COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.TECH

POWER SYSTEM CONTROL AND AUTOMATION

(Applicable for the batches admitted from 2018-2019)

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

(UGC-Autonomous)

Narasampet, Warangal – 506 332
Telangana State, India

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

(AUTONOMOUS)

M.TECH –Power System Control and Automation

COURSE STRUCTURE

(Applicable from the batch admitted from 2018-19 onwards)

I YEAR **I SEMESTER**

S No	Code	Subject	Internal Marks	External Marks	L	T	P	Credits
1	JD532C01	**Program Core-I** Advanced Power System Analysis	30	70	3	0	0	3
2	JD532C02	**Program Core-II** Power System Dynamics	30	70	3	0	0	3
3	JD532C03	**Program Core-III** Modern Control Theory	30	70	3	0	0	3
4	JD532E01 JD532E02 JD532E03 JD532E04	**Program Elective-I** 1. Analysis and Computation of Electromagnetic Transients in Power Systems 2. Analysis and Design of Power Converters 3. Industrial Power System Analysis and Design 4. Analysis of Electrical Machines	30	70	3	0	0	3
5	JD532E05 JD532E06 JD532E07 JD532E08	**Program Elective-II** 1. Advanced Digital Signal Processing 2. Microcontrollers and applications 3. Distribution Automation 4 System Theory	30	70	3	0	0	3
6	JD532A01	Research Methodology	100	0	2	0	0	2
7	JD532A02	**Audit Course-I**			2	0	0	0
9	JD532L1	**Laboratory 1** Power Systems simulation Lab	30	70	0	0	4	2
		Credits					**Total**	**19**

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I YEAR **II SEMESTER**

S No	CODE	Subject	Internal Marks	External Marks	L	T	P	Credits
1	JD532C04	**Program Core-IV** Advanced Power System Protection	30	70	3	0	0	3
2	JD532C05	**Program Core-V** Restructured Power System	30	70	3	0	0	3
3	JD532E09 JD532E10 JD532E11 JD532E12	**Program Elective-III** 1. Flexible AC Transmission Systems (FACTS) 2. Distributed Generation and Micro grid 3. Energy Auditing, Conservation & Management 4. Soft Computing Techniques	30	70	3	0	0	3
4	JD532E13 JD532E14 JD532E15 JD532E16	**Program Elective-IV** 1. Control System Design for Power Electronics 2. Wind Energy Conversion Systems 3. Renewable energy systems 4. Smart Grid	30	70	3	0	0	3
5		**Open Elective**	30	70	3	0	0	3
6	JD532A03	Intellectual Property Rights	100	0	2	0	0	2
7	JD532A04	**Audit Course-II**			2	0	0	0
8	JD532L2	**Laboratory 2** Power Systems Lab	30	70	0	0	4	2
9	JD532S1	Mini Project	100	-	0	0	4	2
							Total Credits	**21**

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M.TECH –Power System Control and Automation

COURSE STRUCTURE

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II YEAR **I SEMESTER**

S No	CODE	Subject	Internal Marks	External Marks	L	T	P	Credits
1	JDPR158	Dissertation-I	50	-	0	0	20	10
2	JD532S2	Compressive Viva Voce	100	-	0	0	4	2
		Total Credits						**12**

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

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M.TECH –Power System Control and Automation

COURSE STRUCTURE

(Applicable from the batch admitted from 2018-19 onwards)

II YEAR **II SEMESTER**

S No	CODE	Subject	Internal Marks	External Marks	L	T	P	Credits
1	JDPR258	Dissertation-II		150	0	0	32	16
							Total Credits	**16**

Open Elective:

1. Business Analytics
2. Industrial Safety
3. Operations Research
4. Cost Management of Engineering Projects
5. Composite Materials
6. Waste to Energy

Audit Course 1 &2:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)

ADVANCED POWER SYSTEM ANALYSIS
(JD532C01 Program Core Course I)

UNIT-I:

Admittance Model and Network Calculations, Branch and Node Admittances, Mutually Coupled Branches in Y_{BUS} , An Equivalent Admittance Network, Modification of Y_{BUS} , Network Incidence Matrix and Y_{BUS} , Method of Successive Elimination, Node Elimination, Triangular Factorization, Sparsity and Near Optimal Ordering.

UNIT-II:

Impedance Model and Network Calculations, the BUS Admittance and Impedance Matrices, Thevenin‟s Theorem and Z_{BUS} ,Algorithms for building Z_{BUS} Modification of existing $Z_{BUS,}$ Calculation of Z_{BUS} elements from $Y_{BUS,}$ Power Invariant Transformations, Mutually Coupled Branches in $Z_{BUS.}$

UNIT-III:

Gauss Seidel method, N-R Method, Decoupled method, fast decoupled method, comparison between power flow solutions. DC load flow.

UNIT-IV:

Z_{BUS} Method in Contingency Analysis, Adding and Removing Multiple Lines, Piecewise Solution of Interconnected Systems, Analysis of Single Contingencies, Analysis of Multiple Contingencies, Contingency Analysis of DC Model, System Reduction for Contingency and Fault Studies.

UNIT-V:

Fault Analysis: Symmetrical faults-Fault calculations using Z_{BUS}- Fault calculations using Z_{BUS} equivalent circuits –Selection of circuit breakers- Unsymmetrical faults-Problems on various types of faults.

TEXT BOOKS:

1. John J.Grainger and W.D. Stevenson, “Power System Analysis”- T.M.H.Edition.
2. Modern Power System Analysis – by I.J.Nagrath & D.P.Kothari Tata M Graw – Hi Publishing

Company Ltd, 2nd edition.

REFERENCE:

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., cengage 3rd Edition.
2. Olle. L.Elgard, “Electrical Energy Systems Theory”-T.M.H.Edition.
3. Power systems stability and control, Prabha Kundur, The Mc Graw – Hill companies**.**
4. Power System Operation and Control, Dr. K. Uma Rao, Wiley India Pvt. Ltd.
5. Operation and Control in Power Systems, PSR Murthy, Bs Publications.
6. Power System Operation, Robert H. Miller, Jamesh H. Malinowski, The Mc Graw – Hill companies**.**
7. Power Systems Analysis, operation and control by Abhijit Chakrabarti, Sunitha Halder, PHI 3/e , 2010

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)

POWER SYSTEM DYNAMICS
(JD532C02 Program Core Course II)

UNIT-I: BASIC CONCEPTS
Power system stability states 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-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- Dynamics of a synchronous generator connected to infinite bus - system model Synchronous machine model-stator equations rotor equations - Synchronous machine model with field circuit - one equivalent damper winding on q axis (model 1.1) - calculation of Initial conditions.

