M.TECH.(PED) - COURSE STRUCTURE

I - SEMESTER

Code No	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lecture	Tutorial	Lab	Internal	External		
MTEE101	Machine Modeling and Analysis	4	1	-	40	60	100	3
MTEE102	Power Converters	4	1	-	40	60	100	3
MTEE103	Control of Motor Drives-I	4	1	-	40	60	100	3
MTEE104	Computational Mathematics	4	1	-	40	60	100	3
	Elective - I	4	1	-	40	60	100	3
MTEE1051	Reactive Power Management							
MTEE1052	Reliability Systems Engineering							
MTEE1053	Electro Magnetic Interference and Compatibility							
	Elective – II	4	1	-	40	60	100	3
MTEE1061	Industrial Electronics							
MTEE1062	Modeling and Simulation of Power Electronics							
MTEE1063	System Identification and Parameter Estimation							
MTEE151	Power Converters and Drives Lab-I			3	25	50	75	2
MTEE152	Technical Seminar	--	--	--	75	-	75	2
Total		24	6	3	340	410	750	22

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II-SEMESTER

Code No	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lecture	Tutorial	Lab	Internal	External		
MTEE201	Switched Mode Power Conversion	4	1	-	40	60	100	3
MTEE202	Control of Motor Drives-II	4	1	-	40	60	100	3
MTEE203	DSP Processors and FPGA	4	1	-	40	60	100	3
MTEE204	Modern Control Theory	4	1	-	40	60	100	3
	Elective – III	4	1	-	40	60	100	3
MTEE2051	Power Quality							
MTEE2052	Advanced Digital Signal Processing							
MTEE2053	Power Electronics for Renewable Energy Systems							
	Elective – IV	4	1	-	40	60	100	3
MTEE2061	HVDC and FACTS							
MTEE2062	Hybrid Electric Vehicles							
MTEE2063	Artificial Intelligent Techniques							
MTEE251	Power Converters and Drives Lab-II			3	25	50	75	2
MTEE252	Mini Project	--	--	--	75	-	75	2
Total		24	6	3	340	410	750	22

III & IV SEMESTERS

Subject code	Name of the Subject	Contact hours/week		Credits	Scheme of Valuation		Total Marks
		L+T	P		Internal (CIE)	External (SEE)	
MTEE351	Dissertation			40	50	150	200
	Total			40	50	150	200

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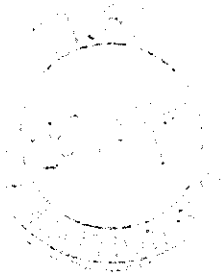
I SEMESTER



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MTEE101 - MACHINE MODELLING AND ANALYSIS

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I
BASIC CONCEPTS OF MODELLING

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 MODELLING

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
MODELLING OF 1-PHASE INDUCTION MOTOR

Linear transformation-Phase transformation - three phase to two phase transformation (abc to $\alpha\beta 0$) and two phase to three phase transformation ($\alpha\beta 0$ to abc) Power equivalence.-Modelling of 1-Phase induction motor-cross field theory-mathematical modelling of 1-phase induction motor

UNIT – IV
MODELLING OF THREE PHASE INDUCTION MACHINE

Generalized model in arbitrary reference frame-Electromagnetic torque-Derivation of commonly used Induction machine models- Stator reference frame model-Rotor reference frame model-Synchronously rotating reference frame model-state space model with flux linkages as variables, small signal equations of induction motor-derivations-DQ flux linkage model derivation-control principles of induction motor

UNIT – V
MODELLING OF SYNCHRONOUS MACHINE

Synchronous machine inductances – Mathematical model-transformation to the rotor's dq0 reference frame- Flux linkages in terms of winding currents-referring rotor quantities to the stator- voltage equations in the rotor's dq0 reference frame-electromagnetic torque-currents in terms of flux linkages-steady state operation- modelling of PM Synchronous motor, modelling of BLDC motor, modelling of Switched Reluctance motor.

TEXT BOOKS:

1. R.Krishnan "Electric Motor Drives - Modelling, Analysis& control", Pearson Publications,1st edition -2002.
2. P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff "Analysis of Electrical Machinery and Drive systems", Second Edition, IEEE Press.

REFERENCES:

1. P.S.Bimbra "Generalized Theory of Electrical Machines ", Khanna publications, 5th edition-1995.
2. Chee Mun Ong "Dynamic simulation of Electric machinery using Matlab / Simulink", Prentice Hall.

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MTEE102 - POWER CONVERTERS

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT - I

SINGLE-PHASE CONTROLLED RECTIFIERS

Introduction, Line-commutated Single-phase Controlled Rectifiers , Single-phase Half-wave Rectifier , Single-phase Bridge Rectifier , Analysis of the Input Current , Commutation of the Thyristors, Operation in the Inverting Mode, Applications. Unity Power Factor Single-phase Rectifiers - Problem of Power Factor in Single-phase Line-commutated Rectifiers, Standards for Harmonics in Single-phase Rectifiers, Single-phase Boost Rectifier, Voltage Doubler PWM Rectifier, PWM Rectifier in Bridge Connection, Applications of Unity Power Factor Rectifiers.

UNIT - II

THREE-PHASE CONTROLLED RECTIFIERS

Three-phase Controlled Rectifiers-Line-commutated Controlled Rectifiers, Three-phase Half-wave Rectifier, Six-pulse Rectifier, Three-phase Full-wave Rectifier, Half Controlled Bridge Converter, Power Factor, Harmonic Distortion, Special Configurations for Harmonic Reduction, Harmonic Standards and Recommended Practices. Force-commutated Three-phase Controlled Rectifiers-Basic Topologies and Characteristics, Operation of the Voltage Source Rectifier, PWM Phase-to-phase and Phase-to-neutral Voltages, Control of the *DC* Link Voltage, New Technologies and Applications of Force-commutated Rectifiers.

