edition, Pearson Education

I Year – I Sem. M.Tech (EPE)

Code: 5X108 **HIGH VOLTAGE ENGINEERING**

(ELECTIVE – II)

L	T	P	C
3	1	-	3

UNIT – I - GENERATION OF HIGH VOLTAGE:

Generation of high D.C. generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT – II - GENERATION OF HIGH CURRENTS:

Generation of high D.C. generation of high alternating currents, generation of impulse currents, tripping and control of impulse generators.

UNIT III - MEASUREMENT OF HIGH VOLTAGE AND CURRENTS:

Measurement of high d.c.voltages, Measurement of high a.c. and impulse voltages, Measurement of high d.c., a.c. and impulse currents. Cathode Ray Oscilloscope for impulse voltage and current measurements.

UNIT – IV - TESTING OF MATERIALS AND APPARATUS:

Measurement of D.C. resistively, measurement of dielectric constant and loss factor, partial discharge measurements, testing of insulators, bushing, circuits breakers, transformers and surge diverters.

UNIT V: OVER VOLTAGE PHENOMENON INSULATION COORDINATION:

Causes of over voltage, lighting phenomenon, switching over voltages and power frequency over voltages in power systems.

UNIT-VI: GAS INSULATED SUBSTATIONS:

Advantages of Gas Insulated Substations, Comparison of Gas Insulated substations and Air Insulated Substations, Design and Layout of Gas Insulated Substations, Description of Various components in GIS.

TEXT BOOKS:

1. High Voltage Engineering- M.S.Naidu and V.Kamaraju – TMH.
2. High Voltage engineering fundamentals- Kuffel and Zungel, Elsavier Publications
3. Switchgear - BHEL, TMH

REFERENCES:

1. Fundamentals of Gaseous Ionization and plasma Electronics - Essam Nasser – Wiley - Inter Science.
2. High Voltage Technology - ALSTOM
3. Gaseous Dielectrics - Arora, TMH

I Year – I Sem. M.Tech (EPE)

Code: 5X109 ENERGY COVNERSION SYSTEMS
(ELECTIVE - II)

L	T	P	C
3	1	-	3

UNIT – I:
Photo voltaic power generation ,spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, commercial photo voltaic systems, test specifications for pv systems, applications of super conducting materials in electrical equipment systems.

UNIT – II:
Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, MHD technology, Wind Energy conversion: Power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

UNIT – III:
Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation. Wave energy conversion: properties of waves and power content, vertex motion of Waves, device applications.

UNIT- IV:
Types of ocean thermal energy conversion systems Application of OTEC systems examples.
Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion.

UNIT – V:
Principles of EMF generation, description of fuel cells. Co-generation and energy storage, combined cycle co-generation, energy storage. Global energy position and environmental effects: energy units, global energy position.

UNIT – VI:
Types of fuel cells, H2-O2 Fuel cells, Application of fuel cells – Batteries, Description of batteries, Battery application for large power. Environmental effects of energy conversion systems, pollution from coal and preventive measures steam stations and pollution, pollution free energy systems.

TEXT BOOKS:
1. “Energy conversion systems” - Rakosh das Begamudre, New age international Publishers, New Delhi - 2000.
2. “Renewable Energy Resources” - John Twidell and Tony Weir, 2nd edition, Fspon & Co

I Year – I Sem. M.Tech (EPE)

Code: 5X110 ADVANCED OPERATION & CONTROL

(ELECTIVE – II)

L	T	P	C
3	1	-	3

UNIT I: ECONOMIC DISPATCH OF THERMAL UNITS AND METHODS OF SOLUTION:
The Economic dispatch problem, Thermal dispatching with network Losses are considered, The Lambda Iteration method, Economic dispatch by Gradient search method.
Dynamic programming of Economic Dispatch, Economic Dispatch using Dynamic programming, Dynamic programming examples.

UNIT II – TRANSMISSION SYSTEM EFFECTS:
Transmission losses – The B.Matrix formula – Exact – method of calculating penalty factors.
Unit commitment: Economic Dispatch vs Unit Commitment, Constraints, priority list method, dynamic programming solution.

UNIT III - HYDRO – THERMAL CO-ORDINATION:
Introduction, Long range and short range Hydro – thermal scheduling, short term Hydro- Thermal scheduling problem, A Gradient approach.

UNITS – IV - INTERCHANGE OF POWER AND ENERGY:
Economic interchange between interconnected utilities, Inter utility energy evaluation, Power pools, Transmission effects and Issues, Limitations, Wheeling.

UNIT V – POWER SYSTEM SECURITY:
Introduction, factors effecting power system security, Contingency analysis, Linear sensitivity factors, AC power flow methods, Contingency selection

UNIT – VI- STATE ESTIMATION:
Introduction, Maximum likelihood weighted least squares equation, Orthogonal Decomposition estimation method, Algorithm.

TEXT BOOKS:
1. Power Generation, Operation and Control - Allen J.Wood and Bruce F.Wollenberg,John wiley & sons (Asia) Pvt. Ltd.,

REFERENCES:
1. Power System Optimization - D.P.Kothari J.S.Dhillon, PHI, 2004.
2. Power System analysis – John Grainger & William D. Stevenson Jr – Tata Mc Graw Hill edition.

I Year – I Sem. M.Tech (EPE)

Code: 5X120 **DIGITAL CONTROL SYSTEMS**

(ELECTIVE – II)

L	T	P	C
3	1	-	3

UNIT – I SAMPLING AND RECONSTRUCTION

Introduction, Examples of Data control systems – Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.

UNIT-II THE Z – TRANSFORMS

Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, the inverse Z – transforms, Modified Z- Transforms.

Z-PLANE ANALYSIS OF DISCRETE-TIME CONTROL SYSTEM

Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane.

UNIT – III STATE SPACE ANALYSIS

State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and its Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations.

CONTROLLABILITY AND OBSERVABILITY

Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function

UNIT – IV STABILITY ANALYSIS

Mapping between the S-Plane and the Z-Plane – Primary strips and Complementary Strips – Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

UNIT– V DESIGN OF DISCRETE TIME CONTROL SYSTEM BY CONVENTIONAL METHODS

Transient and steady – State response Analysis – Design based on the frequency response method – Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.

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UNIT – VI STATE FEEDBACK CONTROLLERS AND OBSERVERS

Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula.

State Observers – Full order and Reduced order observers.

TEXT BOOKS:

1. Discrete-Time Control systems - K. Ogata, Pearson Education/PHI, 2nd Edition

REFERENCE BOOKS:

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control and State Variable Methods by M.Gopal, TMH.

