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Name of Program: M. Tech (Power Electronics)

Session 2018-19

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MTMA101	MA	Advanced Mathematics	60	20	20	-	-	3	1	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Educational Objectives (CEOs):

1. To develop fundamentals of the Various Transforms and the techniques of finding the Analytical and the Numerical solutions of the PDE.
2. To develop modern Probability theorems with the applications and the Mathematical Modelling and the Solution of the various Random Processes.
3. To develop The Concepts of the Fuzzy Set and various Operations with the Fuzzy Logic and the Reliability Engineering.

Course Outcomes (COs):

After the successful completion of this course students will be able to

1. Know the Analytical and the Numerical solutions of the PDE and the various Transforms used in the field of the Technology.
2. Apply the techniques used in the Modern Probability theorems.
3. Model and find the Solution of the various Random Processes.
4. Understand and apply the basics of the Fuzzy Set and various Operations with the Fuzzy Logic.
5. Deal with the problems of the Reliability Engineering.

Syllabus

UNIT I

Solution of Partial Differential Equation (PDE) by separation of variable method, numerical solution of PDE (Laplace, Poisson's, Parabola) using finite difference methods, Elementary properties of FT, DFT, WFT, Wavelet transform, Haar transform.

UNIT II

Probability, compound probability and discrete random variable. Binomial, Normal, Poisson's distribution. Sampling distribution, elementary concept of estimation and theory of hypothesis, recurred relations.

UNIT III

Stochastic process, Markov process transition probability transition probability matrix, just and higher order Markov process, Markov chain. Queuing system, transient and steady state, traffic intensity, distribution queuing system, concepts of queuing models (M/M/1: Infinity/ Infinity/ FC FS), (M/M/1: N/ Infinity/ FC FS), (M/M/S: Infinity/ Infinity/ FC FS)

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UNIT IV

Operations of fuzzy sets, fuzzy arithmetic & relations, fuzzy relation equations, fuzzy logics. MATLAB introduction, programming in MATLAB scripts, functions and their application.

UNIT V

Introduction and definition of reliability, derivation of reliability functions, Failure rate, Hazard rate, mean time t future & their relations, concepts of fault tolerant analysis, Elementary idea about decision theory and goal programming.

Reference Books:

1. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Hill.
2. Advance Engineering Mathematics by Ervin Kreszig, Wiley Easten Edd.
3. Applied Numerical Methods with MATLAB by Steven C chapra, Tata Mc Graw Hill.
4. Introductory Methods of Numerical Analysis by S.S. Shastry,
5. Introduction of Numerical Analysis by Forberg
6. Numerical Solution of Differential Equation by M. K. Jain
7. Numerical Mathematical Analysis By James B. Scarborogh
8. Fourier Transforms by J. N. Sheddon
9. Fuzzy Logic in Engineering by T. J. Ross
10. Fuzzy Sets Theory & its Applications by H. J. Zimmersoms.

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment *	End Sem University Exam	Teachers Assessment*				
MTPE101	EE	Computer Applications in Power Systems	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
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Course Educational Objectives (CEOs):

The Students (A) Will Be Able tolearn essential optimization techniques for applying to day to day problems and (B)impart the load flow solution methodology and (C) assessment methods of power system dynamics. They will be familiar with the method to evaluate power system economic operation and optimal power flow analysis. (D)

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

The students will be able to

1. To recognize the main computer-methods in power system dynamics.
2. To apply optimization techniquesto engineering and other problems.
3. To understand the fundamentals of the linear and non-linear programming problem.
4. To demonstrate the computer-procedures for economic load dispatch operation and optimal load flow analysis of power system networks using Newton-Raphson iterative methods.
5. To develop ability to solve real problems of an existing power system using the computer.
6. **To perform** contingency analysis for power system networks

Syllabus

UNIT -I

Optimization Techniques

Introduction, Statement of an optimization problem, design vector, design constraints, constraint surface, objective function, classification of optimization problem. Classical optimization Techniques, single variable optimization, multivariable optimization with equality constraints, Direct substitution method, constrained variation method, Lagrange Multiplier method, formulation of multivariable optimization, Kunh Tucker conditions.

UNIT -II

Optimization Techniques

Nonlinear Programming, Unconstrained optimization Techniques, Direct search methods, Indirect search methods, Descent methods, One dimensional minimization methods, unimodal function, elimination methods.

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UNIT -III

Load Flow Studies

Revision of Load flow studies by using Newton Raphson method (polar and rectangular). Contingency evaluation, concept of security monitoring, Techniques of contingency evaluation, Decoupled load flow and fast decoupled load flow.