UNIT – III

AC-AC CONVERTERS

Single Phase AC Voltage Controllers with PWM control-Effects of source and load inductances-Synchronous tap changers-Three Phase AC Voltage controllers-Analysis of Controllers with star and delta connected R and RL load-Effects of source and load inductances-Problems.

UNIT – IV

DC-AC CONVERTERS

Voltage source and Current source inverters- Voltage Control of Single-Phase Inverters-Sinusoidal PWM-Modified PWM-Phase displacement Control-Trapezoidal, staircase, stepped, harmonic injection and delta modulation-Voltage Control of Three-Phase Inverters-Sinusoidal PWM-Third Harmonic PWM-Hysteresis current control PWM- Space Vector Modulation-Comparison of PWM Techniques-current source inverters-Variable dc link inverter-Problems.

UNIT – V

MULTI LEVEL INVERTERS

Introduction, Multilevel Concept, Types of Multilevel Inverters-Diode-Clamped Multilevel Inverter, Principle of Operation, Features of Diode-Clamped Inverter, Improved Diode-Clamped Inverter-Flying-Capacitors Multilevel Inverter, Cascaded Multilevel Inverter.

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TEXT BOOKS:

1. Ned Mohan, Tore M. Undeland and William P.Robbins, Power Electronics: Converters, Applications and Design, New Jersey, John Wiley and Sons, 2003.
2. Md.H.Rashid "Power Electronics",Pearson Education Third Edition, First Indian Reprint- 2008.

REFERENCES:

1. Joseph Vithayathil, Power Electronics: Principles and Applications, Delhi, Tata McGraw-Hill, 2010.
2. P.S. Bimbra, Power Electronics, New Delhi, Khanna Publishers, 2006.

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MTEE103 - CONTROL OF MOTOR DRIVES-I

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

CONVERTER CONTROLLED DC MOTOR DRIVES

Steady state analysis of the single and three phase fully controlled converter fed series and separately excited D.C motor drives: Continuous and discontinuous conduction mode, control of output voltage by sequence and sector control, harmonic analysis

UNIT – II

CHOPPER CONTROLLED DC MOTOR DRIVES

Basic equations of motor operation-DC chopper Drives-Basic class A chopper circuit-Analytical properties of the load voltage waveforms-Analytical waveforms of the load current waveforms-Average current, r.m.s current and power transfer-Problems

UNIT – III

STATOR SIDE CONTROL OF INDUCTION MOTOR

Scalar control- Voltage fed Inverter control-Open loop volts/Hz control-Speed control with 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/Hz control of Current-Fed Inverter drive-Efficiency optimization control by flux program.

UNIT – IV

ROTOR SIDE CONTROL OF INDUCTION MOTOR

Rotor resistance control- fixed resistance control, variable resistance control-converter controlled resistance control, Slip power recovery schemes- Static Kramer drive-Phasor diagram-Torque expression-Speed control of Kramer drive-Static scherbius drive-Modes of operation.

UNIT – V

VECTOR CONTROL OF INDUCTION MOTOR

Principles of vector control, Direct vector control, derivation of indirect vector control, implementation – block diagram; estimation of flux, flux weakening operation

TEXT BOOKS:

1. G. K. Dubey "Power semi-conductor Drives", Narosa Publications, 1995.
2. Shepherd, Hulley, Liang "Power Electronics and Motor Control", II Edition, Cambridge University Press.

REFERENCES:

1. M. H. Rashid "Power Electronics Circuits, Devices and Applications", 4th Edition, Prentice Hall.
2. R. Krishnan "Electric Motor Drives Modelling, Analysis and Control", Prentice Hall India.

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MTEE104 - COMPUTATIONAL MATHEMATICS

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

Unit - I

Advanced Matrix Theory

Matrix norms – QR decomposition for 3× 3 matrices(Gram-schmidt process) — Eigen values - Generalized eigenvectors for 3× 3 matrices and for upper triangular matrices of order 4× 4 - Jordan canonical form for 3× 3 matrices and for upper triangular matrices of order 4× 4 – Singular value decomposition for 3× 3 , 3× 2, 2× 3 matrices – Pseudo inverse for 3× 3 matrices – Least square approximations for non homogeneous system of equations in 3 variables.

UNIT – II

Z – Transforms

Transform of standard functions – Convolution – Initial and Final value problems – Shifting Theorem – Inverse transform (Using Partial Fraction – Residues) – Solution of difference Equations using Z – Transform.

Unit – III

Fourier Series

Euler's formula – Dirichlet's conditions – General Fourier series in the intervals $(0,2\pi)$ and $(-\pi,\pi)$ –Fourier series expansion to different types of wave forms– change of intervals- Harmonic analysis .

Unit – IV

Fast Fourier Transform

discrete Fourier transform -Discrete convolution- Periodic sequence and circular convolution- Linear convolution through circular convolution – Fast Fourier transform – Decimation in time algorithm(up to 8 point DFT by Radix-2 FFT), decimation in frequency algorithm (up to 8 point DFT by Radix-2 FFT)- Computation of inverse DFT (up to 4 point DFT by Radix-2 FFT).

Unit - V

Calculus of Variations

Variation and its properties – Euler's equation – Functional dependent on first and higher order derivatives –Functional dependent on functions of several independent variables – Some applications – Direct methods: Ritz method and Galerkin method.

LBRCE EXAMINATION SECTION

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REFERENCE BOOKS:

1. R. Bronson, "Matrix Methods", New Delhi, Elsevier, 2006.
2. B.S Grewal , "Higher engineering mathematics", Khanna publishers
3. S.S.Sastry , "Introductory numerical methods", PHI.
4. A, Nagoor kani, "Digital signal processing", RBI publications
5. Elsgoltis, "Differential Equations and Calculus of Variations", Moscow, MIR Publishers, 1970.
6. Erwin Kreyszig, "Advanced Engineering Mathematics", New Jersey, John Wiley & Sons, 2006.
7. T. Veerarajan," Engineering Mathematics", New Delhi, Tata McGraw-Hill, 2001.
8. Dr. Amit Konar, "Artificial Intelligence and Soft Computing- Behavioural and Cognitive.
9. Modelling of the Human Brain", New York, CRC Press LLC, 1999.

