KURUKSHETRA UNIVERSITY, KURUKSHETRA
Master of Technology (Electrical Engg.)
Credit Based
Scheme of Courses/Examination

Semester- I

S. N.	Course Code	Subject	Teaching Schedule				Evaluation Marks				Duration of Exam.(Hrs)	Credit
			L	T	P	Tot	External Marks	Internal Marks	P/V	Tot		
1	MTEE-101A	Advanced Power System Analysis	3	1	-	4	60	40	-	100	3	4
2	MTEE-103A	Power Apparatus & Electric Drives	3	1	-	4	60	40	-	100	3	4
3	MTEE-105A	Instrumentation & Control	3	1	-	4	60	40	-	100	3	4
4	MTEE-107A	Optimization Theory	3	1	-	4	60	40	-	100	3	4
5	MTEE-109A	Instrumentation & Control Lab	-	-	3	3	-	40	60	100	3	2
6	MTEE-111A	Advanced Power System Lab-I	-	-	3	3	-	40	60	100	3	2
		Total				22	240	240	120	600		20

Semester-II

SN	Course Code	Subject	Teaching Schedule				Evaluation Marks				Duration of Exam.(Hrs)	Credit
			L	T	P	Tot	External Marks	Internal Marks	P/V	Tot		
1	MTEE-102A	Advanced Power System Protection	3	1	-	4	60	40	-	100	3	4
2	MTEE-104A	Renewable Energy Resources	3	1	-	4	60	40	-	100	3	4
3	MTEE-106A	HVDC Transmission and FACTS Devices	3	1	-	4	60	40	-	100	3	4
4	MTEE-108A	Intelligent Control	3	1	-	4	60	40		100	3	4
5	MTEE-110A	Modeling and Simulation Lab	-	-	3	3	-	40	60	100	3	2
6	MTEE-112A	Advanced Power System Lab-II	-	-	3	3		40	60	100	3	2
						22	240	240	120	600		20

Note: At the end of second semester, the candidates will have to undergo thorough literature survey during vacations in the field of interest which will be the basis for his/her Dissertation/ Synopsis in semester-III and IV. A report /synopsis is to be submitted & presentation /viva will be conducted internally on literature surveyed in the end of Semester-III.

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Master of Technology (Electrical Engg.)

Credit Based

Scheme of Courses/Examination

Semester-III

SN	Course Code	Subject	Teaching Schedule				Evaluation Marks				Duration of Exam.(Hrs.)	Credit
			L	T	P	Tot	External Marks	Internal Marks	P/V	Tot		
1		*Elective-I	3	1	-	4	60	40	-	100	3	4
2		**Elective-II	3	1	-	4	60	40	-	100	3	4
3	MTEE-217A	Synopsis						100		100	-	12
			-	-	-	-	120	180		300	-	20

Electives Offered

***Elective-I**

SN	Course Code	Subject	SN	Course Code	Subject
1	MTEE -201A	Power Electronics Applications in Renewable Energy	3	MTEE -205 A	Advanced Microprocessors
2	MTEE -203A	Electric Power Distribution & Automation	4	MTEE -207A	Reliability Engineering

****Elective-II**

SN	Course Code	Subject	SN	Course Code	Subject
1	MTEE -209A	Load and Energy Management	3	MTEE -213A	Power System Restructuring & Deregulation
2	MTEE -211A	Special Topics in Power System	4	MTEE -215 A	Advanced Digital Signal Processing

Semester-IV

Sl. No	Course No.	Subject	Teaching Schedule	Examination Schedule (Marks)			Credit
			Total	Sessional	P/V	Tot	
1	MTEE-202A	Dissertation(Thesis)	-	100	200	300	20
				100	200	300	20

Note: Each student is required to publish at least two research papers (minimum standards: one paper in a referred journal and one in an International journal/National conference), to enable him/her to qualify for the award of M. Tech degree. Before submission of Dissertation, student has to submit proof of his/her publications with acceptance.

First Semester

KURUKSHETRA UNIVERSITY KURUKSHETRA
M. Tech. (Electrical Engg.) Credit Based w.e.f.Aug.2015

L	T	Ext	Int	Cr
3	1	60	40	4

Advanced Power System Analysis
MTEE-101A

UNIT 1

Network Modelling: System graph, loop, cut set and Incidence matrices, Primitive network and matrix, Formation of various network matrices by singular transformation.
Bus Impedance Algorithm: Singular transformation, direct inspection, Building Block algorithm for bus impedance matrix, Addition of links, addition of branches, (considering mutual coupling).

UNIT 2

Balanced and unbalanced network elements: Representation of three phase network elements, representation under balanced and unbalanced excitation, transformation matrices, symmetrical components, sequence impedances, unbalanced elements and three phase power invariance.
Short circuit studies: Network representations for single line to ground fault, line to line fault, LL-G fault, and 3-phase faults, Short circuit calculations for various types of faults in matrix form.