UNIT -IV

Three Phase Load Flow: Three phase load flow problem notation, specified variables, derivationof equations.

AC-DC load flow: Introduction, formulation of problem, D.C. System model, convertervariables, Derivation of equations, Inverter operation, generalized flow chart for equation solution.

UNIT -V

Optimal Power Flow Analysis

Optimal power flow analysis considering equality and inequality constraints.Economic dispatch with and without limits (Classical method) Gradient method.

Optimal Power System Operation: Calculation of loss coefficients, loss coefficients usingsensitivity factors, power loss in a line, Generation shift distribution factors, Transmission loss coefficients, transmission loss formula as a function of generation and loads, economic dispatch using loss formula which is function of real and reactive power, linear programming method.

References

1. Computer Aided Power System Operation and Analysis-R.N.Dhar, Tata McGraw Hill New Delhi.
2. Computer Techniques in Power System Analysis- M.A. Pai, Tata Mc-Graw Hill New Delhi.
3. Computer Methods in Power System Analysis- Stagg and El.Abiad, Mc-Graw Hill (International Student Edition.)
4. Computer Analysis of Power Systems-J.Arrilinga, C.P.Arnold. Wiely Eastern Ltd.
5. Optimisation Techniques-S.S.Rao, Wiely Eastern Ltd, New Delhi.
6. Modern Power System Engineering, Nagrath and Kothari (Tata McGraw Hill)
7. Electrical Energy System Theory–an introduction- OlleElgerd. TMH Publishing Company, New Delhi.
8. Power System Optimisation- D. P. Kothari, J. S. Dhillon, PHI.
9. Power Generation Operation and Control – Allen Wood, Wiley Publications.

List of Experiments

1. Load flow analysis by using Newton Raphson method on digital computer.
2. Optimal Power flow analysis.
3. AC-DC load flow analysis on digital computer.
4. Analysis of various types of faults on digital computer.
5. Short circuit analysis.

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			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MTPE102	PE	Analysis of Power Electronics Circuits-I	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Educational Objectives (CEOs):

1. To provide an in depth knowledge about the operation and analysis of power converter circuits.
2. A foundation in the fundamentals of power electronic circuits and Ability to design and analytical formulation of various power electronic circuits.

Course Outcomes (COs):

The students will be able to

1. Acquire knowledge about the concepts and techniques used in power electronics circuits
2. Design and analyze various power converter circuits.
3. Analyze and comprehend the various operating modes of different configurations of power converters.
4. Design and analyze A.C. voltage Controllers & Cyclo converters.

Syllabus

UNIT I

Modern Power Semiconductor Devices: Modern power semiconductor devices – MOS turn Off Thyristor (MTO) – Emitter Turn off Thyristor (ETO) – Intergrated Gate-Commutated thyristor (IGCTs) – MOS-controlled thyristors (MCTs) – Static Induction circuit – comparison of their features.

UNIT II

Three-Phase Ac Voltage Controllers: Single phase AC voltage controllers: with Resistive, Resistive – inductive and Resistive – inductive-induced EMF loads – AC voltage controllers with PWM Control – Effects of source and load inductances – Synchronous tap changers – Applications – numerical problems. Three Phase AC Voltage Controllers – Analysis of controllers with star and delta Connected Resistive, Resistive-inductive loads – Effects of source and load Inductances – applications – numerical problems.

UNIT III

Cyclo-Converters: Single phase to single phase cyclo-converters – analysis of midpoint and bridge Configurations – Three phase to three phase cyclo-converters – analysis of Midpoint and bridge configurations – Limitations – Advantages – Applications – numerical problems.

UNIT IV

Single-Phase & Three-Phase Converters: Single phase converters – Half controlled and fully controlled converters – Evaluation of input power factor and harmonic factor – continuous and Discontinuous load current – single phase dual converters – power factor Improvements – Extinction angle control –

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symmetrical angle control – PWM – single phase sinusoidal PWM – single phase series converters – Applications – Numerical problems.

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 phase converters – applications – Numerical problems.

UNIT V

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

Text Books:

1. Power Electronics – Mohammed H. Rashid – Pearson Education Third Edition – First Indian reprint 2004.
2. Power Electronics – Ned Mohan, Tore M. Undeland and William P. Robbins – John Wiley and Sons – Second Edition.
3. Power Electronics Devices, Circuits and Industrial applications, V. R. Moorthi, Oxford University Press

Reference Books:

1. Power Electronics, Dr. P. S. Bimbhra, Khanna Pubishers.
2. Elements of Power Electronics, Philip T. Krein, Oxford University Press.
3. Power Electronics, M. S. Jamil Asghar, PHI Private Limited.
4. Principles of Power Electronics John G. Kassakian, Martin F. Schlect, Geroge C. Verghese, Pearson Education.