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MTEE1051 - REACTIVE POWER MANAGEMENT

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

LOAD COMPENSATION

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

UNIT – II

STEADY STATE REACTIVE POWER COMPENSATION IN TRSANSMISSION SYSTEM

Uncompensated line – types of compensation – Passive shunt, series and dynamic shunt compensation – examples

Transient state reactive power compensation in transmission systems:

Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation –compensation using synchronous condensers – examples

UNIT – III

REACTIVE POWER COORDINATION

Objective – Mathematical modelling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency – Harmonics, radio frequency and electromagnetic interferences

UNIT – IV

DEMAND SIDE MANAGEMENT

Load patterns – basic methods of load shaping – power tariffs- KVAR based tariffs, penalties for voltage flickers and Harmonic voltage levels

Distribution side Reactive Power Management:

System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics, Planning, capacitor placement – retrofitting of capacitor banks

UNIT – V

USER SIDE REACTIVE POWER MANAGEMENT

KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors –deciding factors – types of available capacitor, characteristics and Limitations

Reactive power management in electric traction systems and arc furnaces:

Typical layout of traction systems – reactive power control requirements – distribution transformers-Electric arc furnaces – basic operations- furnace transformer –filter requirements – remedial measures –power factor of an arc furnace

TEXT BOOKS:

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

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MTEE1052 - RELIABILITY SYSTEMS ENGINEERING

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

BASICS OF PROBABILITY THEORY & DISTRIBUTION

Basic probability theory – rules for combining probabilities of events – Bernoulli's trials – probabilities density and distribution functions – binomial distribution – expected value and standard deviation of binomial distribution.

Network Modelling and Reliability Analysis-Analysis of Series, Parallel, Series-Parallel networks – complex networks – decomposition method.

UNIT – II

RELIABILITY FUNCTIONS

Reliability functions f(t), F(t), R(t), h(t) and their relationships – exponential distribution – Expected value and standard deviation of exponential distribution – Bath tub curve – reliability analysis of series parallel networks using exponential distribution – reliability measures MTTF, MTTR, MTBF.

UNIT – III

MARKOV MODELLING

Markov chains – concept of stochastic transitional probability Matrix, Evaluation of limiting state Probabilities. – Markov processes one component repairable system – time dependent probability evaluation using Laplace transform approach – evaluation of limiting state probabilities using STPM – two component repairable models.

UNIT –IV

FREQUENCY & DURATION TECHNIQUES

Frequency and duration concept – Evaluation of frequency of encountering state, mean cycletime, for one , two component repairable models – evaluation of cumulative probability and cumulative frequency of encountering of merged states.

UNIT – V

GENERATION SYSTEM RELIABILITY ANALYSIS

Reliability model of a generation system– recursive relation for unit addition and removal – load modeling - Merging of generation load model – evaluation of transition rates for merged state model – cumulative Probability, cumulative frequency of failure evaluation – LOLP, LOLE.

TEXT BOOKS:

1. R. Billinton, R.N.Allan "Reliability Evaluation of Engineering System', Plenum Press, New York, reprinted in India by B.S.Publications, 2007
2. R. Billinton, R.N.Allan "Reliability Evaluation of Power systems", Pitman Advance Publishing Program, New York, reprinted in India by B.S.Publications, 2007

REFERENCES:

1. Alessandro Birolini "Reliability systems engineering theory and practice", 6th edition, Springer press.
2. Elsayed A.Elsayed "Relisability Engineering", 2nd edition, wiley

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MTEE1053 - ELECTROMAGNETIC INTERFERENCE AND COMPATABILITY

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

INTRODUCTION

Sources of EMI, Conducted and radiated interference- Characteristics - Designing for electromagnetic compatibility (EMC)- EMC regulation- typical noise path- use of network theory- methods of eliminating interferences.

UNIT – II

METHOD OF HARDENING

Cabling –capacitive coupling- inductive coupling- shielding to prevent magnetic radiation-shield transfer impedance, Grounding – safety grounds – signal grounds single point and multipoint ground systems- hybrid grounds- functional ground layout – grounding of cable shields- ground loops-guard shields

UNIT – III

BALANCING, FILTERING AND SHIELDING

Power supply decoupling- decoupling filters-amplifier filtering –high frequency filtering & shielding – near and far fields- shielding effectiveness- absorption and reflection loss, Shielding with magnetic material- conductive gaskets, windows and coatings- grounding of shields.

UNIT – IV

DIGITAL CIRCUIT NOISE AND LAYOUT

Frequency versus time domain- analogy versus digital circuits- digital logic noise- internal noise sources- digital circuit ground noise –power distribution-noise voltage objectives measuring noise voltages-unused inputs-logic families

UNIT – V

ELECTROSTATIC DISCHARGE, STANDARDS AND LABORATORY TECHNIQUES

Static Generation- human body model- static discharges-ED protection in equipment design-ESD versus EMC, Industrial and Government standards – FCC requirements – CISPR recommendations-Laboratory techniques- Measurement methods for field strength-EMI

TEXT BOOKS:

1. Henry W.Ott, " Noise reduction techniques in electronic systems", John Wiley & Sons, 1989.
2. Bernhard Keiser, "Principles of Electro-magnetic Compatibility", Artech House, Inc. 1987.

REFERENCES:

1. Bridges, J.E Milleta J. and Ricketts.L.W., "EMP Radiation and Protective techniques", John Wiley and sons, USA 1976.
2. IEEE National Symposium on "Electromagnetic Compatibility", IEEE, Press.

