R16

M.Tech - PE

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

M.Tech (PE)

COURSE STRUCTURE

I Year – I Semester

S.No.	Course code	Subject	L	T	P	CP
1.	16EE4301	Principles of Machine Modeling and Analysis	4	0	-	4
2.	16EC5501	Micro Controllers and Interfacing	4	0	-	4
3.	16EE7501	System Theory	4	0	-	4
4.	16EE4302	Analysis of Power Electronic Converters	4	0	-	4
5.	16EE4303	Power Electronic Control of DC Drives	4	0	-	4
ELECTIVE-I						
6.	16EE4304	Advanced Digital Signal Processing	4	0	-	4
7.	16EE4305	Neural Networks and Fuzzy Logic				
LABORATORY						
8	16EE4306	Power Converters-I Lab	-	-	4	2
Contact periods / week			24	0	4	26
			Total/Week 28			

I Year – II Semester

S.No.	Course code	Subject	L	T	P	CP
1.	16EE4307	Power Electronic Control of AC Drives	4	0	-	4
2.	16EE4308	Advanced Power Semiconductor Devices & Protection	4	0	-	4
3.	16EE4309	Flexible AC Transmission Systems	4	0	-	4
4.	16EE4310	Modern Power Electronics	4	0	-	4
5.	16EE4311	HVDC Transmission	4	0	-	4
ELECTIVE- II						
6.	16EE4312	Special Machines	4	0	-	4
7.	16EE4313	Energy Auditing Conversation and Management				
LABORATORY 1						
8.	16EE4314	Power Converters-II Lab	-	-	4	2
Contact Periods / Week			24	0	4	26
			Total/Week 28			

II YEAR (III & IV Semesters)

S. No	Subject Code	Subject	Credits
1	16EE4315	Seminar	2
2	16EE4316	Project work	16

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4301) PRINCIPLES OF MACHINE MODELING AND ANALYSIS

M.Tech I Year -I Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

UNIT-I

Basic concepts of Modeling

Basic Two-pole Machine representation of Commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron's primitive Machine, voltage, current and Torque equations.

UNIT II

DC Machine Modeling

Mathematical model of separately excited D.C motor, Steady State analysis, Transient State analysis Sudden application of Inertia Load, Transfer function of Separately excited D.C Motor, Mathematical model of D.C Series motor, Shunt motor, Linearization Techniques for small perturbations.

UNIT-III

Modeling of Three Phase Induction Machine

Transformation from Three phase to two phase and Vice Versa, Transformation from Rotating axes to stationary axes and vice- versa, Park's Transformation and it's physical concept, The Inductance matrix Mathematical model of Induction machine, Steady State analysis, d-q model of induction machine in Stator reference Frame, Rotor reference Frame and Synchronously rotating reference Frame Small signal equations of induction machine d-q flux linkages model derivation, Signal flow graph of the induction machine Per unit model , Dynamic simulation of induction machine.

UNIT-IV

Modeling of Single Phase Induction Machine

Comparison between single phase and poly-phase induction motor, Cross field theory of single-phase induction machine, steady state analysis,steady state torque.

Modeling of Synchronous Machine

Synchronous machine inductances, The phase Co-ordinate model, The Space phasor (d-q) model, Steady state operation, Mathematical model of PM Synchronous motor.

UNIT-V

Modeling of Special Machines

Modelling of Permanent Magnet Brushless DC Motor, Operating principle, Mathematical modeling of PM Brushless DC motor, PMDC Motor Drive Scheme, Mathematical model of Switched Reluctance Motor, Operating principle, Construction and functional Aspects, Average torque and Energy Conversion Ratio,The Commutation windings, SRM modeling, The flux current position curve fitting.

REFERENCES:

1. Generalized Theory of Electrical Machines – P.S.Bimbra-Khanna publications-5th edition-1995
2. The Unified Theory of Electrical Machines by C.V.jones, Butterworth- London, 1967
3. Electric Motor Drives Pearson Modeling, Analysis& control -R.Krishnan-Publications-1st edition -2002
4. Electrical Drives- I. Boldea & S.A. Nasar-The Oxford Press Ltd.
5. Electrical Machine Dynamics- D.P. Sengupta & J.B. Lynn- The Macmillan Press
6. Electromechanical Dynamics- Woodson & Melcher -John Wiley & Sons
7. Analysis of Electrical Machinery – P.C.Krause – McGraw Hill- 1980

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EC5501) MICROCONTROLLERS & INTERFACING

M.Tech I Year -I Sem. (PE) **L T C**
4 - 4

UNIT-I

INTEL 8051: Architecture of 8051, Memory Organization, Register banks, Bit addressing media, SFR area, Addressing modes, Instruction set, Programming examples, 8051 Interrupt structure, Timer modules, Serial Features, Port structure, Power saving modes.