UNIT-IV: ANALYSIS OF SINGLE MACHINE SYSTEM
Small signal analysis with block diagram - Representation Characteristic equation and application of Routh Hurwitz criterion- synchronizing and damping torque analysis-small signal model - State equations.

UNIT-V: APPLICATION OF POWER SYSTEM STABILIZERS
Basic concepts in applying PSS - Control signals - Structure and tuning of PSS - Washout circuit - Dynamic compensator analysis of single machine infinite bus system with and without PSS.

TEXT BOOK:
1. K.R. PADIYAR," Power system dynamics "- B.S. Publications.

REFERENCE BOOKS:
1. P.M. Anderson and A.A. Fouad,"Power system control and stability ",IEEE Presss
2. R. Ramanujam, "Power Systems Dynamics"- PHI Publications.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)
MODERN CONTROL THEORY
(JD532C03 Program Core Course III)

UNIT–I:

Mathematical Preliminaries: Fields, Vectors and Vector Spaces – Linear combinations and Bases – Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-Time State models.

UNIT-II:

State Variable Analysis: Linear Continuous time models for Physical systems– Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. General concept of controllability – General concept of Observability – Controllability tests for Continuous-Time Invariant Systems – Observability tests for Continuous-Time Invariant Systems – Controllability and Observability of State Model in Jordan Canonical form – Controllability and Observability Canonical forms of State model.

UNIT-III:

Non Linear Systems: Introduction – Non Linear Systems - Types of Non-Linearities – Saturation – Dead-Zone - Backlash – Jump Phenomenon etc;– Singular Points – Introduction to Linearization of nonlinear systems, Properties of Non-Linear systems – Describing function–describing function analysis of nonlinear systems – Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

UNIT-IV:

Stability Analysis: Stability in the sense of Lyapunov, Lyapunov‟s stability and Lypanov‟s instability theorems - Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski‟s method. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

UNIT-V:

Optimal Control: Introduction to optimal control - Formulation of optimal control problems – calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator.

TEXT BOOKS:

1. modern control system theory by m.gopal – new age international -1984
2. Control System Engineering, Nagrath and Gopal - New Age International – Fourth Edition

REFERENCES:

1. Optimal control by Kirck , Dover Publications
2. Advanced Control Theory A. Nagoor Kani, RBA Publications, 1999
3. Modern Control Engineering by Ogata.K – Prentice Hall - 1997

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – II SEM (PSC&A)

ADVANCED POWER SYSTEM PROTECTION
(JD532C04 Program Core Course IV)

UNIT-I:

Static Relays: Advantages of static relays-Basic construction of static relays-Level detectors-Replica impedance –Mixing circuits-General equation for two input phase and amplitude comparators-Duality between amplitude and phase comparators.

Amplitude Comparators: Circulating current type and opposed voltage type- rectifier bridge comparators, Direct and Instantaneous comparators.

UNIT-II:

Phase Comparators: Coincidence circuit type- block spike phase comparator, techniques to measure the period of coincidence-Integrating type-Rectifier and Vector product type- Phase comparators.

Static Over Current Relays: Instantaneous over-current relay-Time over-current relays-basic principles –definite time and Inverse definite time over-current relays.

UNIT-III:

Static Differential Relays: Analysis of Static Differential Relays –Static Relay schemes – Duo bias transformer differential protection –Harmonic restraint relay.

Static Distance Relays: Static impedance-reactance–MHO and angle impedance relay-sampling comparator –realization of reactance and MHO relay using sampling comparator.

UNIT-IV:

Multi-Input Comparators: Conic section characteristics-Three input amplitude comparator –Hybrid comparator-switched distance schemes –Poly phase distance schemes-phase fault scheme –three phase scheme – combined and ground fault scheme.

Power Swings: Effect of power swings on the performance of distance relays –Power swing analysis-Principle of out of step tripping and blocking relays-effect of line and length and source impedance on distance relays.

UNIT-V:

Microprocessor based Protective Relays: (Block diagram and flowchart approach only)-Over current relays–impedance relays-directional relay-reactance relay .Generalized mathematical expressions for distance relays-measurement of resistance and reactance –MHO and offset MHO relays-Realization of MHO characteristics- Realization of offset MHO characteristics -Basic principle of Digital computer relaying.

TEXT BOOKS:

1. Badri Ram and D.N.Vishwakarma, “Power system protection and Switch gear “, TMH publication New Delhi 1995.
2. T.S.Madhava Rao , “Static relays”, TMH publication, second edition 1989.

REFERENCE:

1. Protection and Switchgear, Bhavesh Bhalja, R. P. Maheshwari, Nilesh G. Chothani, Oxford University Press.
2. Electrical Power System Protection, C. Christopoulos and A. Wright, Springer International.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – II SEM (PSC&A)

Restructured Power System

(JD532C05 Program Core Course V)

OBJECTIVES:

- To introduce the restructuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyse the concepts of locational marginal pricing and financial transmission
- rights.
- To Illustrate about various power sectors in India

UNIT I

INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behaviour, Supplier behaviour, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II

TRANSMISSION CONGESTION MANAGEMENT

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of
congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods – Nodal pricing – Inter zonal and Intra zonal congestion management – Price area congestion management – Capacity alleviation method.

UNIT III

LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS

Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality -Simultaneous feasibility test and revenue adequency – FTR issuance process: FTR auction, FTR allocation – Treatment of revenue shortfall – Secondary trading of FTRs – Flow gate rights – FTR and market power - FTR and merchant transmission investment.

UNIT IV

ANCILLARY SERVICE MANAGEMENT AND PRICING OF TRANSMISSION NETWORK

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - Transmission pricing – Principles – Classification – Rolled in transmission pricing methods – Marginal transmission pricing paradigm – Composite pricing paradigm – Merits and demerits of different paradigm.