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MTEE1061 - INDUSTRIAL ELECTRONICS

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

INDUSTRIAL POWER CONTROLLERS

Uninterrupted power supplies (UPS), online UPS, offline UPS, high frequency online UPS, programmable logic controllers, Voltage stabilizers-servo mechanism, single phase & three phase servo voltage stabilizers

UNIT – II

AMPLIFIERS IN INDUSTRIAL ELECTRONIC CIRCUITS & INDUSTRIAL TIMING CIRCUITS

Introduction, Direct coupled amplifiers (DCA)-basic & special types, differential amplifier as DCA, chopper stabilized DCA, differential DCA using Op-Amp, Timers-classification, thermal, electro-mechanical, electronic timers, transistor control with relay load control, SCR delay timer, IC electronic timer.

UNIT III

OPTOELECTRONIC DEVICES AND CONTROL

Introduction, photo emitters, lasers, liquid crystal displays, photoconductive sensors, photodiodes, phototransistors, LASERs/photo SCRs, opto-couplers, solid state relays (light operated relays), optical fiber.

UNIT – IV

STEPPER MOTORS & SERVO MOTORS CONTROL

Stepper motors and servo motors- control and applications. Servo motors – servo motor controllers – servo amplifiers – selection of servo motor – applications of servo motors.

UNIT – V

HEATING & WELDING CONTROL

Induction heating, Effects of supply frequency & source voltage on induction heating, Dielectric heating, Effect of variation of supply voltage & frequency on dielectric heating, Welding, Resistance welding-theory & classification, scheme of AC resistance welding, Ignitron-heat control by change of firing angles in Ignitrons, complete control in resistance welding by a sequence timer.

TEXT BOOKS:

1. G.K.Mithal and Dr.Maneesha Gupta "Industrial and Power Electronics", Khanna Publisher, 2007
2. Biswanath Paul" Industrial Electronics and control", PHI learning Pvt .,Ltd, 2004

REFERENCES:

1. F.D.Petruzulla" Industrial Electronics", McGraw Hill, Singapore, 1996
2. G. M. Chute and R. D. Chute "Electronics in Industry", McGraw Hill Ltd, Tokyo, 1995.

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MTEE1062 - MODELING & SIMULATION OF POWER ELECTRONIC SYSTEMS

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT - I

INTRODUCTION

Need for Simulation - Challenges in simulation - Classification of simulation programs - Overview of PSPICE, MATLAB and SIMULINK.Review of numerical methods. Application of numerical methods to solve transients in D.C. Switched R, L, R-L, R-C and R-L-C circuits-Extension to AC circuits.

UNIT - II

MODELLING & SIMULATION OF POWER SEMICONDUCTOR DEVICES

Modelling and simulation of diode, SCR, TRIAC, IGBT and Power Transistors -Application of numerical methods to power electronic switches- Simulation of gate/base drive circuits and snubber circuits (using MATLAB and PSPICE)

UNIT – III

MODELLING & SIMULATION OF RECTIFIERS

Mathematical modelling and simulation of single phase and three phase semi, fully controlled rectifiers with R, R-L and R-L-E loads using MATLAB/SIMULINK

UNIT – IV

MODELLING & SIMULATION OF CHOPPERS

Mathematical modelling and simulation of buck, boost and buck-boost converters with R, R-L and R-L-E loads using MATLAB/SIMULINK

UNIT – V

MODELLING & SIMULATION OF INVERTERS

Mathematical modelling and simulation of single phase and three phase half and full bridge inverter with R and R-L loads using MATLAB/SIMULINK

TEXT BOOKS:

1. Robert Ericson, 'Fundamentals of Power Electronics', Chapman & Hall, 1997.
2. Issa Batarseh, 'Power Electronic Circuits', John Wiley, 2004, Simulink Reference Manual, Math works, USA

REFERENCES:

1. Simulink Reference Manua , Math works, USA.

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MTEE1063 - SYSTEM IDENTIFICATION AND PARAMETER ESTIMATION

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I
MODEL PARAMETERIZATIONS
Probability Theory And Random Variable ,A Family of Transfer function Models- Equation Error Model Structure-Linear Regression- ARMAX Model Structure- Other Equation- Error-Type Model Structures-Output Error Model Structure- Box- Jenkins Model Structure- A General Family of Model Structures- Continuous Time Black -Box Model.

UNIT – II
LEAST SQUARE ESTIMATION
Recursive least squares (RLS), Consistency of estimation, Weighted LS.Parametric models, LS estimation, generalized least squares (GLS) and instrumental variable (IV) method.

UNIT – III
PROPERTIES OF LEAST SQUARE ESTIMATION
Persistently exciting input signal, Likelihood functions and maximum likelihood estimation (MLE),Singular value decomposition (SVD),Stochastic approximation algorithm (STA), Model order and structure determination

UNIT – IV
KALMAN FILTERING
Introduction, The asymptotic observer, The Kalman filter problem, kalman state and parameter estimation, Extended Kalman Filters for continuous and discrete time systems.

UNIT – V
MULTI VARIABLE SYSTEM REPRESENTATION
Multi-variable system representation, controllability and observability indices, Feedback system identification and Identification cycle.

TEXT BOOKS:

1. Papoulis and Pillai, Probability, Random Variables and Stochastic Process-, McGraw Hill, 2002.
2. Soderstrom and Stoica, "System Identification", Prentice Hall, 1989.

REFERENCES:

1. Michel Verhaegen and VincentVerdult, Filtering and System Identification A Least Squares Approach-, Cambridge Univ. Press, 2007.
2. M.S. Grewal and A.P. Andrews, Kalman Filtering Theory and Practice Using Matlab-, John Wiley, 2008.
3. Jerry M.Mendel, Lessons in Estimation Theory for Signal Processing, Communications, and Control,Prentice-Hall, 1995.