UNIT-II

MOTOROLA 68HC11: Controllers features,Different modes of operation and memory map, Functions of I/O ports in single chip and expanded multiplexed mode, Timer system.

PIC MICROCONTROLLERS:

Program memory, CPU registers, Register file structure, Block diagram of PIC 16C74, I/O ports, Timer 0,1 and 2 features, Interrupt logic, serial peripheral interface, I2C bus, ADC, UART PIC family parts.

UNIT-III

MICROCONTROLLER INTERFACING: 8051, 68HC11, PIC-16C6X and ATMEL External Memory Interfacing, Memory Management Unit, Instruction and data cache memory Controller, On Chip Counters, Timers, Serial I/O, Interrupts and their use, PWM, Watch dog, ISP, IAP features.

UNIT-IV

ARM PROCESSOR FUNDAMENTALS:

Registers, State and Instruction Sets, Pipeline, Memory Management, Introduction to the ARM Instruction Set.

UNIT-V

INTERRUPT SYNCHRONIZATION:

Interrupt vectors & priority, external interrupt design. Serial I/O Devices: RS232 Specifications, RS552/Apple Talk/ RS 553/RS435 & other communication protocols, Serial Communication Controller.

CASE STUDIES:

Design of Embedded Systems using the micro controller 8051/ARM6TDMI for applications in the area of Communications, Automotives, industrial control.

TEXT BOOKS:

1. The 8051 Micro Controller & Embedded Systems Pearson Education, Asia (2000), M.A. Mazadi & J.G. Mazidi.
2. Designing with PIC Micro Controllers Pearson Education, John B. Peatman.
3. Embedded Microcomputer systems, Real Time Interfacing, Brookes/Cole, Thomas Learning, 1999Jonathan W. Valvano.
4. ARM Systems Developer's Guides- Designing & Optimizing System Software–Andrew N. Sloss, Dominic Symes, Chris Wright, 2008, Elsevier.

REFERENCES:

1. 8-bit Embedded Controllers, INTEL Corporation 1990.
2. Designing with PIC Microcontrollers, Pearson Education Inc, India, 2005.John B.Peatman,
3. Embedded Microcomputer Systems, Real Time Interfacing, Jonathan W. Valvano – Brookes / Cole, 1999, Thomas Learning.
4. Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem, 3rd Edition, 1999, Oxford.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE7501) SYSTEM THEORY

M.Tech I Year -I Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

UNIT-I

Introductory matrix algebra and linear vector space, State-space representation of systems, Linearization of a non-linear System, Solution of state equations, Evaluation of State Transition Matrix (STM), Simulation of state equation using MATLAB / SIMULINK program. Similarity transformation and invariance of system properties due to similarity transformations, Minimal realization of SISO, SIMO, MISO transfer functions, Discretization of a continuous time state space model, Conversion of state space model to transfer function model using Fadeeva algorithm.

UNIT- II

Fundamental theorem of feedback control, Controllability and Controllable canonical form, Pole assignment by state feedback using Ackermann's formula, Eigen structure assignment problem.

UNIT- III

Linear Quadratic Regulator (LQR) problem and solution of algebraic Riccati equation using eigenvalue and eigen vector methods, iterative method, Controller design using output feedback.

UNIT-IV

Observability and observable canonical form, Design of full order observer using Ackermann's formula, Bass Gura algorithm, Duality between controllability and observability, Full order Observer based controller design, Reduced order observer design.

UNIT-V

Internal stability of a system, Stability in the sense of Lyapunov, asymptotic stability of linear time invariant continuous and discrete time systems, Solution of Lyapunov type equation, Model decomposition and decoupling by state feedback, Disturbance rejection, sensitivity and complementary sensitivity functions.

TEXT BOOKS:

1. K. Ogata, Modern Control Engineering, Prentice Hall, India 1997
2. T. Kailath, T., Linear Systems, Perntice Hall, Englewood Cliffs, NJ, 1980.
3. N. K. Sinha, Control Systems, New Age International, 3rd edition, 2005.