List of experiments.

A) HARDWARE

1. Single Phase Semi-converter with R-L load for continuous & discontinuous conduction modes
2. Single Phase Full-converter with R-L load for continuous & discontinuous conduction modes
3. Digital firing circuit
4. Three Phase Full-converter with R-L-E load
6. Current & voltage commutated thyristorized chopper
7. MOSFET/ IGBT/Transistor based DC Choppers (Buck & Boost)
8. Half bridge square wave inverter
9. Single-phase Sine triangle PWM inverter
10. Single Phase AC Voltage Controller

B) SIMULATION

1. 3-phase full converter and semi-converter with R, RL and RLE loads
2. 3-phase ac voltage controller
3. Closed loop control of DC-DC converter
4. 3-phase sine PWM inverter
5. Measurement of THD of current & voltage waveforms of controlled & uncontrolled 3-phase rectifiers.

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MTPE113	PE	FACTS	60	20	20	-	-	3	1	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.
*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Educational Objectives (CEOs):
To enable the students acquire a comprehensive knowledge on the concepts and technology of flexible AC transmission systems.

Course Outcomes (COs):
The students will be able to
1. Apply knowledge of FACTS controller to AC transmission system
2. Apply shunt, series and their combination for compensation.
3. Identify, formulate and solve network problems with FACTS controller.
4. Familiarize application & control strategies of FACTS controllers to improve power transmission capability.

Syllabus

UNIT I
FACTS Concept and General System Considerations, Power Flow in AC System, Definitions on FACTS, Basic Types of FACTS Controllers. Converters for Static Compensation, Three Phase Converters and Standard Modulation Strategies (Programmed Harmonic Elimination and SPWM), GTO Inverters, Multi - Pulse Converters and Interface Magnetics,

UNIT II
Transformer Connections for 12 , 24 and 48 pulse operation, Multi -Level Inverters of Diode Clamped Type and Flying Capacitor Type and suitable modulation strategies (includes SVM), Multi -level inverters of Cascade Type and their modulation, Current Control of Inverters

UNIT III
Static Shunt Compensators, SVC and STATCOM, Operation and Control of TSC, TCR, STATCOM, Compensator Control, Comparison between SVC and STATCOM, STATCOM for transient and dynamic stability enhancement

UNIT IV
Static Series Compensation, GCSC, TSSC, TCSC and SSSC, Operation and Control, External System Control for Series Compensators, SSR and its damping, Static Voltage and Phase Angle Regulators, TCVR and TCPAR, Operation and Control

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UNIT V

UPFC and IPFC, The Unified Power Flow Controller, Operation, Comparison with other FACTS devices, control of P and Q, Dynamic Performance, Special Purpose FACTS Controllers, Interline Power Flow Controller, Operation and Control.

Text Books:

1. N.G . Hingorani & L. Gyugyi : Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems. IEEE Press, 2000.
2. T.J.E Miller, Reactive Power Control in Electric Systems John Wiley & Sons Ned Mohan et.al: Power Electronics.John Wiley and Sons.
3. 'FACTS Controllers and applications" course book for STTP, 2003, Dr Ashok S & K S Suresh kumar

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment *	End Sem University Exam	Teachers Assessment*				
MTPE123		Renewable Energy System	60	20	20	-	-	3	1	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Educational Objectives (CEOs):

1. To learn fundamentals and main characteristics of renewable energy systems
2. To compare different renewable energy technologies
3. To choose the most appropriate based on local conditions.

Course Outcomes (COs):

The students will be able to

1. Describe the main components of different renewable energy systems.
2. Perform simple techno-economical assessments of renewable energy systems
3. Perform and compare basic environmental assessments of renewable energy systems and conventional fossil fuel systems.
4. Design renewable/hybrid energy systems that meet specific energy demands, are economically feasible and have a minimal impact on the environment
5. Discuss how to utilize local energy resources to achieve the sustainable energy system

Syllabus

UNIT-I

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

UNIT-II

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

UNIT-III

Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation. Wave energy conversion: properties of waves and power content, vertex motion of Waves, device applications. Types of ocean thermal energy conversion systems Application of OTEC systems examples,

UNIT-IV

Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, therma electric energy conversion, principles of EMF generation, description of fuel

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cells, Co-generation and energy storage, combined cycle co-generation, energy storage. Global energy position and environmental effects: energy units, global energy position.