UNIT V

REFORMS IN INDIAN POWER SECTOR

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff
– Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future

OUTCOMES:

- Learners will have knowledge on restructuring of power industry
- Learners will understand basics of congestion management
- Learners will attain knowledge about locational margin prices and financial transmission rights
- Learners will understand the significance ancillary services and pricing of transmission
- network
- Learners will have knowledge on the various power sectors in India

REFERENCES

1 Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, "Restructured electrical power systems: operation, trading and volatility" Pub., 2001.

2 Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, "Operation of restructured power systems", Kluwer Academic Pub., 2001.

3 Paranjothi, S.R. **, "**Modern Power Systems**"** Paranjothi, S.R. **,** New Age International, 2017.

4 Sally Hunt," Making competition work in electricity", John Willey and Sons Inc. 2002.

5 Steven Stoft, "Power system economics: designing markets for electricity", John Wiley & Sons, 2002.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – I SEM (PSC&A)

ANALYSIS AND COMPUTATION OF ELECTROMAGNETIC TRANSIENTS IN POWER SYSTEMS

(JD532E01 Program Elective- I)

OBJECTIVES:

- To understand the various types of transients and its analysis in power system.
- To learn about modeling and computational aspects transients computation

UNIT I
REVIEW OF TRAVELLING WAVE PHENOMENA

Lumped and Distributed Parameters – Wave Equation – Reflection, Refraction, Behaviour of Travelling waves at the line terminations – Lattice Diagrams – Attenuation and Distortion.

UNIT II
LIGHTNING, SWITCHING AND TEMPORARY OVERVOLTAGES

Lightning overvoltage's: interaction between lightning and power system- ground wire voltage
and voltage across insulator; switching overvoltage: Short line or kilometric fault, energizing transients - closing and re-closing of lines, methods of control; temporary overvoltage's: line dropping, load rejection; voltage induced by fault; very fast transient overvoltage (VFTO).

UNIT III
PARAMETERS AND MODELING OF OVERHEAD LINES

Review of line parameters for simple configurations: series resistance, inductance and shunt capacitance; bundle conductors : equivalent GMR and equivalent radius; modal propagation in transmission lines: modes on multi-phase transposed transmission lines, α-β-0 transformation and symmetrical components transformation, modal impedances; analysis of modes on un transposed lines; effect of ground return and skin effect; transposition schemes; introduction to frequency-dependent line modeling.

UNIT IV
PARAMETERS AND MODELING OF UNDERGROUND CABLES 9

Distinguishing features of underground cables: technical features, electrical parameters, overhead lines versus underground cables; cable types; series impedance and shunt admittance of single-core self-contained cables, impedance and admittance matrices for three phase system formed by three single-core self-contained cables; approximate formulas for cable parameters.

UNIT V
COMPUTATION OF POWER SYSTEM TRANSIENTS 9

Digital computation of line parameters: salient features of a typical line parameter evaluation program; constructional features of that affect transmission line parameters; line parameters for physical and equivalent phase conductors elimination of ground wires bundling of conductors; principle of digital computation of transients: features and capabilities of electromagnetic transients program; steady state and time step solution modules: basic solution methods; case studies on simulation of various types of transients

OUTCOMES:

- Learners will be able to model over head lines, cables and transformers.
- Learners will be able to analyze power system transients.

REFERENCES

1 Allan Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc. New York, 1991.

2 R. Ramanujam, “Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation”, I.K. International Publishing House Pvt. Ltd, New Delhi, 2014.

3 Naidu M S and Kamaraju V, “High Voltage Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)
ANALYSIS AND DESIGN OF POWER CONVERTERS
(JD532E02 Program Elective- I)

Unit I

Single Phase AC Voltage Controllers: Single phase AC voltage controllers with Resistive, Resistive-inductive and Resistive-inductive-induced e.m.f. loads - ac voltage controllers with PW Control - Effects of source and load inductances - Synchronous tap changers- Applications - numerical problems.

Unit II

Three Phase AC Voltage Controllers: Three phase AC voltage controllers - Analysis of controllers with star and delta Connected Resistive, Resistive-inductive loads - Effects of source and load Inductances - applications - numerical problems.

Cycloconverters: Single phase to single phase cycloconverters - analysis of midpoint and bridge Configurations - Three phase to three phase cycloconverters - analysis of Midpoint and bridge configurations - Limitations - Advantages - Applications- numerical problems.

Unit III

Single Phase Converters: Single phase converters - Half controlled and Fully controlled converters -Evaluation of input power factor and harmonic factor - continuous and Discontinuous load current - single phase dual converters - power factor Improvements - Extinction angle control - symmetrical angle control - PWM -single phase sinusoidal PWM - single phase series converters - Applications -Numerical problems.

Three Phase Converters: Three phase converters - Half controlled and fully controlled converters - Evaluation of input power factor and harmonic factor - continuous and Discontinuous load current - three phase dual converters - power factor Improvements - three phase PWM - twelve pulse converters - applications -Numerical problems.

Unit VI

D.C. to D.C. Converters: Analysis of step-down and step-up dc to dc converters with resistive and Resistive-inductive loads - Switched mode regulators - Analysis of Buck Regulators - Boost regulators - buck and boost regulators - Cuk regulators - Condition for continuous inductor current and capacitor voltage - comparison of regulators -Multiouput boost converters - advantages - applications - Numerical problems.

Unit V

Pulse Width Modulated Inverters(single phase): Principle of operation - performance parameters - single phase bridge inverter -evaluation of output voltage and current with resistive, inductive and Capacitive loads - Voltage control of single phase inverters - single PWM - Multiple PWM - sinusoidal PWM - modified PWM - phase displacement Control - Advanced modulation techniques for improved performance - Trapezoidal, staircase, stepped, harmonic injection and delta modulation - Advantage - application - numerical problems.

Pulse Width Modulated Inverters(three phase): Three phase inverters - analysis of 180 degree condition for output voltage And current with resistive, inductive loads - analysis of 120 degree Conduction - voltage control of three phase inverters - sinusoidal PWM - Third Harmonic PWM – 60 degree PWM - space vector modulation - Comparison of PWM techniques

- harmonic reductions - Current Source Inverter - variable d.c. link inverter - boost inverter - buck and boost inverter - inverter circuit design - advantages -applications - numerical problems.