REFERENCES:

1. Panos J Antsaklis, and Anthony N. Michel, Linear Systems, New age international Pvt. LTD. Publishers, 2009.
2. John J D'Azzo and C. H. Houpis, "Linear Control System Analysis and Design Conventional and Modern", McGraw, Hill Book Company, 1988.
3. B.N. Dutta, Numerical Methods for linear Control Systems, Elsevier Publication, 2007
4. C.T.Chen Linear System Theory and Design, PHI, India.
5. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 11th Edition, Pearson 2 Edu, India, 2009.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4302) ANALYSIS OF POWER ELECTRONIC CONVERTERS

M.Tech I Year -I Sem. (PE) **L T C**
4 - 4

UNIT-I

Single Phase AC voltage Controllers: Single Phase AC Voltage Controllers with resistive, resistive-inductive and resistive-inductive induced emf loads, ac voltage controller's wit PWM control, Effects of source and load inductances, synchronous tap changers, Application, numerical problems

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, Application, numerical problems.

UNIT-II

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

Single phase converters

Single phase cycloconverters, 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, Application, numerical problems

UNIT-III

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, Application, numerical problems

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-Boost Regulators, Cuk Regulators, Condition for continuous inductor and capacitor voltage, Comparison of regulators, Multi output boost regulators, advantages, Application, numerical problems

UNIT –IV

Pulse Width Modulated Inverters (Single Phase Inverter)

Principle of operation, Performance parameters, Single Phase bridge Inverters, 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, Advantages, Application, numerical problems

UNIT-V

Pulse Width Modulated Inverters (Three Phase Inverter)

Three Phase inverters-analysis of 180 degree condition of 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, Space vector modulation, Comparison of PWM techniques, harmonic reduction, current source inverters,Variable dc link inverter, boost inverters, buck and boost inverter, inverter circuit design, Advantages, Application, numerical problems.

REFERENCES:

1. Power Electronics-Md.H.Rashid –Pearson Education 3rd Edition, 2004
2. Power Electronics- N.Mohan, Tore.M.Undeland, W.P.Robbins –John Wiley,s -2nd Edition.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4303) POWER ELECTRONIC CONTROL OF DC DRIVES

M.Tech I Year -I Sem. (PE) **L T C**
4 - 4

UNIT-I

Controlled Bridge Rectifier (1-Φ) with DC Motor Load

Separately excited DC motors with rectified single phase supply, single phase semi converter and single phase full converter for continuous and discontinuous modes of operation, power and power factor.

Controlled Bridge Rectifier (3-Φ) with DC Motor Load

Three phase semi converter and three phase full converter for continuous and discontinuous modes of operation, power and power factor, Addition of Free wheeling diode, Three phase double converter.

UNIT-II

Three phase naturally commutated bridge circuit as a rectifier or as an inverter

Three phase controlled bridge rectifier with passive load impedance, resistive load and ideal supply, Highly inductive load and ideal supply for load side and supply side quantities, shunt capacitor compensation, three phase controlled bridge rectifier inverter.

UNIT-III

Phase Controlled DC Motor Drives

Three phase controlled converter, control circuit, control modeling of three phase converter, Steady state analysis of three phase converter control DC motor drive, Two quadrant, Three-phase converter controlled DC motor drive, DC motor and load converter.

Current and Speed controlled DC Motor drives

Current and Speed controllers, current and speed feedback, Design of controllers, Current and Speed controllers, Motor equations, Filter in the speed feedback loop speed controller, current reference generator, current controller and flow chart for simulation, Harmonics and associated problems, sixth harmonics torque.

UNIT-IV

Chopper controlled DC motor drives

Principle of operation of the chopper, Four quadrant chopper circuit, Chopper for inversion Chopper with other power devices, model of the chopper input to the chopper, Steady state analysis of chopper controlled DC motor drives, rating of the devices, Pulsating torque.

UNIT- V

Closed loop operation of DC motor Drives

Speed controlled drive system, current control loop, pulse width modulated current controller, hysterisis current controller, modeling of current controller, design of current.

Simulation of DC motor Drives

Dynamic simulations of the speed controlled DC motor drives, Speed feedback speed Controller,command current generator,current controller.

