COURSE STRUCTURE
AND
DETAILED SYLLABUS

for

M.Tech Two Year Degree Course

in

ELECTRICAL POWER ENGINEERING

(EPE)

(Applicable from the Academic Year 2014-2015)

Department of Electrical and Electronics and Engineering

SREENIDHI INSTITUTE OF SCIENCE & TECHNOLOGY

(An Autonomous Institution approved by UGC and affiliated to JNTUH)

(Accredited by NAAC with 'A' Grade, Accredited by NBA of AICTE, Recipient of WBA under TEQIP I & II)

Yamnampet, Ghatkesar, R.R.District-501 301.

M.Tech (Electrical Power Engineering)
Course Structure and Syllabus
Academic Year: 2014 - 2015

I Year - I Semester

Code	Subject	L	T	P	Credits	Marks	
						Int.	Ext.
4X101	Power System Dynamics	3	1	--	3	40	60
4X102	Optimization & Control	3	1	--	3	40	60
4X118	Reactive Power Compensation & Management	3	1	--	3	40	60
4X104	Computer Methods in Power Systems	3	1	--	3	40	60
	Elective – I	3	1	--	3	40	60
	Elective – II	3	1	--	3	40	60
4X171	Power System Simulation Lab – I	--	--	4	2	40	60
4X172	Technical Paper Writing and Seminar	--	--	3	2	50	--
Total Credits		**18**	**6**	**7**	**22**	**330**	**420**

I Year - II Semester

Code	Subject	L	T	P	Credits	Marks	
						Int.	Ext.
4X211	Power System Stability	3	1	--	3	40	60
4X212	Advanced Power System Protection	3	1	--	3	40	60
4X213	Flexible AC Transmission Systems	3	1	--	3	40	60
4X214	Power Quality	3	1	--	3	40	60
	Elective – III	3	1	--	3	40	60
	Open Elective	3	1	--	3	40	60
4X273	Power System Simulation Lab – II	--	--	4	2	40	60
4X274	Technical Seminar (Independent Review Paper)	--	--	3	2	50	--
Total Credits		**18**	**6**	**7**	**22**	**330**	**420**

Elective – I: Any one subject to be selected

Code	Subject
4X105	High Voltage DC Transmission
4X106	Distribution Planning & Automation
4X107	Microprocessors & Microcontroller Systems

Elective – II: Any one subject to be selected

Code	Subject
4X108	High Voltage Engineering
4X109	Energy Conversion Systems
4X110	Advanced Operation and Control

Elective – III: Any one subject to be selected

Code	Subject
4X215	Soft Computing Techniques
4X216	Restructuring in Electrical Power Systems
4X217	Power System Harmonics

Open Elective: Any one subject to be selected

Code	Subject
4ZC56	Banking Operations, Insurance and Risk Management
4G386	INTELLECTUAL PROPERTY RIGHTS, VALUES & ETHICS
4T216	Embedded and Real time control

II Year - I Semester

Code	Subject	L	T	P	Credits	Marks	
						Int.	Ext.
4X375	Comprehensive Viva	--	--	--	2	--	50
4X376	Project Seminar-I	--	--	--	2	50	--
4X377	Project work (Part – I) (Project Status Report) (Excellent/ Good/ Satisfactory/ Un-Satisfactory	--	--	--	18	Grading	--
Total Credits		**--**	**--**	**--**	**22**	**50**	**50**

II Year - II Semester

Code	Subject	L	T	P	Credits	Marks	
						Int.	Ext.
4X478	Project Seminar-II	--	--	--	2	50	--
4X479	Project work and Dissertation (Excellent/ Good/ Satisfactory/ Un-Satisfactory)	--	--	--	20	--	Grading
Total Credits		--	--	--	**22**	**50**	**--**

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

I Year – I Sem. M.Tech (EPE)

Code: 4X101 **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: 4X102 **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: 4X118 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: 4X104 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: 4X105 **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: 4X106 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: 4X107 MICROPROCESSORS & MICROCONTROLLERS SYSTEMS (ELECTIVE – I)

L	T	P	C
3	1	-	3

UNIT I- 8086/8088 PROCESSORS:
Introduction to 8086 Microprocessors, Architecture, Addressing modes, Instruction set, Register Organization, Assembler directives.

UNIT II - HARD WARE DESCRIPTION:
Pin diagram signal description min & max modes, bus timing, ready & wait states, 8086 based micro computing system.
Special features & Related Programming: Stack structure of 8086, Memory segmentation, Interrupts, ISR, NMI and MI and interrupt Programming, Macros.

UNIT III - ADVANCED MICROPROCESSORS:
Intel 80386 programming model, memory paging, Introduction to 80486, Introduction to Pentium Microprocessors and special Pentium pro features.