I Year – I Sem. M.Tech (EPE)

Code: 5X121 **SMART ELECTRIC GRID**

(ELECTIVE-II)

L	T	P	C
3	1		3

UNIT – I Introduction to Smart Grid:

What is Smart Grid? Working definitions of Smart Grid and Associated Concepts –Smart Grid Functions-Traditional Power Grid and Smart Grid –New Technologies for Smart Grid – Advantages –Indian Smart Grid –Key Challenges for Smart Grid.

UNIT – II Smart Grid Architecture:

Components and Architecture of Smart Grid Design –Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs –Transmission Automation – Distribution Automation – Renewable Integration

UNIT – III Tools and Techniques for Smart Grid:

Computational Techniques –Static and Dynamic Optimization Techniques –Computational Intelligence Techniques –Evolutionary Algorithms –Artificial Intelligence techniques.

UNIT – IV Distribution Generation Technologies:

Introduction to Renewable Energy Technologies –Micro grids –Storage Technologies –Electric Vehicles and plug –in hybrids –Environmental impact and Climate Change –Economic Issues.

UNIT – V Communication Technologies and Smart Grid:

Introduction to Communication Technology –Synchro Phasor Measurement Units (PMUs) –Wide Area Measurement Systems (WAMS).

UNIT – VI Control of Smart Power Grid System:

Load Frequency Control (LFC) in Micro Grid System –Voltage Control in Micro Grid System – Reactive Power Control in Smart Grid. Case Studies and Test beds for the Smart Grids.

Text Books:

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 2013
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley-IEEE Press, 2004.
3. A.G. Phadke and J.S. Thorp, ―Synchronized Phasor Measurements and their Applications, Springer Edition, 2010.
4. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2005.

I Year – I Sem. M.Tech (EPE)

Code: 5FC03 **DATA BASE MANAGEMENT SYSTEMS**

(ELECTIVE – II)

L	T	P	C
3	1	-	3

UNIT I:

Data base System Applications, data base System VS file System – View of Data – Data Abstraction –Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base System Structure – Storage Manager – the Query Processor, History of Data base Systems. Data base design and ER diagrams – Beyond ER Design Entities, Attributes and Entity sets – Relationships and Relationship sets – Additional features of ER Model – Concept Design with the ER Model – Conceptual Design for Large enterprises.

UNIT II:

Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views.

Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.

UNIT III:

Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOT – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases.

UNIT IV:

Schema refinement – Problems Caused by redundancy – Decompositions – Problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – FORTH Normal Form.

UNIT V:

Transaction Concept- Transaction State- Implementation of Atomicity and Durability – Concurrent – Executions – Serializability- Recoverability – Implementation of Isolation – Testing for serializability- Lock – Based Protocols – Timestamp Based Protocols- Validation- Based Protocols – Multiple Granularity, Recovery and Atomicity – Log – Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems.

UNIT VI:

Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing – Comparison of File Organizations – Indexes and Performance Tuning- Intuitions for tree Indexes – Indexed Sequential Access Methods (ISAM) – B+ Trees: A Dynamic Index Structure.

TEXT BOOKS:

1. Data base Management Systems- Raghurama Krishnan, Johannes Gehrke, Tata Mc-Graw Hill 3rd Edition
2. Data base System Concepts- Silberschatz, Korth, McGraw hill, V edition.

REFERENCES:

1. Data base Systems design, Implementation, and Management- Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems- Elmasri Navrate Pearson Education
3. Introduction to Database Systems- C.J.Date Pearson Education

I Year – I Sem. M.Tech (EPE)

Code: 5X171 POWER SYSTEM SIMULATION LAB - I

L	T	P	C
-	-	4	2

1. Y-bus and Z-bus Formation method and Y bus formation using Sparsity technique.
2. Conduct a power flow study on a given power system network using Guass-Seidal iterative method for 5bus, IEEE 14bus and IEEE 30bus system.
3. Develop a SIMULINK model for a single area load frequency problem and simulate with and without controller.
4. Develop a program to solve swing equation.
5. Symmetrical fault analysis
6. Determine stability of a given dynamical system using following methods.
   a) Root locus b) Bode Plot c) Nyquist Plot
   d) Liapunov's stability criteria
7. Obtain model matrix of a given system, obtain it's diagonalize form if exists or obtain Jordon Canonical form of system.
8. PSPICE Simulation of three Phases full converter using RL & E loads PSPICE Simulation of Single Phase full converter using RL & E loads.
9. PSPICE Simulation of Single Phase AC voltage controller using RL load.
10. AC / DC load flow study.
11. General a clock pulse of time duration T at port1-0th pin?
    a)5 microsecond b)10microsec c)5 millisecond d)15 millisecond
12. Write ALP to send a character 'A', continuously to serial window at baud rate 4800?
13. Write an ALP to send "Embedded system" to a serial window using timer0, mode1?
14. Write a program to generate square wave, triangular wave using ADC interfacing

I Year – I Sem. M.Tech (EPE)

Code: 5X172 TECHNICAL PAPER WRITING AND SEMINAR

L	T	P	C
-	-	3	2

Max. Marks: 50

There shall be two seminar presentations during I year I semester and I year II Semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee, which shall consist of the Head of the Department, a senior Faculty Member and the Supervisor and will jointly evaluate the report and presentation. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful.

In the First semester the report must be in the form of the review paper with a format used by IEEE / ASME etc.

The evaluation format for seminar is as follows:

- Day to day evaluation by the Supervisor : 10 marks
- Final Report : 10 marks
- Presentation : 30 marks

I Year – I Sem. M.Tech (EPE)

Code: 5X172 **RESEARCH METHODOLOGIES**

L	T	P	C
1	1		1

UNIT I

Introduction: Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.

UNIT II

Quantitative Methods for problem solving: Statistical Modeling and Analysis, Time Series Analysis Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

UNIT III

Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables, Relation between frequency distributions and other graphs, preparing data for analysis

UNIT IV

Soft Computing: Computer and its role in research, Use of statistical soft ware SPSS, GRETL etc in research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems.

UNIT V

Structure and Components of Research Report, Types of Report, Layout of Research Report.

UNIT VI

Mechanism of writing a research report, referencing in academic writing.

Text Books

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan, 2006
2. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN: 81-315-0047- 0, 2006.

Reference Books

1. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.
2. Fuzzy Logic with Engg Applications, Timothy J.Ross, Wiley Publications, 2nd Ed.
3. Simulated Annealing: Theory and Applications (Mathematics and Its Applications, by P.J. van Laarhoven & E.H. Aarts.
4. Genetic Algorithms in Search, Optimization, and Machine Learning by David E. Goldberg

I Year – II Sem. M.Tech (EPE)

Code: 5X211 **POWER SYSTEM STABILITY**

L	T	P	C
3	1	-	3

UNIT – I - INTRODUCTION TO VOLTAGE STABILITY:
Definitions: Voltage Stability, Voltage Collapse, Voltage Security, Physical relation indicating dependency of voltage on reactive power flow, Factors affecting Voltage collapse and instability, previous cases of voltage collapse incidences.