UNIT 3

Load flow studies: Load flow and its importance. classification of buses, load flow techniques, Iterative solutions and computer flow charts using Gauss-Seidel and Newton-Raphson methods, Decoupled and fast decoupled methods, Representation of regulating and off nominal ratio transformers and modification of Y_{bus}.

UNIT 4

Power system security: Introduction to Power system security, Addition and removal of multiple lines, network reduction for contingency analysis, current injection, shift destitution factor, single outage contingency analysis.
State estimation in power systems: data acquisition system, Method of least-squares, State estimation by weighted least square technique.

References:

1. G.W. Stagg and A.H EI-Abaid, “Computer methods in Power system analysis”, McGraw Hill, New York.
2. L. P. Singh, “Advanced Power System Analysis and Dynamics”, New Age, Int. Pub, New Delhi.
3. N. V. Ramana, “Power System Analysis”, Pearson Education, Noida, 2012.
4. T K Nagsarkar and M S Sukhija, “ Power System Analysis”, Oxford University Press, New Delhi, 2010
5. K Uma Rao, “Computer Techniques and Models in Power System”, I K Publications, New Delhi, 2007.
6. John J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill, New York, 1994.
7. Allen Wood and Bruce Wollenberg : Power Generation operation & control, John Wiley & Sons, 1984.
8. I. J. Nagrath and D P Kothari, “Power System Engineering” McGraw Hill, New York, 1994.
9. M. A. Pai, ‘Computer Techniques in Power System Analysis’, 2nd Edition, TMH-New Delhi.

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L	T	Ext	Int	Cr
3	1	60	40	4

Power Apparatus & Electric Drives
MTEE-103A

UNIT-1

Generalized Theory of Electrical Machines: Two pole machine, Kron's primitive model and linear transformation

Induction Machines: Electrical performance equations, effect of voltage and frequency variations on induction machines performance, slip power control schemes, slip power control, Leblanc and Kramer system of speed control.

UNIT-2

Transformer: Introduction of three phase transformer, excitation phenomenon in transformers, harmonics in single phase and three phase transformers, disadvantages and suppression of harmonics in transformers, Tertiary winding and its effect.

Multi-circuit Transformers: Advantage, theory, equivalent circuit, regulation.

Three phase autotransformer, Transformer transients and inrush current phenomenon in three phase transformer.

UNIT-3

D.C. drives: Introduction, Theory of operation, E.M.F. equation, state-space modeling, block dig. & transfer function, Fundamental relationship, Field control, Armature control, Armature & Field control, 4- quadrant operation, steady state analysis of 3-Φ converter controlled DC motor drive, transfer function of DC control system, Design of controllers.

UNIT-4

Induction motor drives: Introduction, principle of operation, induction- motor equivalent circuit, real-time model of a 2- Φ induction motor, transformation to obtain constant matrices, 3 to 2- Φ transformation, power equivalence, derivation of commonly used induction motor models.

References:

1. P S Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers, New Delhi.
2. Krishan R, "Electric Motor Drives: Modeling Analysis and Control", PHI Pvt Ltd. New Delhi-2013.
3. Dubey G K, "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi.
4. S K Pillai, "A First Course on Electrical Drives", New Age International (P) Ltd., New Delhi.
5. Fitzgerald and Kingsley, "Electric Machinery", McGraw Hill Co. New Delhi
6. MIT Staff, "Magnetic Circuits and Transformers", MIT Press Cambridge.
7. E Openshaw Taylor, "The performance and design of A.C. commutator motors; Including the single-phase induction motor Unknown Binding", Wheeler Publicationss, 1971.
8. Bose B K, "Power Electronics and Variable Frequency Drives: Technology and Applications", IEEE Press, 1997.

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L	T	Ext	Int	Cr
3	1	60	40	4

Instrumentation & Control
MTEE- 105A

Unit 1

Transducers: Introduction ,Characteristics and Classifications of electrical transducers, measurement of displacement, Force, pressure, speed, temperature and intensity of light using different electrical transducers, advantages, disadvantages and applications of transducers

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Unit 2

Smart Sensors: Introduction, architecture of smart sensor, optical sensor, microelectronic sensor, chemical, Bio Sensor and Physical Sensor, piezo-resistive pressure sensor, fiber optic temperature sensor, light sensor, advantages, disadvantages and applications of smart sensors.

Unit 3

Virtual Instrumentation: Introduction, architecture of VI, Evaluation and architecture of VI, conventional Virtual Instrumentation, Advantage of Lab View, Software Environment, Creating and Saving VI, front Panel and block diagram Tool Bar, Palettes, front panel control and indicators, block diagram : Terminals, Nodes, Functions, Sub VI, Data Flow Program.

Unit 4

VI Structures: Control structures, selection structures, case structures, Sequence structures, formula node, array, single and multi-dimensional array, auto indexing, clusters, Creating clusters control and indicators, data plotting.

References:

1. Gary Johnson, Lab VIEW Graphical Programming, Second edition, McGraw Hill, 1997.
2. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey, 1997.
3. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement.
4. Jovitha Jerome, Virtual Instrumentation using Lab View.