TEXT BOOKS:

1. Power Electronics - Mohammed H. Rashid - Pearson Education -Third Edition - First Indian reprint 2004.
2. Power Electronics - Ned Mohan, Tore M. Undeland and William P. Robbins –John Wiley and Sons - Second Edition

REFERENCES:

1. Power Electronics Daniel W. Hart
2. Fundamentals of Power Electronis, 2nd Edition. R.W. Erickson
3. The power electronics Hand Book Timothy, L. Skvarenina, Purdue University

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)
INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN
(JD532E03 Program Elective- I)

OBJECTIVES:

- To analyze the motor starting and power factor correction.
- To perform computer-aided harmonic and flicker analysis and to design filters.
- To expose various grid grounding methodologies

UNIT I
MOTOR STARTING STUDIES
Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-
Aided Analysis-Conclusions.

UNIT II
POWER FACTOR CORRECTION STUDIES
Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Overvoltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

UNIT III
HARMONIC ANALYSIS
Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

UNIT IV
FLICKER ANALYSIS
Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc
Furnace Load-Minimizing the Flicker Effects-Summary.

UNIT V
INSULATION AND COORDINATION
Modeling of system; simulation of switching surges; description of EMTP – capabilities; voltage acceptance criteria; insulation coordination case study; methods of minimizing switching transients; conclusions.

OUTCOMES:

- Learners will have knowledge on motor starting and power factor correction.
- Learners will perform computer-aided harmonic and flicker analysis and to design filters.
- Learners will have knowledge on various grid grounding methodologies

REFERENCES
1 Ramasamy Natarajan, “Computer-Aided Power System Analysis”, Marcel Dekker Inc., 2002.
2 EMTP literature from www.microtran.cm

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)
ANALYSIS OF ELECTRICAL MACHINES
(JD532E04 Program Elective- I)

OBJECTIVES:

- To provide knowledge about the fundamentals of magnetic circuits, energy, force and torque of multi-excited systems.
- To analyze the steady state and dynamic state operation of DC machine through mathematical modeling and simulation in digital computer.
- To provide the knowledge of theory of transformation of three phase variables to two phase variables.
- To analyze the steady state and dynamic state operation of three-phase induction machines using transformation theory based mathematical modeling and digital computer simulation.
- To analyze the steady state and dynamic state operation of three-phase synchronous machines using transformation theory based mathematical modeling and digital computer simulation.

UNIT I
PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION
Magnetic circuits, permanent magnet, stored magnetic energy, co-energy - force and torque in singly and doubly excited systems – machine windings and air gap mmf - winding inductances
and voltage equations.

UNIT II
DC MACHINES
Elementary DC machine and analysis of steady state operation - Voltage and torque equations – dynamic characteristics of permanent magnet and shunt d.c. motors – Time domain block diagrams - solution of dynamic characteristic by Laplace transformation – digital computer simulation of permanent magnet and shunt D.C. machines.

UNIT III
REFERENCE FRAME THEORY
Historical background – phase transformation and commutator transformation – transformation
of variables from stationary to arbitrary reference frame - variables observed from several frames of reference.

UNIT IV
INDUCTION MACHINES
Three phase induction machine, equivalent circuit and analysis of steady state operation – free
acceleration characteristics – voltage and torque equations in machine variables and arbitrary reference frame variables – analysis of dynamic performance for load torque variations – digital computer simulation.

UNIT V

SYNCHRONOUS MACHINES

Three phase synchronous machine and analysis of steady state operation - voltage and torque equations in machine variables and rotor reference frame variables (Park's equations) – analysis of dynamic performance for load torque variations – Generalized theory of rotating electrical machine and Krons primitive machine.

OUTCOMES:

- Ability to understand the various electrical parameters in mathematical form.
- Ability to understand the different types of reference frame theories and transformation relationships.
- Ability to find the electrical machine equivalent circuit parameters and modeling of electrical machines.

REFERENCES

1. Paul C.Krause, Oleg Wasyzczuk, Scott S, Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley, Second Edition, 2010..
2. P S Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers, 2008
3. A.E, Fitzgerald, Charles Kingsley, Jr, and Stephan D, Umanx, " Electric Machinery", Tata McGraw Hill, 5th Edition, 1992
4. R. Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, New Delhi, Prentice Hall of India, 2001

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – I SEM (PSC&A)

ADVANCED DIGITAL SIGNAL PROCESSING

(JD532E05 Program Elective- II)

UNIT–I:

Digital Filter Structures: Block diagram representation – Equivalent Structures – FIR and IIR digital filter Structures AII pass Filters-tunable IIR Digital Sine-cosine generator- Computational complexity of digital filter structures.

UNIT–II:

Digital Filter Design :

Preliminary considerations- Bilinear transformation method of IIR filter design –design of Low pass high-pass – Band-pass, and Band stop- IIR digital filters – Spectral transformations of IIR filters – FIR filter design –based on Windowed Fourier series – design of FIR digital filters with least – mean square-error – constrained Least –square design of FIR digital filters.

UNIT-III:

DSP Algorithme Implémentation : Computation of the discrete Fourier transform- Number representation – Arithmetic operations – handling of overflow – Tunable digital filters – function approximation.

UNIT-IV:

Analysis Of Finite Word Length Effects: The Quantization process and errors-Quantization of fixed

–point and floating –point Numbers – Analysis of coefficient Quantization effects – Analysis of Arithmetic Round-off errors- Dynamic range scaling – signal –to- noise in Low –order IIR filters- Low – Sensitivity Digital filter – Reduction of Product round-off errors feedback – Limit cycles in IIR digital filter – Round – off errors in FFT Algorithms.

UNIT-V:

Power Spectrum Estimation : Estimation of spectra from Finite Duration Observations signals-Non-parametric methods for power spectrum Estimation- parametric method for power spectrum Estimation- Estimation of spectral form-Finite duration observation of signals- Non-parametric methods for power spectrum estimation – Walsh methods – Blackman and torchy method.

TEXT BOOKS:

1. Digital Signal Processing principles –algorithms and Applications- john G. Proakis – PHI – 3rd edition 2002.
2. Digital Time Signal Procesing: Alan V.Oppenheim,Ronald W ,Shafer – PHI 1996 1st Edition reprint
3. Advanced Digital Signal Processing – Theory and Applications – Glenn Zelniker, Fred J. Taiylor.