UNIT II - VOLTAGE STABILITY INDICES:
Voltage collapse proximity indicator, Determinant of Jacobin as proximity indicators, Voltage Stability margin.

UNIT III– VOLTAGE STABILITY MARGIN:
Stability Margin: Compensated and un-compensated systems.
Voltage Security: Definition, Voltage Security, Methods to improve voltage stability and its practical aspects.

UNIT IV:

Concepts of steady state, dynamic and transient stabilities.
Models for stability, synchronous machine, excitation system, governing system induction machine modeling.

UNIT V:
Generator connected to infinite bus Energy balance, Solution to non-linear swing equation, Phase- plane trajectory from potential energy curve, Analysis in phase plane multi Machine system modeling and Multi Machine system transient stability analysis.

UNIT VI - TRANSIENT STABILITY CONTOLLERS:
System Design for Transient Stability, Discrete Supplementary Controls, Dynamic Braking, Discrete control of Excitation Systems, Momentary and Sustained Fast Valving, Discrete Control of HVDC Links, Series capacitor Insertion, Emergency control Measures.

TEXT BOOKS:
1. "Performance, Operation and Control of EHV power transmission system" A.Chakrabarthy, D.P. Kotari and A.K.Mukopadyay, A.H.Wheeler Publishing, 1 Edition, 1995
2. "Power System Dynamics Stability and Control" – K.R.Padiyar, II Edition, B.S. Publications.

REFERENCES:
1. "Power System Voltage Stability" - C.W. Taylor, Mc Graw Hill Publications, 1994.

I Year – II Sem. M.Tech (EPE)

Code: 5X212 ADVANCED POWER SYSTEM PROTECTION

L	T	P	C
3	1	-	3

UNIT I:
Primary and back up protection, current transformers for protection, potential transformer, review of electromagnetic relays static relays.
Over current relays time current characteristic, current setting time setting, directional relay, static over current relays.

UNIT II- DISTANCE PROTECTION:
Impedance, reactance, mho, angle impedance relays. Input quantities for various types of distance relays, effect of arc resistance on the performance of distance relays, selection of distance relays. MHO relay with blinders, quadrilateral relay, elliptical relay. Restricted mho, impedance directional, reactance relays. Swiveling characteristics.

UNIT III:
Compensation for correct distance measurement, reduction of measuring units switched schemes. Pilot relaying schemes. Wire pilot protection, circulating current scheme, balanced voltage scheme, transley scheme, carrier current protection, phase comparison carrier current protection, carrier aided distance protection.

UNIT IV:
Digital relaying algorithms, differential equation technique, discrete Fourier transform technique, walsh-hadamard transform technique, rationalized harr transform technique, removal of dc offset

UNIT V:
Introduction to Microprocessors: review of microprocessors and interfacing. Single chip microcomputers programmable interval timer, A/D converter.

UNIT VI - MICROPROCESSOR BASED PROTECTIVE RELAYS:
Over current, directional, impedance, reactance relays. Generalized mathematical expressions for distance relays, mho and offset mho relays, quadrilateral relay.
Microprocessor implementation of digital distance relaying algorithms.

TEXT BOOKS:
1. Power system protection & switchgear - Badri Ram & Vishwakarma, TMH Publication New Delhi, 1995.
2. Power System Protection - Madhava Rao TMH.

REFERENCES:
1. Power System - Ravindra Nath and Chandar PHI.

I Year – II Sem. M.Tech (EPE)

Code: 5X213 FLEXIBLE A.C. TRANSMISSION SYSTEM

L	T	P	C
3	1	-	3

UNIT I - FACTS CONCEPT:
Transmission inter connection – Power flow in AC system – What limits the loading capability – Power flow and dynamics stability consideration of a transmission inter – connection – importance of controllable parameters – Basic types of FACTS controllers – Brief description of FACTS controllers. In perspective HVDC vs FACTS.

UNTI II- VOLTAGE SOURCED CONVERTERS:
Basic concept of VSC – Single phase full wave bridge converter operation – Single phase leg operation – Three phase full wave bridge converter – Sequence of valve conduction in each phase leg- Transformer connection for 12 pulse operation – Current sourced converters.

Basic concept of C.S.C. – Thyristor based converter – Rectifier & inverter operation – Valve voltage – communication failure – A.C. Current & D.C. voltage harmonics – Current sourced converter with turn off devices, CSC vs VSC.

UNIT III - STATIC SHUNT COMPENSATORS:
Objectives of shunt compensation methods of controllable VAR generation – Variable impedance type – switching converter type – VAR generators – SVC & STATCOM.

UNTI VI - STATIC SERIES COMPENSATORS:
Objectives of series compensation – Variable impedance types series compensation – GCSC – ISSC – TCSC – Switching converter type series compensation – Static synchronous series compensator (SSSC) – Transmitted power Vs. transmission angle characteristics – Control range & VA rating – Capability to provide real power compensation.

UNTI V - STATIC VOLTAGE & PHASE ANGLE REGULATORS:
Objectives, Voltage and Power angle regulation – Power flow control by PAR – Real and Reactive loop power flow control – Improvement of transient stability with PAR.

UNIT – VI- UNIFIED POWER FLOW CONTROLLER:
Basic operating principle – conventional transmission control capabilities, Independent real and reactive power flow control, Control structure Control Scheme for P & Q control.

TEXT BOOKS:
1. Narain G.HIngorani & Laszio Gyugyi, Understanding FACTS – Concepts & Technology of Flexible AC transmission Systems, 2001, Standard Publication Distribution, Delhi, 2001.
2. Flexible AC transmission Systems, Edited - Yong Hau Song & Allah T.Johns, Published by IEE, London, 1999.

I Year – II Sem. M.Tech (EPE)

Code: 5X214 **POWER QUALITY**

L	T	P	C
3	1	-	3

UNIT I: INTRODUCTION:
Introduction of the Power Quality (PQ) problems. Terms used in PQ Voltage, Sag, Swell, Surges, Harmonics, over voltages, Spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

UNIT II: LONG INTERRUPITONS:
Interruptions – Definition – Difference between failures, outage, Interruptions – causes of Long Interruptions Origin of Interruptions – Limits for the Interruption frequency
Limits for the interruption duration – Costs of interruption – Over view of Reliability evaluation to power quality, comparison of observations and reliability evaluation.

UNIT – III - SHORT INTERRUPTIONS:
Short interruptions – definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping, voltage and current during faulty period, voltage and current at post fault period, stochastic prediction of short interruptions.