REFERENCES:

1. Power Electronics and motor control–Shepherd,Hulley, Liang – II Edn, CU Press
2. Electric motor drives modeling, Analysis and control – R. Krishnan – I Edn, PHI.
3. Power Electronic Circuits, Devices and Applications - M.H.Rashid–PHI, I Edn – Fundamentals of Electric Drives – G. K. Dubey – Narosa Publications – 1995.
4. Power Semiconductor drives – S.B. Dewan and A. Straughen – 1975.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4304) ADVANCED DIGITAL SIGNAL PROCESSING
(Elective –I)

M.Tech I Year -I Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

UNIT-I

Short introduction, Analog to digital and Digital to Analog conversion, sampled and Hold circuit, Continuous time Fourier Transforms, Discrete time signals and systems, Discrete, time Fourier transform, its properties and applications, Fast Fourier Transform (in time domain and Frequency domain), IDFT and its properties.

UNIT-II

z-Transform: Definition and properties, Rational z-transforms, Region of convergence of a rational z-Transform, The inverse z-Transform, z-Transform properties, Computation of the convolution sum of finite, length sequences, The transfer function

UNIT-III

Digital filter structures: Block Diagram representation, Equivalent structures, Basic FIR Digital Filter structures, Basic IIR Digital Filter structures, Realization of Basic structures using MATLAB, All pass filters, Computational complexity of Digital filter structures.

UNIT-IV

IIR Digital filter design: Preliminary considerations, Bilinear transformation method of IIR Filter design, Design of low pass IIR Digital filters, Design of High pass, Band pass and band stop IIR digital filters, Spectral Transformations of IIR filter, IIR digital filter design using MATLAB, Computer aided design of IIR digital filters, FIR digital filter design: Preliminary considerations, FIR filter design based on windowed Fourier series, Computer aided design of Equiripple Linear phase FIR filters, Design of Minimum phase FIR filters, FIR digital filter design using MATLAB, Design of computationally efficient FIR digital filters.

UNIT-V

Analysis of Finite word length effects: The quantization process and errors, quantization of Fixed point numbers, Quantization of floating point numbers, Analysis of coefficient quantization effects, Analysis of arithmetic round off errors, Low sensitivity digital filters, Reduction of product round off errors using error feedback, Round off errors in FFT algorithms, The basic sample rate alteration devices, Multi rate structures for sampling rate conversion, Multistage design of decimator and interpolator, The Polyphase decomposition, Arbitrary rate sampling rate converter, Nyquist Filters and some applications of digital signal processing.

TEXT BOOKS:

1. Digital Signal Processing- S.K. Mitra, Tata McGraw-Hill, Third Edition, 2006.
2. Principle of Signal Processing and Linear Systems- B.P. Lathi, Oxford International Student Version, 2009
3. Continuous and Discrete Time Signals and Systems- M. Mondal and A Asif, Cambridge, 2007

REFERENCES:

1. Digital Signal Processing- Fundamentals and Applications-LiTan, Indian reprint,Elsevier,2008.
2. Discrete- Time Signal Processing- Alan V. Oppenheim, Ronald W. Schafer, and John R.Buck, Pearson Education, 2008.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4305) NEURAL NETWORKS AND FUZZY LOGIC
(Elective –I)

M.Tech I Year -I Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

UNIT-I

Introduction to Neural Networks

Introduction, Humans and Computers, Organization of the Brain, BiologicalNeuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-FireNeuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Essentials of Artificial Neural Networks

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN-Connectivity, Neural Dynamics(Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT-II

Feed Forward Neural Networks

Introduction, Perceptron Models: Discrete,Continuous and Multi-Category, Training Algorithms:Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Multilayer Feed Forward Neural Networks

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backporpagation (BP)Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT-III

Associative Memories

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory(Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storageand Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT-IV

Self-Organizing Maps (SOM) and Adaptive Resonance Theory (ART)

Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability-Plasticity Dilemma, Feed forward competition, Feedback Competition, Instar, Outstar, ART1, ART2, Applications.

Classical & Fuzzy Sets

Introduction to classical sets, properities, Operations and relations; Fuzzy sets, Membership, Uncertainity, Operations, Properities, fuzzy relations, cardinalities, membership functions.

UNIT-V

Fuzzy Logic System Components

Fuzzification, Membership Value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Neural network applications: Process identification, Fraction Approximation, Control and Process Monitoring, Fault diagnosis and Load forecasting.

Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

REFERENCES

1. Neural Netwroks, Fuzy logic , Gnenetic algorithms: synthesis and applications by Rajasekharan and Rai- PHI Publication.
2. Introduction to Artificial Neural Systems- Jacek M.Zurada, Jaico Publishing House, 1997.
3. Neural Netwroks – James A Freeman and Davis Skapura, Pearson, 2002
4. Neural Netwroks – Simon Hykins, Pearson Education.
5. Neural Engineering by C. Eliasmith and CH. Anderson, PHI
6. Neural Netwroks and Fuzzy Logic System by Brok Kosko, PHI Publication

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4306) POWER CONVERTERS-I LAB

M.Tech I Year -I Sem. (PE)	**L**	**P**	**C**
	0	**4**	**2**

1. Speed Measurement and closed loop control using PMDC motor.
2. Thyristorised drive for PMDC Motor with speed measurement and closed Loop control.
3. IGBT used single 4 quadrant chopper drive for PMDC motor with speed measurement and closed loop control.
4. Thyristorised drive for 1Hp DC motor with closed loop control.
5. 3-Phase input, thyristorised drive, 3 Hp DC motor with closed loop
6. 3-Phase input IGBT, 4 quadrant chopper drive for DC motor with closed Loop control equipment.
7. Cyclo-converter based AC Induction motor control equipment.
8. Speed control of 3 phase wound rotor Induction motor.
9. Single-phase fully controlled converter with inductive load.
10. Single phase half wave controlled converter with inductive load.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4307) POWER ELECTRONIC CONTROL OF AC DRIVES

M.Tech I Year -II Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

UNIT-I

Introduction to AC drives

Introduction to motor drives, torque production, Equivalent circuit analysis, Speed, Torque characteristics with variable voltage operation, variable frequency operation, constant v/f operation, Induction motor characteristics in constant torque and field weakening regions

UNIT-II

Control of Induction motor drives at stator side

Scalar control, Voltage fed inverter control, Open loop volts/Hz Control, Speed control slip regulation, Speed control with torque and flux control, Current controlled voltage fed inverter drive, Current fed inverter control, Independent current and frequency control, Speed and flux control in current fed inverter drive, Volts/Hertz Control current fed, Inverter drive, Efficiency optimization control by flux program

Control of Induction motor at rotor Side

Slip power recovery drives, Static Kramer Drive, Phasor diagram, Torque expression, Speed control of Kramer Drive, Static Scheribus Drive, Modes of operation

UNIT-III

Vector control of Induction motor Drives

Principles of Vector Control, Vector Control Methods, Direct method of Vector control, Adaptive control principles, Self tuning regulator, Model referencing control

Control of Synchronous motor Drives

Synchronous motor and its characteristics, control strategies, constant torque angle control, Unity power factor control, Constant mutual flux linkage control

UNIT-IV

Controllers

Flux weakening operation, Maximum speed, Direct flux weakening algorithm, Constant torque mode controller, Flux Weakening controller, Indirect flux weakening, Maximum permissible torque, Speed control scheme, Implementation strategy, Speed controller design.

UNIT-V

Variable Reluctance motor Drive

Variable reluctance motor drives, Torque Production in the variable reluctance motor, Drive characteristics and control principles, Current control variable reluctance servo drive.

Brushless DC motor Drives

Three phase full wave Brushless dc motor, Sinusoidal type of Brushless dc motor, Currentcontrolled Brushless dc servo drives.

REFERENCES:

1. Electric Motor Drives Pearson modeling, analysis and control R.Krishnan – Publication -1st Edition -2002
2. Modern Power Electronics and AC drives-B.K Bose-Pearson Publication -1ST Edition
3. Power Electronic Control of AC motors- MD Murphy & FG Turn Bull Pergman Press(For Chapters II,III, V) – 1st Edition
4. Power Electronics and AC drives-B.K Bose-Prentice Hall Publication -1ST Edition
5. Power Electronics Circuits , Devices and Application- M.H Rashid –PHI 1995
6. Fundamentals of Electric Drives –GK Dubey- Narora Publications -1995
7. Power Electronics and Variable Frequency drives-B.K.Bose-IEEE press-Standard publication-1st Edition-2002

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4308) ADVANCED POWER SEMICONDUCTOR DEVICES AND PROTECTION

M.Tech I Year -II Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

UNIT-I

BJTs

Introduction, vertical power transistor structures, I-V characteristics-physics of BJT operation, switching characteristics, break down voltages, second break down, on-state losses, safe operation areas design of drive circuits for BJTs, snubber circuits for BJTs and darlingtons

Power MOSFETs

Introduction, basic structures, I-V characteristics-physics of device operation, switching characteristics, operation limitations and safe operating areas, design of gate drive circuits, snubber circuits

UNIT-II

Gate Turn-Off Thyristors

Introduction, basic structures, I-V characteristics-physics of device operation, GTO switching characteristics, snubber circuits, over protection of GTOs.