UNIT IV - BASIC PERIPHERALS & THEIR INTERFACING:
Memory Interfacing (DRAM) PPI- Modes of operation of 8255, interfacing to ADC & DAC.

UNIT V - SPECIAL PURPOSE OF PROGRAMMABLE PERIPHERAL DEVICES AND THEIR INTERFACING:
Programmable interval timer, 8253, PIC 8259A, serial data communication standards, Programmable communication Interface 8251, USART and Exercises.

UNIT VI - MICROCONTROLLERS:
Introduction to Intel 8 bit &16 bit Microcontrollers, 8051- Architecture, Memory organization, Addressing Modes and exercises.

Hardware description of 8051:
Instruction formats ,Instruction sets, interrupt Structure & interrupt priorities, Port structures &Operation linear counter Functions, different Modes of Operation and Programming examples.

TEXT BOOKS:
1. The Intel Microprocessors Architecture Programming &Interfacing- Barry b Brey.
2. Advanced Microprocessor- Kenrith J Ayala, Thomson publishers.
3. Microcontrollers - Kentrith J Ayala, Thomson publishers.

REFERENCES:
1. Microprocessors & Interfacing Programming & Hardware- DOUGLAS V.Hall.
2. Microprocessors & Microcontrollers - Prof. C.R.Sarma.

I Year – I Sem. M.Tech (EPE)

Code: 4X108 **HIGH VOLTAGE ENGINEERING**
(ELECTIVE – II)

L	T	P	C
3	1	-	3

UNIT I - CONDUCTION AND BREAKDOWN IN GASES:
Ionization process, Townsend's current growth equation, current growth in the secondary processes, Townsend's criterion for breakdown, streamer theory of breakdown in gases, Paschen's law, breakdown in non uniform fields and corona discharge.

UNIT II - CONDUCTION, BREAKDOWN IN LIQUIDS AND SOLIDS:
Pure liquids and commercial liquids, conduction and breakdown in pure liquids, breakdown in solids dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown.

UNIT – III - GENERATION OF HIGH VOLTAGE AND CURRENTS:
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 IV - 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 – V - 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 VI: OVER VOLTAGE PHENOMENON INSULATION COORDINATION:
Causes of over voltage, lighting phenomenon, switching over voltages and power frequency over voltages in power systems.

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: 4X109 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: 4X110 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: 4X171 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: 4X172 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 – II Sem. M.Tech (EPE)

Code: 4X211 **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: 4X212 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: 4X213 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.Hlngorani & 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: 4X214 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 failure, 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: 4X215 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: 4X216 **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: 4X217 **POWER SYSTEM HARMONICS**
(ELECTIVE – III)

L	T	P	C
3	1	-	3

UNIT I:

Mechanism of harmonic generator, definitions and standards. General harmonic indices.

Harmonic Analysis: Fourier series and coefficients, effect of symmetry. Complex form of Fourier series, convolution of harmonic phasors.

UNIT II - THE FOURIER TRANSFORM:

Sampled time functions, discrete Fourier transform, The Nyquist Frequency and Aliasing. Fast Fourier Transform window functions. Efficiency of FFT algorithm. The wavelet transforms, Automation of disturbance recognition.

UNTI III:

Harmonic sources – Transformer magnetization non linearities, Rotating machine harmonics, Distortion caused by arcing devices, Single phase rectification, 3-Phase current source conversion, 3-phase voltage source conversion, Inverter fed A.C. Drives –Thyristor controlled reactors, Modulated phase control A.C regulators.

UNIT IV:

Effects of harmonic distortion, Resonance effects of harmonics on rotation machines, effect of harmonics on static power plant, Power assessment with distorted waveforms, Harmonic interference with ripple control systems, Harmonic interference with Power System Protection, Effect of harmonics on consumer equipment – interference with communications.

UNIT V: HARMONIC MONITORING AND ELIMINATION:

Measurement requirements, Transducers, Harmonic instrumentation, Data transmission, Presentation of harmonic information, Examples of applications.

UNIT VI – HARMONIC ELIMINATION:

Passive filters, Filter design, Network impedance for performance calculations, Tuned Filters, Damped Filters, Conventional filters, Band pass filters, Distribution systems filter planning, Filter components, Costs, DC side filters – Active filters.