UNIT IV – VOLTAGE SAG – CHARACTERIZATION – SINGLE PHASE:
Voltage sag definition, causes of voltage sag, voltage saga magnitude, monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, voltage sag duration.
Voltage sag – characterization – three phase:
Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

UNIT V – PQ CONSIDERATIONS IN INDUSTRIAL POWER SYSTEMS:
Voltage sag, equipment behavior of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

UNIT VI – MITIGATION OF INTERRUPTIONS AND VOLTAGE SAGS:
Overview of mitigation methods – from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface – voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.
Power Quality and EMC standards:
Introduction to standardization, IEC Electromagnetic compatibility standards, European Voltage characteristics standards, PQ surveys.

TEXT BOOKS:
1. "Understanding Power Quality Problems" - Math H J Bollen, IEEE Press.
2. Power Quality- C. Sankaran.

I Year – II Sem. M.Tech (EPE)

Code: 5X215 SOFT COMPUTING TECHNIQUES
(ELECTIVE – III)

L	T	P	C
3	1	-	3

UNIT –I: ARTIFICIAL NEURAL NETWORKS:
Introduction, neural network models, architectures, knowledge representation, learning process, learning tasks, ANN paradigms

UNIT – II:
Mc Cullochs-Pitts model, Back propagation, RBF algorithms, Hopfield networks

UNIT – III:
Fuzzy logic, fuzzy sets, membership function, fuzzy interference, Defuzzification methods

UNIT – IV: Genetic algorithms, encoding, fitness function, reproduction operators, genetic modeling, genetic operators cross over and mutation, generation cycle, convergence of GA

UNIT V - APPLICATION OF SOFT COMPUTING TECHNIQUES:
Load forecasting, load flow studies, economic load dispatch,

UNIT – VI:
Load frequency control, reactive power control, speed control of DC, AC motors

TEXT BOOKS:
1. Principles of soft computing- S.N.Sivandan, S.N.Deepa, Wiley India, 2007.
2. Neural Networks and Fuzzy Logic, Genetic Algorithms, Synthesis, Applications- S.Raja Sekharan, G.A.Vijayalakshmi, PHI, 2005.

REFERENCES:
1. Studies in computational intelligence – Devendra K Chaturuvedi, Springer.

I Year – II Sem. M.Tech (EPE)

Code: 5X216 **RESTRUCTURING IN ELECTRICAL POWER SYSTEMS (ELECTIVE – III)**

L	T	P	C
3	1	-	3

UNIT – I – DEREGULAION OF THE ELECTRICITY SUPPLY INDUSTRY:
What is Delegulation?, Background to Deregulation and the Current Situation around the world, Benefits from Competetive Eelctricity Market, After – Effects of Deregulation.

UNIT – II – POWER SYSTEM ECONOMIC OPERATION OVERVIEW:
Economic Load Dispatch (ELD), Optimal Power Flow as a Basic Tool, Unit Commitment (UC), Formation of Power Pools.

UNIT – III – POWER SYSTEM OPERAITON IN COMPETITIVE ENVIRONMENT: Role of the Independent System Operator (ISO), Operational Planning Activities of ISO, Operatinal Planning Activities of a Genco.

UNIT – IV – TRANSMISSION OPEN ACCESS AND PRICING ISSUES:
What is Power Wheeling?, Transmission Open Access, Cost Components in Transmission, Pricing of Power Transactions, Transmission Open Access and pricing Mechanisms in Various Countries, Security Managment in Deregulated Environment, Cogestion management in Deregulation

UNIT – V – ANCILLARY SERVICES MANAGMENT :
What do we mean by Ancillary Services, Ancillary Services Management in Various Countries, Reactive Power as an Ancillary Service.

UNIT – VI- RELIABILITY AND DEREGULATION:
Reliability Analysis, The network Model, Reliability Costs, Hierarchical Levels, Reliability and Deregulation, Performance Indicators

TEXT BOOKS:
1. Operation of restructured power systems, Kankar Bhattacharya, Math H.J. Bollen, Japp E.Daalder, Kluwar Academic Publishers, 2001.

REFERENCES:
1. Restructured Electrical Power Systems - Mohd.Shahidehpour and Alomoush – Marcel Deccan, Inc, 2001.
2. Power System restructuring and deregulation – trading, performance and information Technology by Loi Lei Lai, John Willey & Sons Ltd.,

I Year – II Sem. M.Tech (EPE)

Code: 5X217 **Extra High Voltage AC TRANSMISSION**

(ELECTIVE – III)

L	T	P	C
3	1	-	3

UNIT –I:

E.H.V. A.C. Transmission, line trends and preliminary aspects, standard transmission voltages – power handling capacities and line losses – mechanical aspects. Calculation of line resistance and inductance: resistance of conductors, temperature rise of conductor and current carrying capacity. Properties of bundled conductors and geometric mean radius of bundle, inductance of two conductor lines and multi conductor lines, Maxwell's coefficient matrix.

UNIT II:

Line capacitance calculation: capacitance of two conductor line, and capacitance of multi conductor lines, potential coefficients for bundled conductor lines, sequence inductances and capacitances and Diagonalization. Calculation of electro static field of AC lines - Effect of high electrostatic field on biological organisms and human beings.

UNIT - III:

Surface voltage Gradient on conductors, surface gradient on two conductor bundle and cosine law, maximum surface voltage gradient of bundle with more than 3 sub conductors, Mangolt formula.

UNIT - IV:

Corona : Corona in EHV lines – corona loss formulae – attenuation of traveling waves due to corona – Audio noise due to corona, its generation, characteristics and limits, measurement of audio noise.

UNIT - V:

Power Frequency voltage control : Problems at power frequency, generalized constants, No load voltage conditions and charging currents, voltage control using synchronous condenser, cascade connection of components : Shunt and series compensation, sub synchronous resonance in series – capacitor compensated lines

UNIT - VI:

Static reactive compensating systems: Introduction, SVC schemes, Harmonics injected into network by TCR, design of filters for suppressing harmonics injected into the system.

REFERENCE BOOKS:

1. Extra High Voltage AC Transmission Engineering – Rakosh Das Begamudre, Wiley Eastem ltd., New Delhi – 1987.
2. EHV Transmission line reference book – Edision Electric Institute (GEC) 1986.

I Year – II Sem. M.Tech (EPE)

Code: 5X122 **REAL TIME CONTROL OF POWER SYSTEMS**
(ELECTIVE-III)

L	T	P	C
3	1		3

UNIT – I Substation/ Generating Station:
Lay out of substation / Generating Station, Main Equipment in Sub Station/ Generating Station, Instrument Transformers and their importance in measurements and protection, important parameters necessary for Grid operation: Analog Points (MW, MVar, Tap Position, Voltage, Frequency), Status Points (CB Status, Isolator Status, SOE Points), Alarms. Hardware required getting these parameters to RTU: Transducers & their connectivity.