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L	T	Ext	Int	Cr
3	1	60	40	4

Optimization Theory
MTEE- 107A

Unit 1

Optimization theory: Introduction & its application in engineering, Convex set & functions, Affine set, supporting & separating Hyper-planes. Solution of Multi-variable optimization problem with equality constraints by using Lagrange Multiplier, Kuhn-Tucker condition & Convex programming problem.

Unit 2

Linear Programming Problems: Introduction, problem formulation, graphical Method, canonical & standard form of L.P.P, Simplex method, Dual principle, & Dual Simplex Method.

Unit 3

Nonlinear Programming Problem: Introduction, Formulation of quadratic optimization problem, Powell's method, steepest descent (Cauchy) method, Newton's method.

Dynamic Programming Problem: Representation of Multistage decision process (MDP) & its types, principle of optimality; causality & invariant Imbedding, MDP in continuous-time by using Hamilton-Jacobi equation.

Unit 4

Calculus of variation: Introduction, problem of calculus variation, Hamilton method. Introduction of travelling salesman problem & Hamilton circuit, Basics of Game theory & Markov model.

References:

1. SS Rao, "Optimization theory and applications" Wiley Eastern Ltd.
2. KV Mittal, "Optimization methods", Wiley Eastern Ltd.
3. NA Kheir, "System modeling and computer simulation" Marcel Decker, New York.
4. Korn G.A., "Interactive Dynamic System Simulation", McGraw Hill, N.Y.

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P	Ext	Int	Cr
3	60	40	2

Instrumentation & Control Lab
MTEE -109A

The following Experiments are to be performed in LabView & Matlab Software.

1. Find addition, subtraction, multiplication and division of two numeric inputs
2. Perform various Boolean operations (AND, OR, NAND, NOR, XOR).
3. Add two binary bits and find the sum and carry (half adder).
4. Create a VI to find the decimal equivalent of a binary number using sub VI.
5. Create VI for studying array functions.
6. Create VI for studying sequence structure.
7. Create VI for studying properties and options of graphs/charts.
8. Measurement of Temperature using Virtual instrumentation.
9. Measurement of Strain using Virtual instrumentation.
10. Implementation of VI to control the speed of a DC motor.
11. Real Time Power measurement and analysis using Virtual instrumentation.
12. Creating Models, Simulation and Analysis of PID Controller.
13. Study and Implementation of Displacement Transducers.

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P	Ext	Int	Cr
3	60	40	2

Advanced Power System Lab-I
MTEE-111A

Following experiments are required to be performed in MATLAB/ETAP/LabView or equivalent.

1. Write a program to develop Bus Admittance Matrix Y_{BUS}.
2. Write a program for the Power Flow Studies using N-R (Newton-Raphson) method.
3. Write a program for the power flow analysis of system using Gauss-Siedel Technique.
4. Determination of the generalized constants A, B, C, D of a long transmission line.
5. Determination of the voltage and current for three phase faults on a 2-bus power system.
6. Simulation and Analysis of a single phase & three phase power system.
7. Simulation & Analysis of generation, transmission & distribution in power system.
8. Simulation & Analysis of different fault condition in power system.
9. Simulation and Analysis of 9- bus power system.
10. Simulation and Analysis of contingency concept in a power system.

Second Semester

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L	T	Ext	Int	Cr
3	1	60	40	4

Advanced Power System Protection
MTEE-102A

Unit 1

Introduction: Need for protective systems, Zones of protection, classification of protective relays, electromechanical, solid state and digital relays, comparisons between different types of relays.
Current transformers and potential transformers: construction, operating principle and their performance

Unit 2

Comparators: general equation of comparators, Analysis for amplitude comparator, analysis for phase comparator, duality between amplitude and phase comparators.
Overcurrent relays, differential relays, operating and restraining characteristics, distance relays, impedance relays, reactance relays, and mho relay quadrilateral relays, elliptical relays, comparison with conventional relays.

Unit 3

Distance protection: Principle of distance relaying, time grading of distance relays, schemes of distance protection, distance protection by impedance, reactance and mho relays, Effect of power swings on the performance of distance relays.
Pilot relaying schemes: Pilot wire protection, carrier current protection.
Protection of Generators and Motors: Types of faults, Stator and rotor protection against various types of faults.