REFERENCE BOOKS

1.Digital Signal Processing – S Salivahanan . A Vallavaraj C. Gnanapriya –TMH – 2nd reprint 2001.

2. Digital Signal Processing – sanjit K.Mitra – TMH second edition.
3 Theory and Applications of Digital Signal Processing – Lourens R RebinarandBernold.
4. Digital Filter Analysis and Design Auntoniam - TMH
   Digital Signal Processing – J.S.Chitode – First Edition, 2008, Technical
5. Publications.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)
MICROCONTROLLERS AND APPLICATIONS
(JD532E06 Program Elective- II)

UNIT-I:

Overview of Architecture & Microcontroller Resources: Architecture of a microcontroller – Microcontroller resources – Resources in advanced and next generation microcontrollers – 8051 microcontroller – Internal and External memories – Counters and Timers – Synchronous serial-cum asynchronous serial communication - Interrupts.

UNIT-II:

8051- Microcontrollers Instruction Set : Basic assembly language programming – Data transfer instructions – Data and Bit-manipulation instructions – Arithmetic instructions – Instructions for Logical operations on the test among the Registers, Internal RAM, and SFRs – Program flow control instructions – Interrupt control flow.

UNIT-III:

Real Time Control: Interrupts: Interrupt handling structure of an MCU – Interrupt Latency and Interrupt deadline – Multiple sources of the interrupts – Non-maskable interrupt sources – Enabling or disabling of the sources – Polling to determine the interrupt source and assignment of the priorities among them – Interrupt structure in Intel 8051.

Timers: Programmable Timers in the MCU‟s – Free running counter and real time control – Interrupt interval and density constraints.

UNIT-IV:

Systems Design: Digital and Analog Interfacing Methods: Switch, Keypad and Keyboard interfacings – LED and Array of LEDs – Keyboard-cum-Display controller (8279) – Alphanumeric Devices – Display Systems and its interfaces – Printer interfaces – Programmable instruments interface using IEEE 488 Bus – Interfacing with the Flash Memory – Interfaces – Interfacing to High Power Devices – Analog input interfacing – Analog output interfacing – Optical motor shaft encoders

– Industrial control – Industrial process control system – Prototype MCU based Measuring instruments – Robotics and Embedded control – Digital Signal Processing and digital filters.

UNIT-V:

Real Time Operating System for Microcontrollers: Real Time operating system – RTOS of Keil (RTX51) – Use of RTOS in Design – Software development tools for Microcontrollers.

16-Bit Microcontrollers: Hardware – Memory map in Intel 80196 family MCU system – IO ports – Programmable Timers and High-speed outputs and input captures – Interrupts – instructions. ARM 32 Bit MCUs: Introduction to 16/32 Bit processors – ARM architecture and organization – ARM / Thumb programming model – ARM / Thumb instruction set – Development tools.

TEXT BOOKS:

1. Raj Kamal," Microcontrollers Architecture, Programming, Interfacing and System Design"– Pearson Education, 2005.
2. Mazidi and Mazidi, "The 8051 Microcontroller and Embedded Systems" – PHI, 2000.

REFERENCES:

1. A.V. Deshmuk, “Microcontrollers (Theory & Applications)” – WTMH, 2005.
2. John B. Peatman, “Design with PIC Microcontrollers” – Pearson Education, 2005.
3. Microcontroller Programming, Julio Sanchez, Maria P. Canton, CRC Press.
4. The 8051 Microcontroller, Ayala, Cengage Learning.
5. Microprocessors and Microcontrollers, Architecture, Programming and System Design, Krishna Kant, PHI Learning PVT. Ltd.
6. Microprocessors, Nilesh B. Bahadure, PHI Learning PVT. Ltd.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)
DISTRIBUTION AUTOMATION
(JD532E07 Program Elective- II)

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 **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-IV:

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, and function shared benefits, Guidelines 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-V:

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 BOOKS:

1. Control and Automation of Electrical Distribution Systems, James. Northcote – Green Robert Wilson, CRC Press.
2. Electric Power Distribution Automation, Dr. M. K. Khedkar, Dr. G.M.Dhole, University Science
   press.

REFERENCES:

1. IEEE Tutorial Course “Distribution Automation”
2. IEEE Working Group on “Distribution Automation”

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)
SYSTEM THEORY
(JD532E08 Program Elective- II)

OBJECTIVES:

- To understand the fundamentals of physical systems in terms of its linear and nonlinear models.
- To educate on representing systems in state variable form
- To educate on solving linear and non-linear state equations
- To educate on stability analysis of systems using Lyapunov's theory
- To educate on modal concepts and design of state and output feedback controllers and estimators

UNIT I
STATE VARIABLE REPRESENTATION
Introduction-Concept of State-State equations for Dynamic Systems -Time invariance and linearity- Non uniqueness of state model- Physical Systems and State Assignment - free and forced responses- State Diagrams.

UNIT II
SOLUTION OF STATE EQUATIONS
Existence and uniqueness of solutions to Continuous-time state equations - Solution of Nonlinear and Linear Time Varying State equations - State transition matrix and its properties – Evaluation of matrix exponential- System modes- Role of Eigen values and Eigen vectors.

UNIT III
STABILITY ANALYSIS OF LINEAR SYSTEMS
Controllability and Observability definitions and Kalman rank conditions -Stabilizability and Detectability-Test for Continuous time Systems- Time varying and Time invariant case-Output Controllability-Reducibility- System Realizations.

UNIT IV
STATE FEEDBACK CONTROL AND STATE ESTIMATOR
Introduction-Controllable and Observable Companion Forms-SISO and MIMO Systems- The Effect of State Feedback on Controllability and Observability-Pole Placement by State Feedback for both SISO and MIMO Systems-Full Order and Reduced Order Observers.

UNIT V
LYAPUNOV STABILTY ANALYSIS
Introduction-Equilibrium Points- BIBO Stability-Stability of LTI Systems- Stability in the sense
of Lyapunov - Equilibrium Stability of Nonlinear Continuous-Time Autonomous Systems-The
Direct Method of Lyapunov and the Linear Continuous-Time Autonomous Systems-Finding Lyapunov Functions for Nonlinear Continuous-Time Autonomous Systems – Krasovskil's and Variable-Gradiant Method.