UNIT – II SCADA Functions:
Introduction to SCADA: Grid Operation & Control, Difficulties in operating the large power systems manually, need for going to SCADA operation, advantages of SCADA operation. Data Acquisition, Monitoring and Event Processing, Control Functions, Time tagged data, Disturbance data collection and analysis, Reports and Calculations. Man –Machine Communication: Operator‘s Console, VDU Display and its use, Operator Dialogs, Mimic Diagram Functions, and Printing Facilities.

UNIT – III Remote Terminal Unit (RTU) & Communication Practices:
Major Components: RTU Panel, Interface Panel. D20M Main Processor, Analog Card, Status Card, Control Card, Modems. Types Of Communications: Power Line Carrier Communications, Microwave, Optical fibre, VSAT Communications. Types of Network Elements in LAN & WAN. Process of Data Communication.

UNIT – IV Sub-Load Dispatch Center (SUB-LDC):
Various Equipment in Sub LDC: (a) Work Stations: details (b) FEPS: Function of FEPS (Front End Processors). (c) Routers: function of routers, interconnectivity of the equipment by LAN, Functionality and responsibilities of Sub LDC

UNIT – V Introduction to SCADA Protocols and Communication Standards for Electrical Power Systems:
Power System Control requirements and evolution of Protocol for Communication, Protocols -Modbus, Distributed Network Protocol (DNP), IEC 870-5 and 60870 series, Benefits from the IEC (International Electro technical Commission) communication Standards. (Ref: www.dnp.org,www.modbus.org, www.kema.nl)

Real Time Software:
Classification of Programs, Structure of Real time Programs, Construction Techniques & Tools, Programming Language Requirements for Process Control.

UNIT – VI Computer Control of Electrical Power Systems:
Evolution of System Control, time scale of system control, online computer control, and Software Elements: State Estimation, Monitoring & Prediction, Generation & Load Control, Security Analysis; Software Coordination & Systems Simulation. State Load Dispatch Center (SLDC): Inter Connectivity of Sub-LDCs & SLDCs, Hierarchy of Data Transfer, Functions & Responsibilities of SLDC, Real Time Operation carried at SLDC.

Southern Regional Load Dispatch Center (SRLDC):
Functions & Responsibilities of SRLDC, Operations carried at SRLDC, Overview of SCADA, Real Time Operation in detail.

Text Books:

1. Hassan Bevrani: Robust Power System Frequency Control, Power Electronics and Power Systems, Edition illustrated Publisher Springer, 2009.

2. Michael John Howard Sterling: Power system control, Volume 6 of IEE control engineering series, Edition illustrated Publisher Peregrinus [for] the Institution of Electrical Engineers, 1978.

3. TorstenCegrell, ―Power System control –Technology‖, Prentice –Hall International seriesin Systems and control Engineering, Prentice Hall International Ltd., 1986.

4. S. Bennett and D.A. Linkens (Editors): Real –Time Computer Control, IEE Control Engineering series (24), peter Peregrinus Ltd., 1984.

5. Real –Time Systems –by C.M. Krishna and Kangg. Shin, McGraw-Hill international companies, 1997.

I Year – II Sem. M.Tech (EPE)

CODE: 5X123 **SWITCHED MODE POWER CONVERSION**
(ELECTIVE – II)

L	T	P	C
3	1	-	3

UNIT- I DC/DC Converters:
Basic topologies of buck, boost converters, buck-boost converters, and cuk converter, isolated DC/DC converter topologies—forward, and fly-back converters, half and full bridge topologies, modeling of switching converters.

UNIT –II Current Mode and Current Fed Topologies:
Voltage mode and current mode control of converters, peak and average current mode control, its advantages and limitations, voltage and current fed converters.

UNIT – III Resonant Converters:
Need for resonant converters, types of resonant converters, methods of control, phase modulation technique with ZVS in full-bridge topology, series resonant converter and resonant transition converter.

UNIT – IV Converter Transfer Functions:
Application of state-space averaging to switching converters, derivation of converter transfer functions for buck, boost, and fly-back topologies.

UNIT – V Power Converter Design:
Design of filter inductor & capacitor, and power transformer, Ratings for switching devices, current transformer for current sensing, design of drive circuits for switching devices, considerations for PCB layout.

UNIT _ VI Controller Design:
Introduction, mechanisms of loop stabilization, shaping E/A gain vs. frequency characteristic, conditional stability in feedback loops, stabilizing a continuous mode forward converter and discontinuous mode fly-back converter, feed-back loop stabilization with current mode control, the right-half plane zero.

TEXT Books:
1. Ned Mohan Tore M. Undeland: Power Electronics: Converters, Applications, and Design, Edition3, John Wiley & Sons, 2007.
2. Abraham I. Pressman, ―Switching Power Supply Design‖, Mc Graw Hill International, Second Edition, 1999.
3. P.C. Sen: Modern Power Electronics, S. Chand-2004.
4. Andrzej M. Trzynadlowski Introduction to Modern Power Electronics, 2nd Edition, illustrated Publisher John Wiley & Sons, 2010.
5. Muhammad H. Rashid, Power electronics hand book, ISBN: 81 8147 367 1.

I Year – II Sem. M.Tech (EPE)

CODE: 5P141 **COMPUTER NETWORKS**
(ELECTIVE – II)

L	T	P	C
3	1	-	3

UNIT – I

INTRODUCTION: OSI, TCP/IP and other networks models, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN.

PHYSICAL LAYER: Transmission media copper, twisted pair wireless, switching and encoding asynchronous communications;

UNIT - II

DATA LINK LAYER: Design issues in data link layer, Logical link control, framing, flow control, Protocol-stop and wait, Sliding Window, error detection and correction, CRC ,,HDLC, ATM.

UNIT - III

MEDIUM ACCESS SUB LAYER: ALOHA, MAC addresses, Carrier sense multiple access, ISDN, IEEE 802.X Standard Ethernet, wireless LANS. Bridges

UNIT - IV

NETWORK LAYER: Virtual circuit and Datagram subnets-Routing algorithm shortest path routing, Flooding, Hierarchical routing, Broad cast, Multi cast, distance vector routing.

UNIT – V

Congestion, Control Algorithms – General Principles – of Congestion prevension policies. Internetworking: The Network layer in the internet and in the ATM Networks.

UNIT –VI

TRANSPORT LAYER: Transport Services, Connection management, TCP and UDP protocols; ATM AAL Layer Protocol.

APPLICATION LAYER – network threats, confidentiality, authenticity, DES and RSA algorithms, Domain name system, Electronic Mail, WWW, Multi Media.