Unit 4

Protection of Transformers: Types of faults, differential protection schemes, harmonic restraint relay, over flux protection, Earthing transformer protection.
Bus Zone Protection: Types of Bus-bar faults, differential current protection frame leakage protection.
Microprocessor based protective relays: Over current relay, impedance relay, reactance relay, mho relay, microprocessor based distance relaying.
Application of artificial intelligence and wavelet transform in protective relays

References:

1. TSM Rao, “Power System Protection – Static Relays”, Tata McGraw Hill Education Pvt. Ltd.
2. B. Bhalja, R P Maheshwari and N G Chothani, “Protection and Switchgear”, Oxford University Press.
3. Ravindernath & Chander, “Power System Protection and Switchgear”, New Age International Publishers.
4. Badri Ram & Vishwakarma, “Power system protection and switch gear” McGraw Hill Education (India)
5. C.L. Wadhwa, “Electrical Power Systems”, New Age International Publishers.
6. Protective Relays -Their Theory and Practice Vol.I & II by W.Van: Warrington.
7. Advanced power system analysis and dynamics by L.P.Singh: Wiley Eastern N.Delhi.
8. Digital Protection: Protective relay from Electro Mechanical to Microprocessor, L P Singh: Wiley Eastern.
9. Switchgear and protection by S. S. Rao: Khanna Pub

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L	T	Ext	Int	Cr
3	1	60	40	4

Renewable Energy Resources
MTEE- 104A

Unit 1

Solar Energy: Availability of solar energy, PV Technology, Principle operation of cell, Parameters, types of Cell Technologies, solar Energy collectors, solar power plant, photo-voltaic cell & its equivalent circuit and VI Characteristics, photo-voltaic power generation, Solar PV system and its Components, applications of solar energy.

Unit 2

Bioenergy: Introduction, biomass resources, Origin of Biomass Resources: Classification and characteristics; PROCESSES USED FOR CONVERSION OF BIOMASS INTO ELECTRICAL ENERGY: Direct combustion, incineration, pyrolysis, gasification and liquefaction; advantages and applications of biomass energy.

Unit 3

Wind Energy: Introduction, Classifications of wind mill, main components of wind mill, Principle of energy conversion, Power analysis, Aerodynamics theory: Axial momentum & Blade element theory, types of wind conversion system: fixed & variable speed, types of wind turbines, advantages and applications of wind energy.

Unit 4

New Energy Resources: Fuel Cell- working principle & basic applications; Ocean Energy- wave –tidal & ocean thermal energy conversion; Geothermal Energy- production method; Magneto Hydrodynamic (MHD)- principle of operation;

References:

1. Tiwari GN. Solar Energy, Fundamentals design, modeling and Applications. Narosa, 2002.
2. Duffie JA. Beckman WA. Solar Engineering of Thermal Processes, John Wiley, 2006.
3. Biomass renegerable Energy– D.O.hall & R.P. Overeed, John wiley & sons, New york, 1987.
4. Burton T. Sharpe D. Jenkins N. Bossanyi E. Wind Energy Handbook. John Wiley, 2001.
5. Nag P K. Power Plant Engineering, 3rd Edition, Tata McGraw Hill, 2008
6. Jain P. Wind Energy Engineering. McGraw-Hill 2011.
7. Tiwari GN. Ghoshal MK. Fundamental of Renewable Energy Sources, Narosa, 2007.

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L	T	Ext	Int	Cr
3	1	60	40	4

HVDC Transmission and FACTS Devices
MTEE-106A

Unit 1

HVDC Transmission: General considerations, Power Handling Capabilities of HVDC Lines, Basic Conversion principles, static converter configuration.
Harmonics in HVDC Systems, Harmonic elimination, AC and DC filters.

Unit 2

Interaction between HVAC and DC systems – Voltage interaction, Harmonic instability problems and DC power modulation.
Multi-terminal DC links and systems; series, parallel and series parallel systems, their operation and control.

Unit 3

Introduction Of Facts Concepts**:** Basic of flexible alternating current transmission system (FACTS) controllers, shunt, series, combined and other controllers, FACTS technology, HVDC or FACTS**,** static VAR compensator (SVC) and static synchronous compensator (STATCOM), Static Synchronous Series Compensator (SSSC), Thyristor Controlled Series, Capacitor (TCSC). Solid State Contactors (SSC) and TSSC

Unit 4

Combined Compensators: Introduction, Unified power flow controller (UPFC), conventional power control capabilities, real and reactive power flow control, comparison of UPFC to series compensators, control structure, dynamic performance. Interline power flow controller basic operating principles, control structure, application considerations.

References:

1. Hingorani N.G. and Gyragyi L., Understanding FACTS (Concepts and Technology of Flexible AC Transmission System), Standard Publishers and Distributors, Delhi.
2. Song Y.H. and Johns A.T., Flexible AC Transmission Systems, IEEE Press.
3. Ghosh A. and Ledwich G., Power Quality Enhancement using Custom Power Devices, Kluwer Academic Publishers.
4. Mathur R.M. and Verma R.K., Thyristor based FACTS controllers for Electrical Transmission Systems, IEEE Press.
5. Bollen M.H.J., Understanding Power Quality and Voltage Sag, IEEE Press.
6. Padiyar K.R., FACTS Controllers in Power Transmission and Distribution, New Age International Publisher, 2007.
7. Miller T.J.E., Reactive Power Control in Electric Systems, John Wiley.

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L	T	Ext	Int	Cr
3	1	60	40	4

Intelligent Control
MTEE -108A

Unit-1

ANN Models & Architecture:
Biological foundations, ANN models, Types of activation function, introduction to network architecture, multilayer feed forward network (MLFFN), Kohonen self-organizing map,radial basis, Function network (RBFN), recurring neural network.