Insulated Gate Bipolar Transistors

Introduction, basic structures I-V characteristics-physics of device operation, Latch in IGBTs, switching characteristics, Device limits and safe operating areas, drive and snubber circuits.

UNIT-III

Emerging Devices and Circuits

Introduction, Power junction field effect transistors, field controlled Thyristor, JFET based devices versus other power devices, MOS controlled Thyristors, high voltage integrated circuits, new semiconductor materials

Passive Components and Electromagnetic compatibility

Introduction, design of inductor-transformer design, selection of capacitors, resistors current measurements, heat-sinking circuit lay out, Electromagnetic Interference (EMI), Sources of EMI-Electromagnetic Interference in Power Electronic Equipment.

UNIT-IV

Noise

Noise sources in SMPS, Diode Storage Charge Noise, Noise generated due to switching, Common noises sources in SMPS, Noises Due to High frequency transformer, How the conducted noise is measured, minimizing EMI, EMI shielding, EMI standards.

UNIT-V

Protection of Devices & Circuits

Cooling & Heat sinks, Thermal modeling of power switching devices, snubber circuits, Reverse recovery transients, Supply and load side transients, voltage protections, current protections.

REFERENCES;

1. Power Electronics Circuits, Devices and Applications – M.H.Rashid-PHI-
2. Power Electronics –Converters, Applications and Design – Mohan and Undeland-John Wiley&Sons
3. Power Electronics Circuits-Vithayathil
4. Power Electronics Circuits-W.C. Lander

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4309) FLEXIBLE A.C. TRANSMISSION SYSTEMS

M.Tech I Year -II Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

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, Voltage source converters: Single phase three phase full wave bridge Converters transformer connections for 12 pulse 24 and 48 pulse operation.

UNIT II

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.

Static shunt compensation: Objectives of shunt compensation, mid point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping.

UNIT III

Methods of controllable var generation, variable impedance type static var generators switching converter type var generators, hybrid var generators.

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 IV

Static series compensators: concept of series capacitive compensation, improvement of transient stability, power oscillation damping.

UNIT V

Functional requirements, GTO thyristor controlled series capacitors (GSC), thyristor switched series capacitor (TSSC) and thyristor controlled series capacitor (TCSC) control schemes for GSC , TSSC and TCSC.

Text Book:

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

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4310) MODERN POWER ELECTRONICS

M.Tech I Year -II Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

UNIT-I

Modern power semiconductor devices

Modern power semiconductor devices, MOS Turn Off Thyristor (MTO), Emitter Turn Off Thyristor (ETO), Integrated Gate, Commutated thyristor (IGCTs), MOS – controlled thyristors (MCTs), Static induction Thyristors (SITHs), Power integrated circuits (PICs) , Symbol, structure and equivalent circuit, comparison of their features.

UNIT-II

Resonant pulse inverters:

Resonant pulse inverters, series resonant inverters,series resonant inverters with unidirectional switches, series resonant inverters with bidirectional switches, analysis of half bride resonant inverter, evaluation of currents and Voltages of a simple resonant inverter, analysis of half bridge and full bridge resonant inverter with bidirectional switches, Frequency response of series resonant inverter- for series loaded inverter for parallel resonant inverters, Voltage control of resonant inverters,class E resonant inverter, class E resonant rectifier, evaluation of values of C's and L's for class E inverter and Class E rectifier, numerical problems.

UNIT-III

Resonant Converters:

Resonant converters, zero current switching resonant converters, L type ZCS resonant Converter, M type ZCS resonant converter, zero voltage Switching resonant converters, comparison between ZCS and ZVS resonant converters, Two quadrant ZVS resonant converters, resonant dc–link inverters,evaluation of L and C for zero current switching inverter,Numerical problems.

Multilevel Inverters:

Multilevel concept,Classification of multilevel inverters, Diode clamped Multilevel Inverter, Principle of operation, main features, improved diode clamped inverter, principle of operation, Flying capacitors multilevel inverter, principle of operation,main features. Cascaded multilevel inverter, principle of operation, main features, multilevel inverter Applications, reactive power compensation, back to back intertie system, adjustable Drives, switching device currents, dc link capacitor voltage balancing, features of Multilevel inverters, comparisons of multilevel converters.