TEXT BOOKS

1. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
2. Data Communications and Networking – Behrouz A. Forouzan.Third Edition TMH.

REFERENCES

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

I Year – II Sem. M.Tech (EPE)

Code: 5ZC03 **BANKING OPERATIONS, INSURANCE AND RISK MANAGEMENT**
(OPEN ELECTIVE)

T	P	C
3	1	3

Course Objective: The objective of the course is to provide to students an understanding of Banking Operations, Insurance Market, and Risk Management Principles and techniques to control the risk & the major Institutions involved and the Services offered within this framework.

UNIT I

INTRODUCTION TO BANKING BUSINESS: Introduction to Banking sectors-History of banking business in India, Structure of Indian banking system: Types of accounts, advances and deposits in a bank New Dimensions and products- E-Banking, Mobile-Banking, Net Banking, CRM, cheque system and KYC system.

UNIT II

BANKING REFORMS AND REGULATIONS: Banking regulation Act-1949, Reserve Bank of India Act-1934, Establishment of RBI, Functions and credit control system; Role of commercial banks and its functions. Banking sector reforms in India and deficiencies in Indian banking including problems accounts and Non-Performing Assets.

UNIT III

INTRODUCTION TO INSURANCE: Introduction to insurance, Need and importance of Insurance, principles of Insurance, characteristics of insurance contract, branches of insurance and types of insurance; life insurance and its products: Role of Agents and brokers.

UNIT IV:

INSURANCE BUSINESS ENVIRONMENT: Regulatory and legal frame work governing the insurance sector, history of IRDA and its functions: Business and economics of insurance, need for changing mindset and latest trends.

UNIT V

INTRODUCTION TO RISK MANAGEMENT: Introduction to Risk, meaning and types of risk in business and individual, Risk management process, methods: Risk identification and measurement, Risk management techniques; Non insurance methods

UNIT VI

FINANCIAL RISK MANAGEMENT: Introduction to Financial markets. Financial risk management techniques –Derivatives, Hedging and Portfolio management techniques: Derivatives and types of Derivatives-Futures, options and swaps: Shares, Commodity and Currency trading in India.

Text Books:

1. Varshney, P.N., Banking Law and Practice, Sultan Chand & Sons, New Delhi.
2. General Principles of Insurance Harding and Evantly
3. Mark S. Dorfman: Risk Management and Insurance, Pearson, 2009.

References:

1. Scott E. Harringam Gregory R. Nichanus: Risk Management & Insurance, TMH, 2009.
2. Geroge E. Rejda: Principles of risk Management & Insurance, 9/e, pearson Education. 2009.
3. G. Koteshwar: Risk Management Insurance and Derivatives, Himalaya, 2008.
4. Gulati: Principles of Insurance Management, Excel, 2009.
5. James S Trieschmann, Robert E. Hoyt & David N. Sommer: Risk Mgt. & Insurance, Cengage, 2009.
6. Dorfman: Introduction to Risk Management and Insurance, 8/e, Pearson, 2009.
7. P.K. Gupta: Insurance and Risk Management, Himalaya, 2009.
8. Vivek & P.N. Asthana: Financial Risk Management, Himalaya, 2009.
9. Jyotsna Sethi & Nishwan Bhatia : Elements of Banking and Insurance, 2/e,PHI, 2012.

I Year – II Sem. M.Tech (EPE)
Ethics, Morals, Gender Sensitization, and Yoga
(Common to all Branches)

Code: 5H233	L	T	P/D	C
	1	1	-	1

COURSE OUTCOMES

Students will be able to

- Discriminate between right and wrong from their own behavior and judge the same in others.
- Understand how moral development involves thoughts, feelings, and behaviors regarding right and wrong and get intrapersonal and interpersonal dimensions.
- Understand Engineer's Responsibility for safety and risk.
- Understand rules and principles set by the society in a customary way.
- Perceive gender literacy and understand the importance of gender perspective and in turn delve into gender issues.
- Understand and appreciate the importance of yoga for an enriched life style.

UNIT I: HUMAN VALUES AND MORALS

Why Value Education, Understanding Social Factors, System, Structure and Source of Generic Values; Morals, Values and Ethics; Integrity; Work Ethics; Service Learning-Civic Virtue-Respect for Others-Living Peacefully-Caring-Sharing; Honesty; Courage; Value Time; Cooperation; Commitment; Empathy; Self Confidence; Spirituality; Character; Loyalty; Confidentiality

UNIT II: ENGINEERING ETHICS AND PERSONALITY DEVELOPMENT

Ethical Principles, Ethical Theories, , Use of Ethical Theories, Types of Inquiry, Engineering and Ethics, Engineering Ethics, Moral Autonomy of Engineers, Professional Ethics, Consensus and Controversy, Ethics in Business, Global business, Understanding Factors of Success, Human Aspirations, Personality and Our Identity, Understanding SELF, Happiness and Self-Interest, Positive Thinking, Custom and Religion, Understanding responsibility toward society, Understanding National and cultural Ethos; Professionalism

UNIT III: ENGINEERING AS SOCIAL EXPERIMENTATION

Comparison with Standard Experiments; Knowledge Gained; Learning from the Past; Engineer as Manager, Consultants and leaders and responsible social Experimenter; Engineers personality Trait, Big Five Personality model, Conscientiousness ,Accountability- Roles of Codes-Codes and Experimental Nature of Engineering; Engineer's Responsibility for safety and Risk, Concept of Safety-Types of Risks

UNIT IV: GLOBAL PERSPECTIVE

Distinguish between Bribes and Gifts; Occupational Crimes; Globalization- Cross-Cultural Issues; Environmental Ethics; Internet and Computer Codes of Ethics

Case Study:

Ethics in Military and Weapons Development-Ethics in Research work

UNIT V: GENDER SENSITIZATION

Introduction to Gender Study; Introduction to Gender Spectrum; Point of view; Gender and Structure of Knowledge; Contribution of Women in growth and development as Technologist, Scientist, R&D, GDP, Social Life, National Development, International Perspective"- Life Exemplary Madame Curie, Durga bai Deshmukh, Kalpana Chawla, Chanda Kochar, Mary Kom, Indra Gandhi, Mother Teresa, Indra Nooyi, Golda Meir, Margaret Thatcher and other achievers

UNIT VI: YOGA

Introduction to Yoga in India; Origin and Development; Theoretical understanding of yoga; Stress Management : Modern and Yogic perspectives ; Tackling ill-effects of Frustration, Anxiety and Conflict through modern and Yogic methods; Meditation Techniques; Suryanamaskar; Pranayama.