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MTEE151 - POWER CONVERTERS & DRIVES LAB-I

Lab/Practical	:	3 Periods / Week	Internal Marks	:	25
Tutorial	:	0 Period / Week	External Marks	:	50
Credits	:	2	External Examination	:	3 hrs.

LIST OF EXPERIMENTS

(Minimum five experiments from each cycle can be conducted)

Cycle – I:

Simulation based experiments using PSCAD, MATLAB, and PSPICE

1. Switching characteristics of power MOSFET & IGBT.
2. Performance of Three phase fully controlled converter with RL & RLE Loads.
3. Performance of Three phase IGBT based AC Voltage controller with RL load.
4. Performance of Single phase current source inverter with RL Load.
5. Performance of Three phase bridge inverter with SPWM control.
6. Performance of Chopper fed dc motor drive.
7. Cascade speed control of a dc motor drive.
8. Characteristics of induction machines under balanced and symmetrical conditions for the following
    a. dq model in synchronous reference frame
    b. dq model in stator reference frame
    c. dq model in rotor reference frame.

Cycle – II:

9. Operation of 3-phase fully controlled Converter with R & R-L loads.
10. Performance of 3-phase AC Voltage controller for R & RL loads.
11. Performance of 3-phase IGBT based PWM Inverter on R & R-L loads.
12. Performance and operation of Four Quadrant Chopper with R, RL & RLE loads.
13. Performance of multi level inverter with R and R-L loads.
14. Operation & performance of a 3-phase A.C. Voltage controller fed induction motor
15. Speed control & performance of 3 phase slip ring Induction motor by Static Rotor Resistance Control.

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II SEMESTER

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MTEE201 - SWITCHED MODE POWER CONVERSION

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

NON ISOLATED SWICHMODE POWER CONVERSION

Analysis & Designing of Buck converters, Boost converters, Buck-Boost converters, Cuk converters-continuous and discontinuous modes, applications, problems

UNIT – II

ISOLATED SWICHMODE POWER CONVERSION

Requirement for isolation in the switch-mode converters, transformer connection, Forward and fly back converters, power circuit and steady state analysis-Applications. Push Pull Converters: Power circuit and steady state analysis-utilization of magnetic circuits in single switch and push-pull topologies- Applications, Half bridge and full bridge converters- Power circuit and steady state analysis-Utilization of magnetic circuits and comparison with previous topologies- Applications

UNIT – III

SOFT SWITCHING CONVERTERS

Classification of Resonant converters-Basic resonant circuits- Series resonant circuit-Parallel resonant circuits- Resonant switches, Concept of Zero voltage switching-Principle of operation, analysis of M-type and L-type Buck or boost Converters-Concept of Zero current switching-Principle of operation-Analysis of M-type and L-type Buck or boost Converters.

UNIT – IV

POWER FACTOR CORRECTION CIRCUITS

Introduction, Definition of PF and THD, Power Factor Correction , Energy Balance in PFC Circuits , Passive Power Factor Corrector, Basic Circuit Topologies of Active Power Factor Correctors , System Configurations of PFC Power Supply, CCM Shaping Technique , Current Mode Control, Voltage Mode Control, Other PFC Techniques.

UNIT – V

CONTROL METHODS FOR SWITCHING POWER CONVERTERS

Control methods for buck, boost and forward dc-dc converters using State-space Modeling, Converter Transfer Functions, Pulse Width Modulator Transfer Functions, and Linear Feedback Design Ensuring Stability

TEXT BOOKS:

1. Ned Mohan, Undeland and Robbin, 'Power Electronics: converters, Application and design', John Wiley and sons.Inc, Newyork, 2006.
2. Robert Erickson and Dragon Maksivimovic "Fundamentals of Power Electronics", Springer Publications.

REFERENCES:

1. Philip T.Krein "Elements of Power Electronics", Oxford University Press
2. L. Umanand "Power Electronics Essentials & Applications", Wiley India Private Limited.
3. Issa Batarseh "Power Electronics Circuits", John Wiely, 2004.

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MTEE202 - CONTROL OF MOTOR DRIVES-II

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

VECTOR CONTROL OF INDUCTION MOTOR

Principles of vector control, Direct vector control, derivation of indirect vector control, implementation – block diagram; estimation of flux, flux weakening operation

UNIT – II

SENSORLESS VECTOR CONTROL OF INDUCTION MOTOR

Slip and Speed Estimation at low performance, Rotor Angle and Flux linkage Estimation at high performance -rotor Speed Estimation Scheme- estimators using rotor slot harmonics, Model Reference adaptive systems, Extended Kaman Filter, injection of auxiliary signal on salient rotor.

UNIT – III

CONTROL OF SYNCHRONOUS MOTOR DRIVES

Synchronous motor and its characteristics- Control strategies-Constant torque angle control power factor control, constant flux control, flux weakening operation, Load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams.

UNIT – IV

CONTROL OF SWITCHED RELUCTANCE MOTOR DRIVES

SRM-principle of operation, Design aspects of stator and rotor pole arcs, torque equation, torque-speed characteristics-Stator Excitation-techniques of sensor less operation-convertor topologies- SRM Waveforms-SRM drive design factors-Torque controlled SRM-Torque Ripple- Instantaneous Torque control -using current controllers-flux controllers.

UNIT – V

CONTROL OF BLDC MOTOR DRIVES

Principle of operation of BLDC Machine, Sensing and logic switching scheme, BLDM as Variable Speed Synchronous motor-methods of reducing Torque pulsations -Three-phase full wave Brushless dc motor -Sinusoidal type of Brushless dc motor - current controlled Brushless dc motor Servo drive.