UNIT-V

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

Reference Books

1. "Energy conversion systems" by Rakosh das Begamudre, New age International publishers, New Delhi - 2000.
2. "Renewable Energy Resources" by John Twidell and Tony Weir, 2nd Edition, Fspon & Co M. Tech –(PE/PEED/PID)-R13 Regulations

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
MTPE133		FACTS controller	60	20	20	-	-	3	1	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Educational Objectives (CEOs):

1. To understand the basic principles, modeling aspects, control, benefits and scope for different types of FACTS controllers and their characteristics.
2. To familiarize with the concept of FACTS envisages the.
3. To use of power electronics
4. To improve system operation by fast & reliable control.

Course Outcomes (COs):

The students will be able to

1. To apply knowledge of FACTS Controllers, shunt, series and combination of compensation and knowledge of recent trend in FACTS controllers.
2. **To identify** the needs of power systems and utility networks where installation of FACTS Controllers/Devices becomes essential.
3. **To compute** power transmission capability of a transmission system and apply reactive compensation methods for its improvement.
4. To comprehend the operating principles, control systems and modeling of different FACTS Controllers.
5. **To apply** the techniques of FACTS controller design for enhancing power transfer, increasing stability, augmenting system damping, mitigating sub-synchronous resonances, preventing voltage instability, performing load compensation, etc.
6. To learn the integration in power flow analysis and their effectiveness in distribution system for harmonic mitigation etc.

Syllabus

Unit-I

FACTS Concept and General System Considerations, Power Flow in AC System, Definitions on FACTS, Basic Types of FACTS Controllers.Converters for Static Compensation, Three Phase Converters and Standard Modulation Strategies (Programmed Harmonic Elimination and SPWM), GTO Inverters, Multi -Pulse Converters and InterfaceMagnetics.

Unit-II

Transformer Connections for 12 , 24 and 48 pulse operation, Multi -Level Inverters of Diode Clamped Type and Flying Capacitor Type and suitable modulation strategies (includes SVM), Multi -level inverters of Cascade Type and their modulation, Current Control of Inverters.

Unit-III

Static Shunt Compensators, -SVC and STATCOM, Operation and Control of TSC, TCR,

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STATCOM, Compensator Control, Comparison between SVC and STATCOM, STATCOM for transient and dynamic stability enhancement.

Unit-IV

Static Series Compensation, GCSC, TSSC, TCSC and SSSC, Operation and Control, External System Control for Series Compensators, SSR and its damping, Static Voltage and Phase Angle Regulators, TCVR and TCPAR, Operation and Control

Unit-V

UPFC and IPFC, The Unified Power Flow Controller, Operation, Comparison with other FACTS devices, control of P and Q, Dynamic Performance, Special Purpose FACTS Controllers, Interline Power Flow Controller, Operation and Control.

Text Books:

1. N.G .Hingorani& L. Gyugyi : Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems. IEEE Press, 2000.
2. T.J.E Miller, Reactive Power Control in Electric Systems John Wiley & Sons Ned Mohan et.al: Power Electronics.John Wiley and Sons.
3. 'FACTS Controllers and applications" course book for STTP, 2003, Dr Ashok S & K S Suresh kumar

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MTPE114		Solid State AC-DC Drives	60	20	20	-	-	3	1	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Educational Objectives (CEOs):

a. To study and analyze the operation of the converter / chopper fed DC drive, both qualitatively and quantitatively.
b. To understand various operating regions of the induction motor drives.

Course Outcomes (COs):

The students will be able to
The students will be able to

1. Design and Analyze different control techniques of DC Drive.
2. Design and Analyze different control techniques of AC Drive
3. Select suitable Special Electrical Drive and apply appropriate control method for the application.

Syllabus

UNIT I: Single phase dc drives Single phase drives-motor and input supply performance parameters separately excited d.c. motor drives basic equations –waveforms-power factor improvement – semiconductor operation of full converters.

UNIT II: Three phase dc drives Three phase drives-operation of semi conductors and full converters-dual converters-non – circulating current and circulating current mode-dual mode dual converters-reversible drives armature current reversal field current reversal drives selection

UNIT III: Chopper fed dc drives Single quadrant, two quadrant and four quadrant choppers chopper details –performance characteristics- separately excited d.c. motor – d.c. series motor input filters, multiphase choppers-dynamic and regenerative braking of chopper controlled drives.

UNIT IV Inverter fed induction motors Voltage control – operation of induction motor with non-sinusoidal waveform-air gap mmf-hamonic behavior motor losses-harmonic torques-vector control of induction motors.

UNIT V: Phase control of induction motors Stator voltage control schemes-slip power recovery schemes rotor resistnce control-cyclo conveters principle of operation-cyclo-converter fed drives.