TEXT BOOKS:

1. Indian Culture Values And Professional Ethics (For Professional Students) by Prof.P.S.R.Murthy ; B.S.Publications.
2. Professional Ethics and Human Values by M. Jayakumar, Published by University Science Press,
3. Telugu Academy, Hyderabad, 2015, Towards A World of Equals, A Bilingual Text Book on Gender.

REFERENCE BOOKS:

1. The Yoga Sutras of Patanjali by Swami Satchitananda
2. The Secret Power of Yoga by Nischala Joy Devi
3. Light on Pranayama by B.K.S. Iyengar
4. Books on the Art of Living by Poojya Sri Sri Ravi Shanker
5. Making It Relevant: Mapping the meaning of women's studies in Tamilnadu by Anandi S and Swamynathan P
6. Feminism is for Everybody; Passionate Politics by Bell Hooks
7. Gender by Geetha V
8. "Growing up Male" in what is worth teaching by K Kumar
9. The Lenses of Gender: Transforming the Debate on Sexual Inequality - Sandra Lipsitz Bem
10. The Lenses Of Gender - by ANNE MURPHY

I Year – II Sem. M.Tech (EPE)

Code: 5T216 EMBEDDED AND REAL TIME CONTROL
(OPEN ELECTIVE)

L	T	P	C
3	1	-	3

UNIT – I – INTRODUCITON:
Embedded systems overview, design challenge, processor technology, IC technology, Design Technology, Trade-offs, Single purpose processors RT – level combinational logic, sequential logic (RT-level), custom single purpose processor design (RT-level), optimizing custom single purpose processors.

UNIT – II – GENERAL PURPOSE PROCESSORS :
Basic architecture, operation, Pipelining, Programmer's view, development environment, Application Specific Instruction-set Processors (ASIPs0 – Micro controllers and Digital Signal Processors.

UNIT – III – STATE MACHINE AND CONCURRENT PROCESS MODELS:
Introduction, models Vs. languages, finite state machines with data path model (FSMS), using state machines, program state machine model (PSM), concurrent process model, concurrent processes, communication among processes, synchronization among processes, implementation, data flow model, real time systems.

UNIT – IV – COMMUNICATION INTERFACE:
Need for communication interfaces, RS232/UART/RS422/RS485, USB, infrared, IEEE 1394 Fire wire, Ethernet, IEEE 802.11, Blue tooth.
Embedded / RTOS concepts – I:
Architecture of the Kernel, Tasks and Task scheduler, Interrupt service routines, Semaphores, Mutex.

UNTI – V – EMBEDDED CONCEPTS – II :
Mailboxes, Message Queues, Event Registers, Pipes, Signals.
Embedded /RTOS Concepts –III: Timers, Memory Management, Priority inversion problem, Embedded operating systems Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE.

UNIT – VI - DESIGN TECHNOLOGY:
Introduction, Automation, Synthesis, Parallel evolution of compilation and synthesis, Logic Synthesis, RT synthesis, Behavioral Synthesis, Systems Synthesis and Hardware / Software Co-Design, Verification, Hardware / Software co-simulation, Reuse of intellectual property codes.

TEXT BOOKS:
1. Embedded System Design – A Unified Hardware / Software Introduction –Frank Vahid, tony D.Gavargis, John Wiley, 2002.
2. Embedded / Real Time Systems – KVKK Prasad Dreamtech Press, 2005.

REFERENCES:
1. Embedded Microcomputer Systems – Jonathan W.Valvano, Broooks / Cole, Thommson, Learning.
2. An Embedded Software Primer – David E.Simon, Pearson, Ed. 2005
3. Introduction to Embedded Systems – Raj Kamal, TMS, 2002.
4. Embedded Real Time Systems Programming – Sri Ram V lyer, Pankaj Gupta, TMH, 2004.

I Year – II Sem. M.Tech (EPE)

Code: 5ZC11 **LOGISTICS AND SUPPLY CHAIN MANAGEMENT**

(Open Elective)

Course Objective: The objective of the course is to give the student an overview of Supply Chain management principles and practices

***The students need Statistical Table to solve numerical problems.**

Prerequisites: Knowledge of Production and Operations Management, Marketing Management and QABD taught in second semester of the programme.

UNIT I

INTRODUCTION TO LSCM: Logistics and Competitive strategy Understanding the Supply Chain. Objective and Importance of Supply Chain Process View of Supply Chain. Competitive and Supply Chain Strategies, Achieving Strategic Fit, Challenges of SCM

UNIT II

SUPPLY CHAIN DRIVERS AND METRICS: Drivers for Supply Chain Performance, Framework for Structuring drivers. Facilities, inventory, transportation, information, sourcing and pricing. Obstacles to Achieving fit. Designing the Supply Chain Network. Role of distribution in the Supply Chain, Factors influencing network design, the role of network in the Supply Chain.

UNIT III

DEMAND FORECASTING & AGGREGATE PLANNING IN SUPPLY CHAIN: Demand Forecasting in Supply Chain Components of forecast and forecasting methods. Role of IT in forecasting. Aggregate Planning in Supply Chain Planning Supply and Demand in A Supply Chain, Managing Predictable Variability.

UNIT IV

LOGISTICS AND SUPPLY CHAIN RELATIONSHIPS: Benchmarking the logistics process and SCM operations –Mapping the supply chain processes – SCOR model – Supplier and distributor benchmarking – setting benchmarking priorities –identifying logistics performance indicators –Channel structure – channel relationships – Transportation, Inventory Planning & Managing - logistics service alliances.

UNIT V

WAREHOUSE MANAGEMENT: Importance, Structure, Business process of warehouse management, product unit used for packaging and shipping, supply chain relevant for warehouse management, Goods receipt, Issue & Transfer within the warehouse, Warehouse management automation & IT integration, RFID.

UNIT VI

MANAGING GLOBAL LOGISTICS AND GLOBAL SUPPLY CHAINS: Performance of Logistics and Supply chain in India, Logistics in a global economy – views of global logistics- global operating levels – interlinked global economy – The global supply chains -Global supply chain business processes.

Books Recommended:

- Sunil Chopra and Peter Meindl: *Supply chain Management: Strategy, Planning and Operation,3/e,* Pearson Education, New Delhi 2007.
- Donald J.Bowersox and David J.Closs, Logistical Management: The Integrated Supply Chain Process, Tata McGraw Hill, 2006.

References:

- Martin Christopher, *Logistics and Supply Chain Management*, Pitman, London.
- B.S.Sahay, *Supply Chain Management for Global Competitiveness*, Macmillan, New Delhi.2003.
- Philip B.Schary, Tage Skjott-Larsen: Managing the Global Supply Chain, Viva, Mumbai, 2006.
- Monczka: Purchasing and Supply Chain Management Thomson, 2006.
- Ballou, Business Logistics/Supply chain Management5/e Pearson Education.
- David Simchi-Levi, Philip Kaminsky,Edith Simchi-Levi, Designing and Managing The Supply Chain 2nd ed. Tata McGraw Hill Publishing Company Ltd.,2006
- Amit Sinha, Herbert Kotzab , Supply Chain Management A managerial Approach, Tata McGraw Hill Education Private Ltd, 2012.