TEXT BOOKS:

1. R. Krishnan "Electric Motor Drives Modelling, Analysis & control", Pearson Education
2. B. K. Bose "Modern Power Electronics and AC Drives", Pearson Publications

REFERENCES:

1. MD Murphy & FG Turn Bull "Power Electronics control of AC motors", Pergman Press, 1st edition-1998.
2. G.K. Dubey "Fundamentals of Electrical Drives", Narosa Publications -1995
3. Peter Vas "Sensor less Vector Direct Torque control", Oxford University Press.
4. Venkataratnam "Special electrical Machines", University press.

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MTEE203 - DSP PROCESSORS AND FPGA

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

INTRODUCTION TO DSP

Introduction, A Digital signal-processing system, the sampling process, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Basic Architectural features of DSP processor TMS320F28X, Memory Mapping.

UNIT – II

I/O & EVENT MANAGERS

Pin Multiplexing (MUX) and General Purpose I/O Overview, Peripheral interrupt expansion unit. Overview of the Event manager (EV), Compare UNITs, Capture UNITs and Quadrature Encoder Pulse (QEP) Circuit

UNIT – III

DSP PROGRAMMING

Instruction Set: data transfer, arithmetic and logical instructions, conditional, bit operating instructions and Programming-arithmetic operations, logical operations and generation of pulses

UNIT – IV

FPGA

Introduction, CPLD Vs FPGA - Types of FPGAs, Configurable logic Blocks (CLB), Input/output Block (IOB) - Programmable Interconnect Point (PIP)

UNIT – V

HDL PROGRAMMING

Instruction set- data transfer, arithmetic instructions, logical instructions, conditional, bit operating instructions. Programming-arithmetic operations, logical operations and generation of pulses.

TEXT BOOKS:

1. TMS320F28X datasheets (Texas Instruments).
2. Hamid.A.Toliyat and Steven G.Campbell" DSP Based Electro Mechanical Motion Control " CRC Press New York , 2004.

REFERENCES:

1. XC 3000 series datasheets (version 3.1). Xilinx,Inc.,USA, 1998.
2. Wayne Wolf," FPGA based system design ", Prentice hall, 2004.

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MTEE204 - MODERN CONTROL THEORY

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

MODAL CONTROL

Introduction to controllability and observability- Effect of state feedback on controllability and observability, Design of State Feedback Control through Pole placement, Full order observer and reduced order observer

UNIT – II

DESCRIBING FUNCTION ANALYSIS

Introduction to Non Linear Systems, behaviour of nonlinear systems, properties of Nonlinear Systems, Types of Nonlinearities – Saturation – Dead Zone – Hysteresis-Relay-Backlash etc, Introduction to Linearization of nonlinear systems, Describing function (DF)– Derivation of general DF, DF for different nonlinearities -saturation, Dead-Zone-Dead-Zone and Saturation, Hysteresis-Backlash .Stability analysis of Non – Linear systems through describing functions

UNIT – III

PHASE PLANE ANALYSIS

Introduction to phase plane analysis, singular points, and their classification, limit cycle and behaviour of limit cycle- Analytical method, Isoclines method, and delta method for constructing Trajectories, phase plane analysis of nonlinear control systems.

UNIT – IV

STABILITY ANALYSIS

Stability of equilibrium state, asymptotic stability, graphical representation, Lyapunov stability theorems, stability analysis of linear and nonlinear systems, construction of Lyapunov functions using– Krasovskii and variable gradient methods.

UNIT –V

OPTIMAL CONTROL

Introduction, Formulation of optimal control problems- Minimum time, Minimum energy, minimum fuel problems- State regulator problem- Output regulator problem-Tracking problem, calculus of variations – fundamental concepts, minimization of functional, Linear quadratic regulator, Linear Quadratic Gaussian(LQG)

TEXT BOOKS:

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers,2003
2. Ashish Tewari, 'Modern control Design with Matlab and Simulink', John Wiley, New Delhi,2002.

REFERENCES:

1. Jinzhi Wang, Zhisheng Duan, Ying Yang, Lin Huang, "Analysis and Control of Nonlinear Systems with Stationary sets-Time domain and Frequency domain methods", World Science publishing co.Pvt Ltd, 2009.
2. George J. Thaler, 'Automatic Control Systems', Jaico Publishers, 1993. M.Gopal, Modern control system theory, New Age International Publishers, 2002.
3. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, "Feedback Control of Dynamic Systems", Fourth edition, Pearson Education, Low price edition.2002

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MTEE2051 - POWER QUALITY

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

OVERVIEW OF POWER QUALITY

Power quality (PQ) problem, Voltage sag, Swell , Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, interruption overview of power quality phenomenon , Remedies to improve power quality, power quality monitoring.

UNIT – II

VOLTAGE SAGS AND INTERRUPTIONS

Sources of sags and interruptions-Estimating Voltage sag performance-Fundamental principles of protection-Solutions at the End-User level-Evaluating the economics of different ride_ through alternatives-Motor_ starting sags-Utility system fault_ clearing issues

UNIT – III

HARMONICS

Harmonic Distortion-Voltage versus current distortion-Harmonic versus Transients-Power system Quantities under non sinusoidal conditions-Harmonic indices-Harmonic sources from commercial loads-Harmonic sources from industrial loads-Locating harmonic sources-System response characteristics-Effects of harmonic distortion- Inter harmonics-Harmonic Distortion Evaluation-Principles of Controlling Harmonics- Harmonic studies-Devices for controlling Harmonics- Harmonic filter Design.

UNIT – IV

POWER QUALITY MONITORING

Monitoring considerations-Historical perspective of power quality measuring instruments-Power quality measurement equipment-Assessment of power quality measurement data-Application of intelligent systems-Power quality monitoring standards.