TEXT BOOKS:

1. Power System Harmonics- J .Arillaga and N.R.Wadson, John Wiley, 2nd Edition.

REFERENCES:

1. Power System Harmonics - Wakileh – Springer verilag.

I Year – II Sem. M.Tech (EPE)

Code: 4ZC03

BANKING OPERATIONS, INSURANCE AND RISK MANAGEMENT

(OPEN ELECTIVE)

T	P	C
4	0	4

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)

Code: 4G836 INTELLECTUAL PROPERTY RIGHTS, VALUES & ETHICS (OPEN ELECTIVE)

L	T	P/D	C
2	1	-	2

UNIT –I: INTELLECTUAL PROPERTY RIGHTS - I
Invention and Creativity, Basic Types of Property, Need for Protection of IPR, Patents, Criteria for Patentability, Overview of Patent search, drafting and filing,

UNIT II: INTELLECTUAL PROPERTY RIGHTS - II
Trade Marks, Trade Secrets, Industrial Designs, Integrated Circuits, Geographical Indications, Copyrights.

UNIT-III: CONVENTIONS AND TREATIES:
WTO, GATT & TRIPS, WIPO Mission and Activities, Patent Cooperation Treaty, Case Studies on IP

UNIT-IV: CULTURE & VALUES:
A Introduction to Indian Culture Values and Ethics, The Indian Concept of Human Life, Indian Civilization, Sanskrit and Indian Languages, Festivals, Sculpture, Music, Dance, Drama, Ayurveda. Family and its Importance, Indian Marriage System, Status of Women in Indian Society, Education, Purpose, Ancient System, Value Education, Human Value System, Interfaith Understanding, Happiness, Modernism and its Effect on Lifestyle, Mind and its Operation, Control of Mind, Yoga, Control of Sense organs, Exemplary Life Sketches- Albert Einstein, M K Gandhi, Abdul Kalam

UNIT-V: ETHICS:
Ethics in Ancient India, Ethics, Morals, Ethics and Human Life, Core Areas for Ethics, Values, Morality, Integrity, Honesty, Character, Loyalty, Trustworthiness, Courage and Confidence, Confidentiality, Secrecy and Transparence, Justification, Contracts and Spirit Promises and Schedules, Quarrels, Selfishness, Obstacles, Supporting Measures, Reputation and its sale, Decision Making in Ethics, Exemplary Life Sketches- Vishveshwaraiah, , Jagadeesh Chandra Bose, Meghanad Saha

UNIT- VI: PROFESSIONAL ETHICS:
Occupation, Profession, Professional, Professional Organization, Obligations of a Professional, Temptations, Aptitude, Importance of Professional Ethics for Engineers, Code of Ethics, Need for a Code, Impact of Ethical Behaviour, The Code of Ethics for Engineers, Fundamental Principles and Cannons, Commerce and Ethics, Marketing Ethics, Finance and Ethics, Science, Religion and Ethics, Medical Ethics, Genetics and Ethics, Politics and Ethics, Genders and Ethics, Media and Ethics, Computer Ethics Exemplary Life Sketches- Narayan Murthy, Homi Jahangir Bhabha

REFERENCES:

1. Anitha Rao R & Bhanoji Rao "Intellectual Property Rights – A Primer", Eastern Book Co, 2008.
2. The ABCs of Ethics by Michael. L. Buckner, Universe. Inc, New York Lincoln, Shangahai
3. Science, Faith and Ethics by Denis Alexander and Robert.S.White, Hendrickson Publishers, Massachusetts, USA, March 2006
4. Vedic Science Primer by PSR Murthy, BS Publications, Hyderabad
5. Medical Ethics-Global View Points, Edited by Diane Andrews, Hennig Feld, Green Haven Press
6. Divine Stories, Human Value Stories, Volume I and II, Sri Satya Sai Books and Publications

I Year – II Sem. M.Tech (EPE)

Code: 4T216 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 Iyer, Pankaj Gupta, TMH, 2004.

Year – II Sem. M.Tech (EPE)

Code: 4X273 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: 4X274 **TECHNICAL SEMINAR**
(Independent Review Paper)

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 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

II Year – I Sem. M.Tech (EPE)

Code: 4X375 COMPREHENSIVE VIVA-VOCE

L	T	P	C
-	-	-	2

Max. Marks: 50

There shall be a Comprehensive Viva-Voce in II year I 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 50 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: 4X376 **PROJECT SEMINAR - I**

L	T	P	C
-	-	-	2

Max. Marks: 50

In II year I semester and II semester, a project seminar shall be conducted for 50 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 25 marks and the end semester seminar evaluation shall carry 25 marks. The report for the project seminar will carry 10 marks and the remaining marks (15) 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: 4X377 **PROJECT WORK (PART I)**
PROJECT STATUS REPORT

L	T	P	C
-	-	-	18

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: 4X478 **PROJECT SEMINAR - II**

L	T	P	C
-	-	-	2

Max. Marks: 50

In II year I semester and II semester, a project seminar shall be conducted for 50 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 25 marks and the end semester seminar evaluation shall carry 25 marks. The report for the project seminar will carry 10 marks and the remaining marks (15) 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: 4X479 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.