UNIT -IV

DC Power supplies:

DC power supplies, classification, switched mode dc power supplie, fly back Converter-forward converter, push- pull converter, half bridge converter, Full bridge converter, Resonant DC power supplies,bidirectional power supplies, Application.

AC Power Supples:

AC power supplies, classification, switched mode ac power supplies Resonant AC power supplies bidirectional ac power supplies, multistage conversions, control circuits, applications.

UNIT-V

Power conditioners and Uninterruptible Power Supplies:

Introduction, power line disturbances, power conditioners, uninterruptible power supplies, applications.

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.Robbind – John Wiley & Sons – Second Edition.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4311) H.VD.C. TRANSMISSION

M.Tech I Year -II Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

UNIT-1

H.V.DC Transmission : General consideration, Power Handling Capabilities of HVDC lines, Basic Conversion principles, static converter configuration.

Static Power Converters: 3 pulse, 6 pulse & 12 pulse converters, converter station and Terminal equipment communication process, Rectifier and inverter operation, equivalent circuit for converter, special futures of converter transformers.

UNIT-II

Harmonics in HVDC systems, harmonicas elimination, AC & DC filter Control of HVDC converter and systems: constant current, constant extinction angle andconstant ignition angle control. Individual phase control and equidistant firing angle control,
DC power flow control

UNIT-III

Interaction between HVAC & DC systems, voltage interaction, harmonic instability problems and DC power modulation.
Multi-terminal DC link and systems, series parallel and series parallel systems, their operation and control.

UNIT-IV

Transient over voltage in HVDC systems: Over voltages due to disturbance on DC side, over voltages due to DC and AC side line faults.

UNIT-V

Converter faults and protection in HVDC systems: Converter faults, over current protection, valve group and DC line protection, Over voltage protection of converters, surge arresters.

REFERENCES:

1. E.W.Kimbark: Direct current Transmission, Wiely inter Science- New york.
2. J.Arillaga: H.V.D.C.Tranmission peter peregrilnus ltd., London UK 1983
3. K.R.Padiyar: High Voltage Direct current Transmission, Wiely Eastern Ltd
4.E.Uhlman: Power Transmission by Direct Current Springer Verlag, Berrlin

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4312) SPECIAL MACHINES
(Elective –II)

M.Tech I Year -II Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

UNIT –I

SPECIAL TYPES OF D. C. MACHINES

Series booster, Shunt booster, Non reversible booster, Reversible booster Armature excited machines, Rosenberg generator, The Amplidyne and Metadyne, Rototrol and Regulex, Third brush generator, Three wire generator, Dynamometer.

UNIT–II

STEPPER MOTORS

Introduction, Synchronous Inductor (or Hybrid Stepper Motor), Hybrid Stepping Motor, Construction, Principle of Operation, Energisation with two phase at a time, Essential conditions for the satisfactory Operation of a 2–Phase Hybrid Step Motor ,Very Slow, Speed Synchronous Motor for Servo Control, Different Configurations for Switching the Phase Windings Control Circuits for Stepping Motors, An Open Loop Controller for a 2-Phase Stepping Motor.

UNIT –III

VARIABLE RELUCTANCE STEPPING MOTORS

Variable Reluctance (VR) Stepping Motors, Single Stack VR step motors, Multiple stack VR motors, Open Loop Control of 3-Phase VR Step Motor, Closed–Loop Control of Step Motor, Discriminator (or rotor position sensor), Translator, Major loop, Characteristics of Step Motor in Open Loop Drive, Comparison between Open Loop Position Control with Step Motor and a Position Control Servo using a Conventional (dc or ac) Servo Motor, Suitability and Areas of Application of Stepping Motors, 5 Phase Hybrid Stepping Motor ,Single Phase Stepping Motor, The Construction, Operating Principle, Torque developed in the Motor.

SWITCHED RELUCTANCE MOTOR

Introduction, Improvements in the Design of Conventional reluctance Motors, Some Distinctive Differences between SR and Conventional Reluctance Motors, principle of Operation of SRM, Some Design Aspects of Stator and Rotor Pole Arcs, Designof stator and Rotor and pole Arcs in SR Motor, Determination of $L(\theta)$–θ Profile,Power Converter for SR Motor ,A Numerical Example, Rotor Sensing Mechanism and Logic Control, Drive and Power Circuits, Position Sensing of rotor with Hall Problems, Derivation of Torque Expression,General, Linear Case.