Text Books:

1. Gopal K.Dubey, "Power Semi conductor controlled drives " Prentice Hall Inc., New Jersey1989.
2. Bimal K. Bose. 'Modern Power Electronics and AC Drives', PHI / Pearson Education, 2002.

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Reference Books:

1. N.K.De and S.K.Sen Electrical Drices" PHI, 2006 9th print.
2. Murphy J.M.D. and Turnbull, " Thyristor control of AC Motor" Pergamon Press Oxford 1988.
3. R. Krishnan, 'Electric Motor & Drives Modeling, Analysis and Control', Prentice Hall of India, 2001

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MTPE124		HVDC Transmission	60	20	20	-	-	3	1	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Educational Objectives (CEOs):

1. Elicit the advantages of HVDC transmission Systems.
2. Mould students to acquire knowledge about HVDC transmission Systems and its control aspects.
3. Understand about the over voltage and effects on power systems.
4. Complete analysis of harmonics and basis of protection for HVDC System.
5. Concept of shunt and Series operation in transmission lines and applications of various Shunt and Series FACTS Controllers in transmission system.

Course Outcomes:

At the end of course, the students will be able to learn.

1. Various aspects of EHV DC transmission.
2. Application of Shunt and Series Compensating devices in transmission System.
3. Control techniques for HVDC power flow
4. Functions of various components in HVDC station.
5. Various types of Filters and their applications.
6. Advantages and limitations of HVDC transmission.

Syllabus

UNIT-I

INTRODUCTION

General consideration, Power Handling Capabilities of HVDC Lines Basic Conversion principles, static converter configuration.

UNIT-II

STATIC POWER CONVERTERS

3-pulse, 6-pulse, and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter – special features of converter transformers. Harmonics in HVDC Systems, Harmonic elimination, AC and DC filters.

UNIT-III

CONTROL OF HVDC CONVERTERS AND SYSTEMS

Constant current, constant extinction angle and constant ignition angle control Individual phase control and equidistant firing angle control DC power flow control. Interaction between HV AC and DC systems – Voltage interaction Harmonic instability problems and DC power modulation.

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UNIT-IV

MTDC SYSTEMS & OVER VOLTAGES

Series parallel and series parallel systems their operation and control. Over voltages due to disturbances on DC side, over voltages due to DC and AC side line faults.

UNIT-V: CONVERTER FAULTS & PROTECTION

Converter faults, over current protection – valve group, and DC line protection over voltage protection of converters, surge arresters

TEXT BOOKS:

1. E.W. Kimbark *"Direct current Transmission"*, Wiely InterScience New York.
2. Jos Arillaga *"High Voltage Direct current Transmission"* IEE London UK.
3. K.R. Padiyar *"High Voltage Direct current power Transmission system "*, New Academic Science, 30 Jan 2017
4. E. Uhlman *"Power Transmission by Direct Current"*, Springer Science & Business Media, 06 Dec 2012

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Name of Program: M. Tech (Power Electronics)

Session 2018-19

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment *	End Sem University Exam	Teachers Assessment*				
MTPE134		Soft computing	60	20	20	-	-	3	1	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.
*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Educational Objectives (CEOs):

The Students (A) Will Be Able to familiarize with different soft computing techniques (B) with emphasis on their analysis and application to practical engineering problems(C) efficiently & effectively (D)

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

The students will be able to

1. Identify various methods and models of neural network.
2. Classify, formulate, and train neural network architecture.
3. Classify, formulate fuzzy logic system.
4. Demonstrate the knowledge of genetic algorithm.
5. Identify and apply soft computing techniques in engineering problem.

Syllabus

UNIT I

Artificial Neural Network

Introduction to soft computing - soft computing vs. hard computing- various types of soft computing techniques- applications of soft computing-Neuron- Nerve structure and synapseArtificial Neuron and its model- activation functions- Neural network architecture- single layer and multilayer feed forward networks- McCullochPitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -back propagation algorithm- factors affecting back propagation training applications..

UNIT II

Artificial Neural Network

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

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UNIT III

Fuzzy Logic System

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

UNIT IV

Genetic Algorithm

Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters, Solution of typical control problems using genetic algorithm- Concept on some other search techniques like tabu search and ant colony search techniques for solving optimization problems.

UNIT V

Applications

GA application to power system optimization problem- Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural Network interconnection systems- Implementation of fuzzy logic controller using Matlab fuzzy logic toolbox-Stability analysis of fuzzy control systems.

References Books:

1. Laurene V. Fausett, Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Pearson Education,
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
3. Zimmermann H.J. "Fuzzy set theory and its Applications" Springer international edition, 2011.
4. David E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson Education, 2009.

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