UNIT – V

POWER QUALITY BENCHMARKING

Introduction, Benchmarking process, power quality contracts, power quality insurance, power quality state estimation, power quality in distribution planning

Wiring and Grounding: Definitions and resources, reasons for grounding, typical wiring and grounding problems, solutions to wiring and grounding problems

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2nd edition.
2. G.T. Heydt, 'Electric Power Quality', 2nd Edition, West Lafayette Stars Circle Publications, 1994.

REFERENCES:

1. M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', New York: IEEE Press, 1999.
2. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', New York: Wiley, 1999.
3. C. Sankaran, "Power Quality", CRC Press, Second Indian reprint 2011.

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MTEE2052 - ADVANCED DIGITAL SIGNAL PROCESSING

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

DIGITAL FILTER STRUCTURE

Block diagram representation-Equivalent Structures-FIR and IIR digital filter Structures All pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures-FIR cascaded Lattice structures-Parallel-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 ALGORITHM IMPLEMENTATION

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 ratio in Low -order IIR filters-Low-Sensitivity Digital filters-Reduction of Product round-off errors using error feedback-Limit cycles in IIR digital filters- 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 & torchy method.

TEXT BOOKS:

1. Sanjit K. Mitra" Digital signal processing", TMH, Second edition
2. Alan V.Oppenheim, Ronald W.Shafer "Discrete Time Signal Processing", PHI, 1st edition, 1996

REFERENCES:

1. John G.Proakis "Digital Signal Processing principles, algorithms and Applications",PHI, 3rd, edition, 2002
2. S.Salivahanan, A.Vallavaraj, C. Gnanapriya "Digital Signal Processing", TMH, 2nd Edition, 2001
3. Auntonian "Digital Filter Analysis and Design", TMH

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MTEE2053 - POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

SOLAR ENERGY& INTEGRATION

Introduction to PV-Cells, Array, Solar power extraction using PV-Cells, I-V Characteristics, PV-Inverters without D.C to D.C converters, Grid interfacing-with isolation, without isolation, Maximum power point tracking-Methods, PV-Inverters with D.C. to D.C. converters-on low frequency side and high frequency side with isolation, without isolation, design aspects of DC -D.C converter.

UNIT – II

WIND ENERGY& INTEGRATION

Sources and potentials, Evaluation of Wind Intensity, Topography, General Classification of Wind Turbines-Rotor Turbines, Multiple-Blade Turbines, Drag Turbines, Lifting Turbines, System TARP–WARP, Principles of Operation, Power and Losses Generated Self-Excited Induction Generator, Magnetizing Curves and Self-Excitation, Interconnected and Stand-Alone Operation, Frequency, Speed and Voltage Controls. Variable-Speed Grid Connection.

UNIT – III

FUEL CELLS

Fuel cells, Commercial Technologies for Generation of Electricity, Constructional Features of Solid Oxide Fuel Cells, Constructional Features of Proton Exchange Membrane Fuel Cells, Load Curve Peak Sharing with Fuel Cells, Advantages and Disadvantages of Fuel Cells, voltage step-up using D.C-D.C converter- with and without battery storage, Voltage controller for Fuel cell using D.C–D.C converter, Inverter interaction with fuel cell for A.C loads, A.C Voltage build-up and controller for fuel cells- using power converters and transformers (isolation).

UNIT – IV

MICROGRIDS

Concept of micro grid, need and applications, formation of micro grid, issues of integration, protection and control of micro grid, integration of renewable energy sources.

UNIT – V

ENERGY STORAGE SYSTEMS

Energy storage parameters, Lead acid batteries-construction features-operating limits-Maintenance, Ultra capacitors-double layer capacitor-high energy capacitor-applications, Flywheels, superconducting magnetic storage system, storage heat

TEST BOOKS:

1. Farret, M. Godoy simoe, "Integration of alternative sources of energy", Felix publisher.
2. Freries LL, 'WInd energy conversion systems', Prentice Hall, UK.

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REFERENCES:

1. Chetan singh solanki, 'Solar Photovoltaic Fundamentals, Technologies and Applications', PHI Learning Pvt Ltd
2. Van overstraeton and Mertens R.P., 'Physics, Technology and use of Photovoltaics', Adam Hilger, Bristol.
3. John F.Walker &Jenkins.N, 'Wind energy technology', John Wiley and sons Chichester, UK.
4. Ramesh & Kumar "Renewable Energy Technologies", Narosa publishers.

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MTEE2061 - HVDC AND FACTS

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

HVDC TRANSMISSION

Types of dc links, schematic of HVDC transmission system, greatz circuit, converter control characteristics, principle of D.C link control, starting and stopping of D.C link,

UNIT – II

MULTI TERMINAL DC LINKS & SYSTEMS

Types-Series, Parallel and series-parallel systems, Converter fault types-D.C fault, A.C fault–protection against over-current and over-voltage in converter station, types of harmonics in HVDC systems, types of filters-AC and DC filters

UNIT – III

FACTS CONCEPTS

Power flow in AC systems-Definitions of FACTS-Basic types of FACTS controllers-power flow control- constraints of maximum transmission line loading-loading capability limits-dynamic stability considerations-benefits from FACTS controllers

UNIT – IV

SERIES & SHUNT COMPENSATIONS

Concepts of static series compensation using GCSC, TCSC and TSSC, applications, Static Synchronous Series Compensator (SSSC)-Principles of shunt compensation–Variable Impedance type & switching converter type- Static Synchronous Compensator (STATCOM) configuration, characteristics and control

UNIT – V

UNIFIED POWER FLOW CONTROLLER

Introduction: The Unified Power Flow Controller-Basic Operating Principles, Conventional Transmission Control Capabilities, Independent Real and Reactive Power Flow Control, Control Structure, Basic Control system for P and Q Control.