Unit-2

Learning Processes:
Supervised and unsupervised learning, error-correction learning, Hebbian learning, Boltzmanlearning, single layer and multilayer perception model, least mean square algorithm, back propagation algorithm, Application in forecasting and pattern recognition and other power engineering problems.

Unit-3

Fuzzy Sets and Theory:
Fuzzy sets, fuzzy set operations, properties, membership functions, fuzzy to crisp conversion,measures of fuzziness, fuzzification and defuzzification methods, application in engineering problems.

Unit-4

Fuzzy Control System:
Introduction, simple fuzzy logic controllers with examples, special forms of fuzzy logic models,classical fuzzy control problems.

References:

1. M. T. Hagon, Howard B. Demuth and Mark Beale, “Neural Network Design, PWSPublishing-1995.
2. Jacek M Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing House, Bombay, 1994.
3. Wasserman, “Neural Computing: Theory and Practice, Van Nastrand Reinhold, 1989”
4. Freeman “Neural Networks _-Algorithms, application and programming techniques, Addison Weley, 1991”
5. Ronald Yager and Dimiyar Filev, Essentials of Fuzzy Modeling and Control, John Wiley & Sons, Inc
6. Rajasekran Pai: Neural Networks, Fuzzy logic and genetic Algorithm Synthesis & Applications, PHI.

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P	Ext	Int	Cr
3	60	40	2

Modeling & Simulation Lab
MTEE- 110A

The following Experiments are to be performed in MATLAB-SIMULINK.

1. To verify Thevenin's, Norton's, & Superposition theorem.
2. To find Avg. & R.M.S. value of (V-I) of RLC series & parallel; series parallel RC-RL circuit.
3. To perform 1- ϕ (half & full) wave rectifier with (R, R-L & R-C) load.
4. To perform 3-ϕ (half & full) wave rectifier with (R, R-L & R-C) load.
5. To find Avg., R.M.S. & T.H.D. of 1- ϕ (half & full) wave inverter with (R & R-L) load.
6. To find Avg., R.M.S. & T.H.D. of 3- ϕ (half & full) wave inverter with (R & R-L) load.
7. To perform current source inverter (C.S.I.) & PWM inverter.
8. To perform step down (BUCK) & step up (BOOST) chopper.
9. To perform Type- (A, B, C & D) chopper
10. To perform Field & Armature control of separately excited DC motor.
11. To perform Field & Armature control of DC series & DC shunt motor.
12. To perform 3-ϕ Induction Motor with constant & variable torque.
13. To perform speed control of 3-ϕ Synchronous motor with constant & variable torque.

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P	Ext	Int	Cr
3	60	40	2

Advanced Power System Lab-II
MTEE-112A

Following experiments are required to be performed in MATLAB/ETAP/LabView or equivalent.

1. Simulation & Analysis of the generator protection.
2. Simulation & Analysis of the transformer protection.
3. Simulation & Analysis of power quality improvement.
4. Simulation and Analysis of different types of relays in power system.
5. To perform the simulation of Photo-Electric Effect.
6. To perform the simulation to construct the PV cell to show the V-I & P-V characteristics curve of it.
7. To perform the simulation of Photovoltaic power conversion for single and 3-ph. load on account with MPPT.
8. To perform the construction of a Simulink model of Biomass Gasifier.
9. To study mathematical modelling of DFIG based Wind Turbine and its impact on connection with grid.
10. To perform the simulation of Permanent Magnet Synchronous Generator (PMSG) based wind energy conversion system.
11. To perform the simulation of PV- Grid interconnection using MPPT technique with the partial shading effect.

Third Semester

KURUKSHETRA UNIVERSITY KURUKSHETRA
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L	T	Ext	Int	Cr
3	1	60	40	4

Power Electronics Application in Renewable Energy
MTEE- 201A

Unit 1

Review of Power Devices: SCR, BJT, MOSFET, IGBT, GTO, Safe operating Limits, Selection of devices for various applications.

Phase controlled Converters: **(**1-φ & 3- φ) thyristor fed half controlled, fully controlled and Dual converters with inductive and motor load.

DC to DC converters: Analysis of various conduction modes of Buck, Boost, Buck-Boost.

Unit 2

Modern Power Electronic Converters: Basic concepts of VSI, single phase half bridge, full bridge and three phase bridge inverters, PWM modulation strategies, Sinusoidal PWM, Space vector modulation, Selective Harmonic Elimination method, other inverter switching schemes, blanking time, Current source inverters.

Unit 3

Design of Power Electronics Interfaces for Solar PV: Solar PV technologies, MPPT, Design of DC-DC converters for MPPT, MPPT algorithms, Implementation of MPPT control through DSP controllers.

Topologies for grid connected and standalone applications: single phase and three phase systems, Single stage and multistage, isolated and non- isolated.