I Year – II Sem. M.Tech (EPE)

Code: 5X273 POWER SYSTEM SIMULAITON LAB – II
(Minimum of ten of the following to be conducted)

L	T	P	C
-	-	4	2

1. Conduct a power flow study on a given power system network using Newton Rapson Method for 5bus, IEEE 14bus and IEEE 30bus system.
2. Develop a SIMULINK model for a two area load frequency problem and simulate with and without controller.
3. Solution of simultaneous differential equations by RK and modified Euler's method.
4. Design excitation systems for voltage control.
5. Unsymmetrical fault analysis.
6. Design a compensator for a given systems for required specifications.
7. Design a PID controller and Write a program and implement linear quadratic regulator.
8. PSPICE Simulation of Three phase inverter with PWM controller
9. PSPICE Simulation of resonant pulse commutation circuit and impulse commutation circuit.
10. NR load flow study with FACTS.
11. Write a program using embedded c to blink pins of port-1?
12. Write a program using embedded c to print given string in the output?
13. Display the status of port1 in the microcontroller on LEDS?
14. Reading from PSBs and writing in to LEDS?

I Year – II Sem. M.Tech (EPE)

Code: 5X274 **Literature Review and Seminar - II**

L	T	P	C
-	-	3	1

Max. Marks: 100

There shall be two seminar presentations during I year I semester and I year II Semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee, which shall consist of the Head of the Department, a senior Faculty Member and the Supervisor and will jointly evaluate the report and presentation. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful.

In the Second semester Technical Seminar in the form of Independent Review Paper must be of high quality fit for publication in a reputed conference / journal.

The evaluation format for seminar is as follows:

- Day to day evaluation by the Supervisor : 10 marks
- Final Report : 10 marks
- Presentation : 30 marks

I Year – II Sem. M.Tech (EPE)

Code: 5X375 COMPREHENSIVE VIVA-VOCE - II

L	T	P	C
-	-	-	1

Max. Marks: 100

There shall be a Comprehensive Viva-Voce in I year II Semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the students' understanding in various subjects he/she studied during the M.Tech course of study. The Comprehensive Viva-Voce is valued for 100 marks by the Committee. There are no internal marks for the Comprehensive Viva-Voce. A candidate has to secure a minimum of 50% to be declared successful.

II Year – I Sem. M.Tech (EPE)

Code: 5X376 **PROJECT SEMINAR - II**

L	T	P	C
-	-	-	4

Max. Marks: 100

In II year I semester and II semester, a project seminar shall be conducted for 100 marks and for 4 credits (there is no external evaluation) in each of the semester. The evaluation for the project seminar shall be done in two stages, i.e. in the middle of the semester and at the end of the semester. The mid-semester seminar evaluation shall carry 50 marks and the end semester seminar evaluation shall carry 50 marks. The report for the project seminar will carry 20 marks and the remaining marks (30) shall be for presentation and discussion. A candidate shall secure a minimum of 50% to be declared successful.

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II Year – I Sem. M.Tech (EPE)

Code: 5X378 **PROJECT WORK (PART I)**
PROJECT STATUS REPORT

L	T	P	C
-	-	-	**20**

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the Project Review Committee.

A Project Review Committee (PRC) shall be constituted comprising of Heads of all the Departments which are offering the M.Tech programs and three other senior faculty members concerned with the M.Tech. Programme.

Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the previous semesters and after obtaining the approval of the PRC.

After satisfying attendance requirement, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the PRC for its approval. Only after obtaining the approval of PRC the student can initiate the Project work. This process is to be completed within four weeks of commencement of II year I semester.

The student shall submit a project report at the end of II year I semester, and the same shall be evaluated at the end of that semester by the PRC as Excellent/Good/Satisfactory/Unsatisfactory. In the case of unsatisfactory declaration, the student shall re-submit the Project report after carrying out the necessary modifications / additions in the Project work, within the specified time as suggested by the PRC.

II Year – II Sem. M.Tech (EPE)

Code: 5X478 **PROJECT SEMINAR - IV**

L	T	P	C
-	-	-	2

Max. Marks: 100

In II year I semester and II semester, a project seminar shall be conducted for 100 marks and for 2 credits (there is no external evaluation) in each of the semester. The evaluation for the project seminar shall be done in two stages, i.e. in the middle of the semester and at the end of the semester. The mid-semester seminar evaluation shall carry 50 marks and the end semester seminar evaluation shall carry 50 marks. The report for the project seminar will carry 20 marks and the remaining marks (30) shall be for presentation and discussion. A candidate shall secure a minimum of 50% to be declared successful.

II Year – II Sem. M.Tech (EPE)

Code: 5X480 PROJECT WORK AND DISSERTATION

L	T	P	C
-	-	-	**20**

A candidate is permitted to submit Project Dissertation only after successful completion of PG subjects (theory and practical), seminars, Comprehensive viva-voce, PG Project Part–I, and after the approval of PRC, not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and shall make an oral presentation before the PRC. Along with the draft thesis the candidate shall submit draft copy of a paper in standard format fit for publication in Journal / Conference, based on the project thesis, to the Head of the Department with due recommendation of the supervisor.

- Four copies of the Project Dissertation certified by the Supervisor and Head of the Department shall be submitted to the College.

- The dissertation shall be adjudicated by one examiner selected by the College. For this, Head of Department shall submit a panel of 3 examiners, who are eminent in that field, with the help of the PRC. The Chief Superintendent of the college in consultation with the college academic committee shall nominate the examiner.

- If the report of the examiner is not favorable, the candidate shall revise and resubmit the Dissertation, in the time frame as prescribed by PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate can re-register only once for conduct of project and evaluation of Dissertation, and will go through the entire process as mentioned above. The total duration for the M.Tech program is limited to four years.

- If the report of the examiner is favorable, viva-voce examination shall be conducted by a Board consisting of the Head of the Department, Supervisor and the Examiner who adjudicated the Dissertation. The Board shall jointly report the student's performance in the project work as – (a) Excellent, or (b) Good, or (c) Satisfactory, or (d) Unsatisfactory, as the case may be. In case, the student fails in the viva-voce examination, or gets the Unsatisfactory grade, he can re-appear only once for the viva-voce examination, as per the recommendations of the Board. If he fails at the second viva-voce examination, the candidate can re-register only once for conduct of project and evaluation of Dissertation, and will go through the entire process as mentioned above. The total duration for the M.Tech program is limited to four years.