TEXT BOOKS:

1. S.Kamakshaih, V.KamaRaju, " HVDC Transmission", Tata Mc Grah Hill education, 1st edition
2. Barain G. Hingorani, "Understanding Facts", IEEE Press, New York 2000

REFERENCES:

1. Kimbark E.X., "Direct Current Transmission", Vol. I, Wiley Interscience, New York, 1971
2. Padiyar, K.R., HVDC Power transmission system, Wiley Eastern Limited, New Delhi, 19903. Yong Hua Sung and Allan T. John (ed), "Flexible AC Transmission System (FACTS)", The Institution of Electrical Engineering, London 1999.
3. EinarV.Larsen, Juan J. Sanchez-Gasca, Joe H.Chow, "Concepts for design of FACTS Controllers to damp power swings", IEEE Trans On Power Systems, Vol.10, No.2, May 1995.
4. Narin G. Hingorani, "High Power Electronics and Flexible AC Transmission Systems", IEEE Power Engineering Review, 1998.

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MTEE2062 - HYBRID ELECTRIC VEHICLES

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

INTRODUCTION

History of hybrid electric vehicles, social and environmental importance of hybrid electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles- Basics of vehicle performance, vehicle power source characterization, transmission characteristics and mathematical models to describe vehicle performance.

UNIT – II

HYBRID ELECTRIC DRIVE-TRAINS

Electric Drive-trains: Basic concepts of electric traction, introduction to various electric drives-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Basic concepts of hybrid traction- introduction to various hybrid drives-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT – III

ELECTRIC PROPULSION

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switched Reluctance Motor drives, drive system efficiency.

UNIT – IV

DRIVE SYSTEM

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor and power electronics, selecting the energy storage technology, Communications, supporting subsystems

UNIT – V

ENERGY MANAGEMENT STRATEGIES

Introduction, classification and comparison of different energy management strategies, implementation issues of energy management strategies

Case Studies: Design of -Hybrid Electric Vehicle (HEV), Battery Electric Vehicle (BEV)

TEXT BOOKS:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.

REFERENCES:

1. James Larminie, John Lowry, "Electric Vehicle Technology Explained",Wiley, 2003.
2. Chris MI, M. Abul and David Wenzhong Gao , "Hybrid Electrical Vehicle Principles and Application with Practical Perspectives".

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MTEE2063 - ARTIFICIAL INTELLIGENT TECHNIQUES

Lecture	:	4 Periods / Week	Internal Marks	:	40
Tutorial	:	1 Period / Week	External Marks	:	60
Credits	:	3	External Examination	:	3 hrs.

UNIT – I

INTRODUCTION TO ARTIFICIAL INTELLIGENCE SYSTEMS

Neural networks, Fuzzy Logic, Genetic algorithms. Basic concepts of Neural networks-Humans and Soft Computing techniques, Organization of the Brain, Biological Neuron, Artificial Neural Networks, McCulloch-Pitts Model, ANN Architectures, Learning strategy (Supervised, Unsupervised, Reinforcement).

UNIT – II

FEED FORWARD NEURAL NETWORKS

Perceptron Models: Perceptron convergence theorem. Generalized Delta Rule, Derivation of Back propagation (BP) Training, Bidirectional Associative Memory (BAM), Architecture and training algorithms. Architecture of Hopfield Network - **Applications:** PWM Controller – selected harmonic elimination PWM.

UNIT – III

FUZZY LOGIC-I

Introduction to Fuzzy sets - Properties, Operations, relations, Fuzzy membership functions - different types. Fuzzification, Membership value assignment, development of rule base.

UNIT – IV

FUZZY LOGIC-II

Implication methods-Defuzzification methods. Defuzzification to crisp sets. **Applications:** Design of Fuzzy Controller for speed control of DC motor – efficiency Improvement of three phase induction motor – Induction motor speed control.

UNIT –V

GENETIC ALGORITHM

Basic concepts of Genetic algorithm – Selection – Cross over – Mutation – Algorithmic Steps – **Applications:** Controllers – Proportional – Derivative – Integral.

TEXT BOOKS:

1. Jacek M. Zuarda, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.
2. T.J.Ross, "Fuzzy Logic with Applications" Mc Graw Hill Inc, 1997.

REFERENCES:

1. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms"-PHI, New Delhi, 2003.
2. Peter Vas "artificial intelligence based Electrical Machines and Drives", Oxpord University Press.
3. B.K.Bose "Modern Power Electronics and AC Drives", Pearson Publications.
4. S.N.Sivanandam, S.Sumathi, S.N.Deepa, "Introduction to neural networks using MATLAB 6.0, TMH, 2006 Edition.
5. Devendra K. Chaturvedi, "Soft Computing:Techniques & its applications in Electrical Engineering, Springer Science.

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MTEE251 - POWER CONVERTERS & DRIVES LAB-II

Lab/Practical	:	3 Periods / Week	Internal Marks	:	25
Tutorial	:	0 Period / Week	External Marks	:	50
Credits	:	2	External Examination	:	3 hrs.

LIST OF EXPERIMENTS

(Minimum five experiments from each cycle can be conducted)

Cycle – I: Simulation based experiments using PSCAD, MATLAB, and PSPICE

1. Performance of capacitor start & capacitor run single phase Induction motor.
2. Performance of dc-dc Boost converter.
3. Performance of a resonant converter.
4. Performance of VSI fed three phase induction motor.
5. Performance of Open-loop V/f control of a synchronous motor drive.
6. Speed control of PM synchronous motor by voltage control method
7. Speed control of BLDC motor by voltage control method

Cycle – II:

8. PIC Microcontroller based Power factor correction with Boost converter
9. Speed control of BLDC motor by voltage control method.
10. Speed control of Switched Reluctance Motor with eddy current load.
11. Performance of DSP based V/f control of 3 phase induction motor.
12. Speed control of PMSM Drive.
13. Digital to Analog converter (DAC) and Analog to Digital converter (ADC) using DSP.
14. Generation of sinusoidal signal using DSP.
15. Generation of three phase sine triangle PWM pulses using DSP.

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