Unit 4

Power Electronics Interfaces for WES: Topologies of WES, design considerations for WES with rectifier /inverter system, Power Converters for Doubly Fed Induction Generators (DFIG) in Wind Turbines.

Power Electronics Interfaces for Fuel Cells: Types of fuel cells, Proton Exchange Membrane (PEM) fuel cell: features and operational characteristics, Design of DC-DC converters for PEM fuel cell, MPPT in Fuel Cell.

References:

1. "Power Electronics, Converters, Applications & Design", N.Mohan, T.M.Undeland, W.P Robbins, Wiley India Pvt. Ltd.
2. "Modern Power Electronics and AC Drives", B. K Bose, Pearson Education.
3. "Power Electronics", Joseph Vithayathil, Tata McGraw Hil.
4. "Voltage Source Converters in Power Systems: Modeling, Control and Applications", Amirnaser Yezdani, and Reza Iravani, IEEE John Wiley Publications.
5. "Solar PhotoVoltaics", Chetan Singh Solanki, PHI learning Pvt Ltd., New Delhi,2009.

Note1: The paper will have a total of **NINE questions. Question No. 1,** which is compulsory, shall be OBJECTIVE Type and have contents from the entire syllabus (all Four Units).

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L	T	Ext	Int	Cr
3	1	60	40	4

Electric Power Distribution & Automation
MTEE-203A

UNIT-1

Introduction: Basis of distribution automation, power delivery systems, control hierarchy, DA concept, Distribution automation system, basis architectures and implementation strategies for DA.
Central Control and Management: Need of power control, operation environment of distribution networks, evolution of Distribution management systems, basic distribution management function, basis of a real time control system outage management, decision support applications, database structures and interfaces.

UNIT-2

Distribution Automation and Control Functions: Introduction, Demand side management, Voltage/VAR control, fault detection, restating function, reconfiguration of distribution systems, power quality.
Intelligent Systems in Distribution Automation: Distribution automation function, artificial intelligent methods, intelligent systems in DA, fault detection, classification and location in distribution systems.

UNIT-3

Renewable Energy Options and Technology: Distributed generation, classification of renewable energy, renewable energy options, other non-renewable energy sources, distributed generation concepts and benefits, examples.
Distribution Management Systems: DMS and EMS, function of EMS, SCADA, remote terminal UNITs, distribution management systems, Distribution system analysis, Feeder automation, Load management systems, GIS customer information system, automatic meter reading, advance billing, Advances in AMR technology, cost benefit analysis in DS.

UNIT-4

Communication System for Control and Automation: Communication and distribution automation, DA communication and link options, wireless communication, wire communication, DA communication and control, DA communication architecture, DA communication user interface.

References:

1. James A. Momoh, “Electric Power Distribution Automation Protection and Control”, CRC Press, Taylor and Francis, 2008”
2. James N-Green and R.Wilson, “Control and Automation of electric Power Distribution Systems”, CRC Press, Taylor and Francis, 2008.
3. Turan Gonen, “Electric Power Distribution System Engineering”, CRC Press, 2007
4. Abdelhay A. Sallam, “Electric Distribution Systems”, Wiley-IEEE Press, 2011.

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L	T	Ext	Int	Cr
3	1	60	40	4

Advanced Microprocessors
MTEE -205A

UNIT-1

Architecture of 8086 microprocessor, Memory Addressing, Bus Timings for MN/MX mode, interrupt structure. Memory Interfacing and Address decoding techniques for 8086 microprocessor

UNIT-2

Addressing modes, Instruction set and application programs, Assembler Directives, Programming Techniques using TASM, Interfacing D/A and A/D converters using programmable I/O devices, Interfacing Stepper motor. Architecture of INTEL X86 Family: CPU block diagrams, Pin diagrams and internal descriptions of -80286, 386,486 and Pentium Processor, Instruction formats.

UNIT-3

Introduction to microcontrollers, Architecture of 8051 microcontroller, basic Instruction set, programming, serial data communication, interfacing with D/A and A/D converters.

UNIT-4

Application of Microprocessors, A Microcomputer-based Industrial Process-control System, Hardware for Control Systems and Temperature Controller, Overview of Smart-Scale Operation.

References:

1. Advanced Microprocessors, D.V.Hall, PHI.
2. The Intel Processors, B. Brey, Pearson Education.
3. Microprocessors, Gibson, Prentice Hall of India.
4. Micro Controller, K.J. Ayala, Penram International

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L	T	Ext	Int	Cr
3	1	60	40	4

Reliability Engineering
MTEE-207A

Unit-1

Review of basic concepts in Reliability Engg., Reliability function, different reliability models, etc. Reliability evaluation techniques for complex systems; Tie set and cutest approaches, different reliability measures, Reliability allocation/apportionment, reliability improvement, redundancy optimization techniques.

Unit-2

Fault tree analysis: fault tree construction, simplification and evaluation, importance measures, modularization, applications, advantages and disadvantages of fault tree techniques.