OUTCOMES:

- Ability to represent the time-invariant systems in state space form as well as analyze, whether the system is stabilizable, controllable, observable and detectable.
- Ability to design state feedback controller and state observers
- Ability to classify singular points and construct phase trajectory using delta and isocline methods.Use the techniques such as describing function, Lyapunov Stability, Popov's Stability
- Criterion and Circle Criterion to assess the stability of certain class of non-linear system.
- Ability to describe non-linear behaviors such as Limit cycles, input multiplicity and output multiplicity, Bifurcation and Chaos.

TEXT BOOKS:

1. M. Gopal, "Modern Control System Theory", New Age International, 2005.
2. K. Ogatta, "Modern Control Engineering", PHI, 2002.
3. John S. Bay, "Fundamentals of Linear State Space Systems", McGraw-Hill, 1999.
4. D. Roy Choudhury, "Modern Control Systems", New Age International, 2005.
5. John J. D'Azzo, C. H. Houpis and S. N. Sheldon, "Linear Control System Analysis and Design with MATLAB", Taylor Francis, 2003.
6. Z. Bubnicki, "Modern Control Theory", Springer, 2005.
7. C.T. Chen, "Linear Systems Theory and Design'' Oxford University Press, 3rd Edition, 1999.
8. M. Vidyasagar, "Nonlinear Systems Analysis', 2nd edition, Prentice Hall, Englewood Cliffs, New Jersey.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – II SEM (PSC&A)
FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS)
(JD532E09 Program Elective- III)

UNIT-I: FACTS CONCEPTS

Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTS controllers.

UNIT-II: VOLTAGE SOURCE CONVERTERS

Single phase three phase full wave bridge converters transformer connections for 12 pulse 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage source converters.

UNIT-III: STATIC SHUNT COMPENSATION

Objectives of shunt compensation, mid-point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping, Methods of controllable VAR generation, variable impedance type static VAR generators switching converter type VAR generators hybrid VAR generators.

UNIT-IV: SVC AND STATCOM

The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping operating point control and summary of compensator control.

UNIT-V: STATIC SERIES COMPENSATORS

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, and functional requirements of GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC)
Control schemes for GSC TSSC and TCSC.

TEXT BOOKS:

1. "Understanding FACTS Devices" N.G. Hingorani and L. Guygi. IEEE Press Publications 2000.

2. K.R.Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International(P) Ltd., Publishers, New Delhi, Reprint 2008.

3. K.R.Padiyar, "HVDC Power Transmission Systems", New Age International (P) Ltd., New Delhi, 2002.

3. J.Arrillaga, "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – II SEM (PSC&A)

DISTRIBUTED GENERATION AND MICROGRID

(JD532E10 Program Elective- III)

OBJECTIVES:

- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Microgrid and its configuration

UNIT I

INTRODUCTION

Conventional power generation: advantages and disadvantages, Energy crises, Nonconventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

UNIT II

DISTRIBUTED GENERATIONS (DG)

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III

IMPACT OF GRID INTEGRATION

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality
issues.

UNIT IV

BASICS OF A MICROGRID

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids

UNIT V

CONTROL AND OPERATION OF MICROGRID

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

OUTCOMES:

- Learners will attain knowledge on the various schemes of conventional and nonconventional power generation.
- Learners will have knowledge on the topologies and energy sources of distributed generation.
- Learners will learn about the requirements for grid interconnection and its impact with NCE sources
- Learners will understand the fundamental concept of Microgrid.

REFERENCES

1 Amirnaser Yezdani, and Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2010.
2 DorinNeacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006
3 Chetan Singh Solanki, "Solar Photo Voltaics", PHI learning Pvt. Ltd., New Delhi,2009
4 J.F. Manwell, J.G. McGowan "Wind Energy Explained, theory design and applications", Wiley publication 2010.
5 D. D. Hall and R. P. Grover, "Biomass Regenerable Energy", John Wiley, New York, 1987.
6 John Twidell and Tony Weir, "Renewable Energy Resources" Tyalor and Francis Publications, Second edition 2006.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – II SEM (PSC&A)
ENERGY AUDITING, CONSERVATION AND MANAGEMENT
(JD532E11 Program Elective- III)

UNIT-I: BASIC PRINCIPLES OF ENERGY AUDIT

Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT-II: ENERGY MANAGEMENT

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions, language, Questionnaire – check list for top management.

UNIT-III: ENERGY EFFICIENT MOTORS

Energy efficient motors , factors affecting efficiency, loss distribution , constructional details , characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation- voltage unbalance- over motoring- motor energy audit

UNIT-IV: POWER FACTOR IMPROVEMENT, LIGHTING AND ENERGY INSTRUMENTS

Power factor – methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on power factor, power factor motor controllers - Good lighting system design and practice, lighting control ,lighting energy audit - Energy Instruments- wattmeter, data loggers, thermocouples, pyrometers,lux meters, tongue testers ,application of PLC's.

UNIT-V: ECONOMIC ASPECTS AND ANALYSIS

Economics Analysis-Depreciation Methods, time value of money, rate of return , present worth method , replacement analysis, life cycle costing analysis- Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment .

REFERENCE BOOKS:

1. Energy management by W.R. Murphy AND G. Mckay Butter worth, Heinemann publications.
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998
3. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995-
4. Energy management hand book by W.C.Turner, John wiley and sons
5. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – II SEM (PSC&A)

SOFT **SOFT COMPUTING TECHNIQUES**

(JD532E12 Program Elective- III)

OBJECTIVES:

- To expose the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To expose the ideas about genetic algorithm
- To provide adequate knowledge about of FLC and NN toolbox

UNIT I

INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS

Introduction to intelligent systems- Soft computing techniques- Conventional Computing versus Swarm Computing - Classification of meta-heuristic techniques - Properties of Swarm intelligent Systems - Application domain - Discrete and continuous problems - Single objective and multi-objective problems -Neuron- Nerve structure and synapse- Artificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- Mc Culloch Pitts neuron model- perceptron model- Adaline
and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training- applications.