UNIT –IV

PERMANENT MAGNET MATERIALS AND MOTORS

Introduction, Hysteresis loops and recoil line,Stator Frames (Pole and YokePart) of Conventional PM dc Motors, Equivalent circuit of a PM Development of Electronically Commutated DC Motor from Conventional DC Motor .

BRUSHLESS DC MOTOR

Types of Construction, Principle of Operation of BLDM, Sensing and Switching Logic Scheme, Sensing, Logic Controller, Lockout Pulses ,Drive and Power Circuits, Base Drive Circuit, Power Converter Circuit, Theoretical Analysis and Performance Prediction, Modeling and magnet circuit, d-q analysis of BLDM, Transient Analysis ,Formulation in terms of Flux Linkages as State Variables, Approximate Solutions for Current and Torque under Steady State, Theory of BLDM as Variable Speed Synchronous Motor (Assuming Sinusoidal Flux Distribution), Methods of reducing Torque Pulsations, 1800 Pole Arc and 1200 current sheet.

UNIT –V

LINEAR INDUCTION MOTOR

Development of a Double sided LIM from Rotary type IM, A Schematic of LIM Drive for Electric Traction, Development of one sided LIM with back Iron, Field Analysis of a DSLIM: Fundamental Assumptions.

TEXT BOOKS:

1. K. Venkataratnam, Special Electrical Machines, University Press.
2. R. K. Rajput, Electrical machines, 4th Edition, Laxmi Publications. [For Chapters I and II Refer Chapter VIII of this book]
3. V. V. Athani, Stepper Motors: Fundamentals, Applications and Design, New Age International Pub
4. N. Mohan, Undeland & Robbins, Power Electronics -Converters, Applications & Design, Wiley India, Student Edition.
5. Johan E. Gibson and F. B. Teuter, Control System Components, McGraw Hill Edition.
6. M. G. Say & E. O. Taylor, D. C. Machines, 2nd Edition, ELBS

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(16EE4313) ENERGY AUDITING, CONSERVATION &MANAGEMENT
(Elective –II)

M.Tech I Year -II Sem. (PE)	**L**	**T**	**C**
	4	**-**	**4**

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, Energymanger, 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, RMShp, voltage variation, voltage unbalance, over motoring, motor energy audit

UNIT IV

Power Factor Improvement, Lighting

Power factor, methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on p.f., p.f motor controllers ,Good lighting system design and practice, lighting control, lighting energy audit.

Energy Instruments

Energy Instruments watt meter, 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 .

REFERENCES:

1. Energy management by W.R. Murphy & 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

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

(16EE4314) POWER CONVERTERS-II LAB

M.Tech I Year -II Sem. (PE)

L	P	C
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1. Write program and simulate dynamical system of following models:
   (a) I/O Model (b) State variable model also identifies time domain specifications of each.
2. Obtain frequency response of a given system by using various methods:
   (a) General method of finding the frequency domain specifications (b) Polar plot
   (c) Bode plot Also obtain the Gain margin and Phase margin.
3. Determine stability of a given dynamical system using following methods: (a) Root locus (b) Bode plot (c) Nyquist plot (d) Liapunov stability criteria
4. Transform a given dynamical system from I/O model to state variable model and vice versa.
   (a) Obtain model matrix of a given system, obtain it's diagonalize form if exists or obtain
   (b) Jordon Canonical form of system.
5. Write a program and implement linear quadratic regulator
6. Design a compensator for a given systems for required specifications.
7. Conduct a power flow study on a given power system.
8. Design a PID controller.
9. Conduct a power flow study on a given power system network using Guass-Seidel iterative method.
10. Develop a program to solve Swing Equation.
11. Develop a Simulink model for a single area load frequency problem and simulate the same.
12. Develop a Simulink model for a two-area load frequency problem and simulate the same.
13. Design a PID controller for two-area power system and simulate the same.
14. PSPICE Simulation of Single phase full converter using RL and E loads.
15. PSPICE Simulation of Three phase full converter using RL and E loads.
16. PSPICE Simulation of Single phase AC Voltage controller using RL load.
17. PSPICE Simulation of Three phase inverter with PWM controller.
18. PSPICE Simulation of resonant pulse commutation circuit.
19. PSPICE Simulation of impulse commutation circuit.