Unit-3

Maintainability Analysis: measures of system performance, types of maintenance, reliability centered maintenance, reliability and availability, evaluation of engineering systems using Markov models.

Unit-4

Applications of fuzzy theory and neural networks to Reliability Engineering. Reliability testing, design for reliability and maintainability. Typical reliability case studies.

References:

1. R. Ramakumar, “Engineering Reliability”, Prentice Hall, NJ.
2. KB Mishra, “Reliability Analysis & Prediction”.
3. KB Mishra, “New trends in System Reliability Evaluation”.
4. M.L. Shooman, “Probabilistic reliability – an engineering approach” RE Krieger Pub., 1990.
5. K.K. Aggarwal, “Reliability Engineering”.
6. Roy & Billington-“Reliability Engineering”.

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L	T	Ext	Int	Cr
3	1	60	40	4

Load and Energy Management
MTEE-209A

Unit-1

Load Forecasting: Classification and characterization of loads, Approaches to load forecasting, Forecasting methodology, Energy forecasting, Peak demand forecasting, Non-weather sensitive forecast and Weather sensitive forecast, Total forecast, Annual and monthly peak demand forecasts. Applications of state estimation to load forecasting.

Unit-2

Load Management: Introduction to Load management. Electric energy production and delivery system structure (EEPDS). Design alternatives for EEPD systems. Communication/control techniques for load management. Tariff structure and load management, principles of macro & microeconomics and energy pricing strategies, Assessing the impacts of load management.

Unit-3

Energy Demand Forecasting: Static and dynamic analysis of energy demand, elements of energy demand forecasting, methodologies and models for energy demand forecasting, techno-economic approach in energy demand forecasting.

Unit-4

Trends and Case Studies: Energy management strategy, symbiotic relation between information, energy models and decision making, case studies like industrial energy forecasting, transportation energy forecasting, residential, commercial and agricultural energy forecasting

References:

1. Martino J., Technological Forecasting for Decision Making, Elsevier Press, New York.
2. Gellings and Penn Well P.E., Demand Forecasting in the Electric Utility Industry, Fairmount Press.
3. Makridakis S., Forecasting Methods and Applications, Wiley.
4. Barney , Wayne Turner, William J. Kennedy, Guide to energy management, The Fairmont Press, Inc.
5. Pradeep Chaturvedi, Energy management: challenges for the next millennium,Concept Pub. New Delhi.

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L	T	Ext	Int	Cr
3	1	60	40	4

Special Topics in Power Systems
MTEE-211A

Unit-1

Power System Restructuring and Deregulations: Introduction to Power System Deregulation Market Models Pool & Bilateral International Experiences, Role of ISO, Market Power, Bidding and Auction Mechanisms. Transmission Open Access, Transmission Pricing, Impact of Congestion and Congestion Management, ATC and Factor affecting ATC, Determination of ATC.

Unit-2

Power System Computation and Computer Application: OPF and its Formulation, Solution Techniques NLP Methods, LPOPF Interior Point Method, AI Techniques, GA and Particle Swarm Optimization (PSO).

Unit-3

SCADA & Distribution Automation: Energy management systems, Power system communication, PICC Digital Communication, Microwave communication, Utility communication architecture, Java and Web based technologies and Software Agents.

Unit-4

Flexible AC Transmission Systems (FACTS): Reactive Power Control in Electric Transmission Systems, Loading Capability and Stability Considerations. Introduction to FACTS, related concepts and system requirements, Application considerations of FACT devices.

References:

1. Lei Lee Lai, Power System restructuring and deregulation. John Wiley and Sons, UK. 2001.
2. K. Bhattacharya, MHT Bollen and J.C Doolder, Operation of Restructured Power Systems, Kluwer Academic Publishers, USA, 2001.
3. A.J Wood and B.F Wollenberg. Power System Operation and Control, John Wiley and Sons.
4. S.A Soman, S.A Khafasok, Shubha Pandit, Computational Methods for large Sparse Power System Analysis: An Object Oriented Approach. Kluwer Academic Publishers.

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L	T	Ext	Int	Cr
3	1	60	40	4

Power System Restructuring and Deregulation
MTEE-213A

Unit-1

Introduction: Basic concept and definitions, privatization, restructuring, transmission open access, wheeling, deregulation, components of deregulated system, advantages of competitive system.
Power System Restructuring: An overview of the restructured power system, Difference between integrated power system and restructured power system, Explanation with suitable practical examples.

Unit-2

Deregulation of Power Sector: Separation of ownership and operation, Deregulated models, pool model, pool and bilateral trades model, multilateral trade model.
Competitive electricity market: Independent System Operator activities in pool market, Wholesale electricity market characteristics, central auction, single auction power pool, double auction power pool, market clearing and pricing, Market Power and its Mitigation Techniques, Bilateral trading, Ancillary services.

Unit-3

Transmission Pricing: Marginal pricing of Electricity, nodal pricing, zonal pricing, embedded cost, Postage stamp method, Contract Path method, Boundary flow method, MW-mile method, MVA-mile method, Comparison of different methods.