UNIT II

ARTIFICIAL NEURAL NETWORKS AND ASSOCIATIVE MEMORY

Counter propagation network- architecture- functioning & characteristics of counter Propagation network- Hopfield/ Recurrent network configuration - stability constraints associative memory and characteristics- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications- Implementation and training - Associative Memory.

UNIT III

FUZZY LOGIC SYSTEM

Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification inferencing and defuzzification-Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV

GENETIC ALGORITHM

Evolutionary programs – Genetic algorithms, genetic programming and evolutionary programming - Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators - Optimization problems using GA-discrete and continuous - Single objective and multi-objective problems - Procedures in evolutionary programming.

UNIT V

HYBRID CONTROL SCHEMES

Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS – Fuzzy Neuron - Optimization of membership function and rule base using Genetic Algorithm –Introduction to Support Vector Machine- Evolutionary Programming-Particle Swarm Optimization - Case study – Familiarization of NN, FLC and ANFIS Tool Box.

OUTCOMES:

- Will be able to know the basic ANN architectures, algorithms and their limitations.
- Will be capable of developing ANN based models and control schemes for non-linear system.
- Will get expertise in the use of different ANN structures and online training algorithm.
- Will be knowledgeable to use Fuzzy logic for modeling and control of non-linear systems.
- Will be competent to use hybrid control schemes and P.S.O and support vector Regressive.

TEXT BOOKS:

1. Laurene V. Fausett, “Fundamentals of Neural Networks: Architectures, Algorithms And Applications”, Pearson Education.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India, 2008.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E.Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2009.
5. W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control” MIT Press”, 1996.
6. T. Ross, “Fuzzy Logic with Engineering Applications”, Tata McGraw Hill, New Delhi, 1995.
7. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning Series)”, MIT Press, 2004.
8. Corinna Cortes and V. Vapnik, " Support - Vector Networks, Machine Learning ” 1995.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – II SEM (PSC&A)

SOFT **CONTROL SYSTEM DESIGN FOR POWER ELECTRONICS**

(JD532E13 Program Elective- IV)

OBJECTIVES:

• To explore conceptual bridges between the fields of Control Systems and Power Electronics

• To Study Control theories and techniques relevant to the design of feedback controllers in Power Electronics.

UNIT I

MODELLING OF DC-TO-DC POWER CONVERTERS

Modelling of Buck Converter , Boost Converter ,Buck-Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter General Mathematical Model for Power Electronics Devices.

UNIT II

SLIDING MODE CONTROLLER DESIGN

Variable Structure Systems. Single Switch Regulated Systems Sliding Surfaces, Accessibility of the Sliding Surface Sliding Mode Control Implementation of Boost Converter ,Buck-Boost Converter, Cuk Converter ,Sepic Converter, Zeta Converter, Quadratic Buck Converter ,Double Buck-Boost Converter, Boost-Boost Converter.

UNIT III

APPROXIMATE LINEARIZATION CONTROLLER DESIGN

Linear Feedback Control, Pole Placement by Full State Feedback , Pole Placement Based on Observer Design ,Reduced Order Observers , Generalized Proportional Integral Controllers, Passivity Based Control , Sliding Mode Control Implementation of Buck Converter , Boost Converter ,Buck-Boost Converter.

UNIT IV

NONLINEAR CONTROLLER DESIGN

Feedback Linearization Isidori's Canonical Form, Input-Output Feedback Linearization, State Feedback Linearization, Passivity Based Control , Full Order Observers , Reduced Order Observers.

UNIT V

PREDICTIVE CONTROL OF POWER CONVERTERS

Basic Concepts, Theory, and Methods, Application of Predictive Control in Power Electronics,

AC-DC-AC Converter System, Faults and Diagnosis Systems in Power Converters.

OUTCOMES:

- Ability to understand an overview on modern linear and nonlinear control strategies for
  power electronics devices
- Ability to model modern power electronic converters for industrial applications
- Ability to design appropriate controllers for modern power electronics devices.

REFERENCES

1. Hebertt Sira-Ramirez, Ramon Silva-Ortigoza, “Control Design Techniques in Power Electronics Devices”, Springer 2012
2. Mahesh Patil, Pankaj Rodey, “Control Systems for Power Electronics: A Practical Guide”, Springer India, 2015.
3. Blaabjerg Jose Rodriguez, “Advanced and Intelligent Control in Power Electronics and Drives” , Springer, 2014
4. Enrique Acha, Vassilios Agelidis, Olimpo Anaya, TJE Miller, “Power Electronic Control in Electrical Systems”, Newnes, 2002
5. Marija D. Aranya Chakrabortty, Marija , “Control and Optimization Methods for Electric Smart Grids”, Springer, 2012.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – II SEM (PSC&A)

SOFT **WIND ENERGY CONVERSION SYSTEMS**

(JD532E14 Program Elective- IV)

OBJECTIVES:

- To learn the design and control principles of Wind turbine.
- To understand the concepts of fixed speed and variable speed, wind energy conversion
  systems.
- To analyze the grid integration issues.

UNIT I

INTRODUCTION

Components of WECS-WECS schemes-Power obtained from wind-simple momentum theory-
Power coefficient-Sabinin's theory-Aerodynamics of Wind turbine.

UNIT II

WIND TURBINES

HAWT-VAWT-Power developed-Thrust-Efficiency-Rotor selection-Rotor design considerations-Tip speed ratio-No. of Blades-Blade profile-Power Regulation-yaw control-Pitch angle control stall control-Schemes for maximum power extraction.

UNIT III

FIXED SPEED SYSTEMS

Generating Systems- Constant speed constant frequency systems -Choice of Generators-Deciding factors-Synchronous Generator-Squirrel Cage Induction Generator- Model of Wind Speed- Model wind turbine rotor - Drive Train model- Generator model for Steady state and Transient stability analysis.

UNIT IV

VARIABLE SPEED SYSTEMS

Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator- DFIG- PMSG -Variable speed generators modelling - Variable speed variable frequency schemes.

UNIT V

GRID CONNECTED SYSTEMS

Wind interconnection requirements, low-voltage ride through (LVRT), ramp rate limitations, and supply of ancillary services for frequency and voltage control, current practices and industry trends wind interconnection impact on steady-state and dynamic performance of the power system including modeling issue.