Unit-4

Congestion Management: Congestion management in normal operation, explanation with suitable example, total transfer capability (TTC), Available transfer capability (ATC), Different Experiences in deregulation: England and Wales, Norway, China, California, New Zealand and Indian power system.

Reference:

1. Loi Lei Lai,"Power System Restructuring and Deregulation", John Wiley & Sons Ltd.
2. K. Bhattacharya, MHT Bollen and J.C Doolder, Operation of Restructured Power Systems, Kluwer Academic Publishers, USA, 2001.
3. Lorrin Philipson and H. Lee Willis,"Understanding Electric Utilities and Deregulation", Marcel Dekker Inc, New York.
4. Yong-Hua Song, Xi-Fan Wang, Operation of market-oriented power systems, Springer, Germany.

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L	T	Ext	Int	Cr
3	1	60	40	4

Advanced Digital Signal Processing
MTEE-215A

Unit-1

LTI Systems:- Transform LTI systems as frequency selective filters. Invertibility of LTI systems. Minimum phase, maximum phase and mixed phase systems. All-pass filters. Design of digital filters by placement of poles and zeros. DFT as a linear transformation. Linear filtering methods based on DFT. Frequency analysis of signals using DFT. Discrete cosine transform.

Unit-2

Design of FIR filters:- Introduction-Specifications-Coefficient calculation methods-Window, Optimal and Frequency sampling methods- Comparison of different methods-Realization structures-Finite word length effects-Implementation techniques-Application examples.

Unit-3

Design of IIR filter:- Introduction-Specifications. Coefficient calculation methods-Pole zero placement, Impulse invariant, Matched Z transform and Bilinear Z transform(BZT) .Design using BZT and classical analog filters. IIR filter coefficients by mapping S plane poles and zeros.

Unit-4

Adaptive Digital Filters:- Concepts -Wiener filter-LMS adaptive algorithm-Recursive least squares algorithm-Lattice Ladder filters. Application of Adaptive filters.

Power Spectrum Estimation:- Estimation of spectra from finite-duration signals. Nonparametric and Parametric methods for Power Spectrum Estimation.

References:

1. Emmanuel C Ifeachor, Barrie W.Jervis, Digital Signal Processing, A practical Approach, 2/e, Pearson.
2. Proakis, Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, 4/e, Pearson.
3. Johnny R. Johnson, Introduction to Digital Signal Processing, PHI, 1992
4. Ashok Ambardar, Digital Signal Processing: A Modern Introduction, Thomson, IE, 2007.
5. Douglas F. Elliott, Handbook of Digital Signal Processing- Engineering Application, Academic Press.
6. Schilling, Sandra Harris, Fundamentals of Digital Signal Processing using MATLAB, Thomson, 2005.

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L	T	Ext	Int	Cr
-	-	-	100	12

Synopsis
MTEE-217A

The students are required to initially work on Literature survey/ problem formulation / adopted methodology/ Industry selection/ etc. on some latest areas of Industrial and Production Engineering or related fields during summer vacations after second semester.

The students will be required to submit a progress report duly signed by their respective supervisors to the department, related to their dissertation work in the last week of September and November. The progress report will cover the following:

- The goal set for the month.
- Research papers studied.
- Methodology used in achieving the goal.
- The extent of fulfillment of the goal.

The progress report must be at least of 8-10 pages and the cover page should include the tentative topic, name of the candidate, name of the supervisor, period of progress report, signature of candidate and supervisor.
The students will be required to appear for comprehensive seminar & viva-voce and submit a synopsis report based on their progress related to the dissertation at the end of semester. The synopsis report will be submitted in the same format as that of the thesis and will contain the following:

1. Introduction
2. Literature Survey
3. Gaps in Literature
4. Objectives of the Proposed Work
5. Methodology
6. References

* Student will choose his/her guide in the end of second semester

Fourth Semester

KURUKSHETRA UNIVERSITY KURUKSHETRA
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L	T	Ext	Int	Cr
-	-	200	100	20

Dissertation (Thesis)
MTEE-202A

The students are required to undertake Analytical/Experimental/computational investigations in the field of Industrial and Production Engg. or related fields which have been finalized in the third semester. They would be working under the supervision of a faculty member.

The students will be required to submit a progress report duly signed by their respective supervisors to the department, related to their dissertation work in the last week of February and April. The progress report will cover the following:

- The goal set for the month.
- Research papers studied.
- Methodology used in achieving the goal.
- The extent of fulfillment of the goal.
- References

The progress report must be at least of 8-10 pages and the cover page should include the tentative topic, name of the candidate, name of the supervisor, period of progress report, signature of candidate and supervisor.

The final dissertation will be submitted in the end of semester which will be evaluated by internal as well as external examiners based upon his/her research work. Each student is required to publish at least two research papers (minimum standards: one paper in a referred journal and one in an International journal/National conference), to enable him/her to qualify for the award of M. Tech degree. Before submission of Dissertation, student has to submit proof of his/her publications with acceptance.