OUTCOMES:

- Acquire knowledge on the basic concepts of Wind energy conversion system.
- Understand the mathematical modeling and control of the Wind turbine
- Develop more understanding on the design of Fixed speed system
- Study about the need of Variable speed system and its modeling.
- Able to learn about Grid integration issues and current practices of wind interconnections with power system.

REFERENCES

1. L.L.Freris “Wind Energy conversion Systems”, Prentice Hall, 1990
2. S.N.Bhadra, D.Kastha,S.Banerjee,”Wind Electrical Sytems”,Oxford University Press,2010.
3. Ion Boldea, “Variable speed generators”, Taylor & Francis group, 2006.
4. E.W.Golding “The generation of Electricity by wind power”, Redwood burn Ltd.,Trowbridge,1976.
5. N. Jenkins,” Wind Energy Technology” John Wiley & Sons,1997
6. S.Heir “Grid Integration of WECS”, Wiley 1998.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – II SEM (PSC&A)

RENEWABLE ENERGY SYSTEMS

(JD532E15 Program Elective- IV)

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. Types of ocean thermal energy conversion systems Application of OTEC systems examples,

UNIT-IV:

Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, 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-V:

Types of fuel cells, H_2-O_2 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" by Rakosh das Begamudre, New age International publishers,
   New Delhi - 2000.
2. "Renewable Energy Resources" by John Twidell and Tony Weir, 2nd Edition, Fspon & Co.

REFERENCES:

1. "Understanding Renewable Energy Systems" by Volker Quaschning, 2005, UK.
2. "Renewable Energy Systems-Advanced Conversion, Technologies & Applications" by Faner
   Lin Luo Honer Ye, CRC press, Taylor & Francies group.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – II SEM (PSC&A)

SMART GRID

(JD532E16 Program Elective- IV)

UNIT–I: INTRODUCTION

Introduction to smart grid- Electricity network-Local energy networks- Electric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid.

SMART GRID TO EVOLVE A PERFECT POWER SYSTEM: Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

UNIT–II: DC DISTRIBUTION AND SMART GRID

AC vs DC sources-Benefits of and drives of DC power delivery systems-Powering equipment and appliances with DC-Data centers and information technology loads-Future neighborhood-Potential future work and research.

INTELLIGRID ARCHITECTURE FOR THE SMARTGRID: Introduction- Launching intelligrid-Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies.

UNIT–III: DYNAMIC ENERGY SYSTEMS CONCEPT

Smart energy efficient end use devices-Smart distributed energy resources-Advanced whole building control systems- Integrated communications architecture-Energy management-Role of technology in demand response- Current limitations to dynamic energy management-Distributed energy resources-Overview of a dynamic energy management-Key characteristics of smart devices- Key characteristics of advanced whole building control systems-Key characteristics of dynamic energy management system.

UNIT–IV: ENERGY PORT AS PART OF THE SMART GRID:

Concept of energy -Port, generic features of the energy port.

POLICIES AND PROGRAMS TO ENCOURAGE END – USE ENERGY EFFICIENCY: Policies and programs in action -multinational - national-state-city and corporate levels.

MARKET IMPLEMENTATION: Framework-factors influencing customer acceptance and response - program planning-monitoring and evaluation.

UNIT–V: EFFICIENT ELECTRIC END – USE TECHNOLOGY ALTERNATIVES

Existing technologies – lighting - Space conditioning - Indoor air quality - Domestic water heating - hyper efficient appliances - Ductless residential heat pumps and air conditioners - Variable refrigerant flow air conditioning-Heat pump water heating - Hyper efficient residential appliances - Data center energy efficiency- LED street and area lighting - Industrial motors and drives - Equipment retrofit and replacement - Process heating - Cogeneration, Thermal energy storage - Industrial energy management programs - Manufacturing process-Electro-technologies, Residential, Commercial and industrial sectors.

TEXT BOOKS:

1. Clark W Gellings, “The Smart Grid, Enabling Energy Efficiency and Demand Side Response”- CRC Press, 2009.
2. Janaka Ekanayake, Kithsiri Liyanage,Jianzhong.Wu, Akihiko Yokoyama, Nick Jenkins, “Smart Grid: Technology and Applications”- Wiley, 2012.
3. James Momoh, “Smart Grid :Fundamentals of Design and Analysis”-Wiley, IEEE Press, 2012.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES
M. TECH – I YEAR – I SEM (PSC&A)
POWER SYSTEMS SIMULATION LAB

All the Ten Experiments are Compulsory:

1. Develop Program for Y_{BUS} formation.

2. Develop Program for G-S Load Flow Analysis.
3. Develop Program for N-R Load Flow Analysis.

4. Develop Program for FDLF Load Flow Analysis.

5. Develop Program for Short Circuit Analysis.

6. Develop Program for Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point Method.
7. Develop Simulation of RLC Circuit

8. Develop Simulation of Single Phase Full Converter with RLE Load

9. Develop Program model for Closed Loop Speed Control of Separately Excited D.C Motor.

10. Develop Program model for Sinusoidal Pulse Width Modulation.

JAYAMUKHI INSTITUTE OF TECHNOLOGICAL SCIENCES

M. TECH – I YEAR – II SEM (PSC&A)

POWER SYSTEMS LAB

All the Ten Experiments are Compulsory:

1. Determination of Xd and Xq for a 3-phase salient pole Synchronous motor
2. Characteristics of Over Current Relays
   - (i) IDMT Electromagnetic Relay (7051 A)
   - (ii) Microprocessor based Relay (7051 B)
3. Determination of Breakdown strength of oil by Variable Distance Electrodes
4. Determination of Transmission Line Parameters
5. Fault Analysis (LL, LG, LLL) of transmission Lines
6. Determination of Earth resistance under various conditions
7. Characteristics of Over Voltage Relay
   - (i) Electromagnetic Relay (7053 A)
   - (ii) Microprocessor based Relay (7053 B)
8. Characteristics of Under Voltage (UV) and Negative sequence Relays
   - (i) UV Electromagnetic Relay (7052 A)
   - (ii) UV Microprocessor based Relay (7052 B)
   - (iii) Static Negative Sequence Relay (7055 B)
9. Performance and Testing of Generator Protection System.
10. Performance and Testing of Transformer Protection System.