

**M. Tech in Electrical Engineering Specialization: Electrical Device & Power System**  
**JIS College of Engineering**

Structure & Academic curriculam for M. Tech in Electrical Engineering

1. Title of Course: Electrical Devices and Power System
2. Course Structure:

**1<sup>st</sup> Semester**

**A) THEORY**

SL NO	CODE	THEORY	CONTACT PERIODS/WEEK			TOTAL	CREDIT	MARKS
			L	T	P			
1	MT-M 101	ADVANCED ENGINEERING MATHEMATICS	3	-	-	3	3	100
2	MT-EE101	ADVANCED MICROPROCESSOR AND COMPUTER	3	-	-	3	3	100
3	MT-EE102	ADVANCED POWER SYSTEM	3	-	-	3	3	100
4	MT-EE103	ADVANCED CONTROL SYSTEM	3	-	-	3	3	100
5	MT-EE104	SPECIAL ELECTRO-MECHANICAL DEVICES	3	-	-	3	3	100

**B. PRACTICAL / SESSIONAL**

S L N O	CODE	PRACTICAL/SESSIONAL	CONTACT PERIODS/WEEKS			TOTAL	CREDIT	MARKS
			L	T	P/S			
1	MTEE197	LABORATRY - I	-	-	4	4	4	100
2	MTEE198	ASSIGNMENT - I	-	-	4	4	4	50
3	MTEE199	SEMINAR	-	-	4	-	1	50
TOTAL OF SESSIONAL							9	200
TOTAL OF THEORY							15	500
TOTAL OF SEMISTER							24	700

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**2<sup>ND</sup> SEMESTER**

A

SL NO	COD E	THEORY	CONTACT PERIODS/WEEK			TOTAL	CREDIT	MARKS
			L	T	P			
1	MT-EE201	PROTECTION OF POWER SYSTEM AND DEVICE	3	-	-	3	3	100
2	MT-EE202	POWER SYSTEM NETWORKING AND MANAGEMENT	3	-	-	3	3	100
3	MT-EE203	MEASUREMENT AND INSTRUMENTATION IN POWER SYSTEM DRIVES	3	-	-	3	3	100
4	MT-EE ELECTIVE - I	(MT EE 211 TO MTEE215) ANY OF THE SUBJECTS	3	-	-	3	3	100
5	MT-EE ELECTIVE - 2	(MT EE 216 TO MT EE 219) ANY OF THE SUBJECTS	3	-	-	3	3	100

B. PRACTICAL / SESSIONAL

SL N	CODE	PRACTICAL/SESSIONAL	CONTACT PERIODS/WEEKS			TOTAL	CREDIT	MARKS
			L	T	P/S			
1	MTEE296	ASSIGNMENT - II	-	-	4	4	4	100
2	MTEE297	TERM END PAPER LEADING TO THESIS	-	-	6	6	6	100
3	MTEE298	SEMINAR	-	-	4	4	4	100
TOTAL OF SESSIONAL							14	300
TOTAL OF THEORY							15	500
TOTAL OF SEMISTER							29	800

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**3<sup>RD</sup> SEMESTER**

**A) THEORY:**

SL NO	COD E	THEORY	CONTACT PERIODS/WEEK			TOTAL	CREDIT	MARKS
			L	T	P/S			
1	MT-EE 314	MODELING SIMULATION AND EVOLUTIONARY TECHNIQUES	3	-	3	3	3	100
2	MT-EE 311, MT-EE 312, MT-EE 313 ANY ONE	ELECTIVE-III	3	-	-	3	3	100
TOTAL OF THEORY							6	200

**B. PRACTICAL / SESSIONAL:**

SL N	CODE	PRACTICAL/SESSIONAL	CONTACT PERIODS/WEEKS			TOTAL	CREDIT	MARKS
			L	T	P/S			
1	MTEE391	ASSIGNMENT - III	-	-	4	4	4	100
2	MTEE315	TERM END PAPER LEADING TO THESIS	FULL TIME			6	6	100
TOTAL OF SESSIONAL							10	200
TOTAL OF THEORY							6	200
TOTAL OF SEMISTER							16	400

**4<sup>TH</sup> SEMESTER**

SL N	CODE	PRACTICAL/SESSIONAL	CONTACT PERIODS/WEEKS			TOTAL	CREDIT	MARKS
			L	T	P/S			
1	MTEE401	THESIS/PRACTICAL SESSIONAL	FULL TIME			6	6	200
2	MTEE402	SEMINAR	-	-	4	4	4	100
3	MTEE403	VIVA-VOCE	-	-	4	4	4	100
TOTAL OF SESSIONAL							14	300
TOTAL OF SEMISTER							14	400

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**M-TECH SYLLABUS**

SEMESTER- I

MT-M 101 Advance engineering Mathematics

Vector space, linear dependence, basis, linear transformation; inner product space, Hilbert space, Linear functions, Riesz representation theorem and adjoints.

Orthogonal projections, product of projections; orthogonal direct sums; unitary and orthogonal transformations; orthonormal sets and Parseval's identity; closed subspace and projection theorem for Hilbert spaces. Polynomials, algebra of polynomials, matrix polynomials, annihilating polynomials, invariant subspace; Jordan forms.

Complementary orthogonal space in networks; graphs, their relation to vector space, properties of their matrix representations; solution of state equations in linear system theory; relation between rational and Jordan forms.

Direct and iterative methods of solution of linear equations; Matrices, norms, complete metric spaces and complete normal linear spaces (Banach spaces); Least square problems (Constrained and unconstrained); Eigenvalue problem.

Books recommended:

1. Hoffman, K. & Kunze, R. - Linear Algebra; PHI
2. Golub, G.H. & Van Loan, C.F. - Matrix computations; North Oxford Academic
3. Bachman, G. & Narici, I. - Functional Analysis with Applications; John Wiley

MT-EE 101 Advance Microprocessor and Computers

Microprocessor Architectures: 80X86, 8088 configuration; Minimum and maximum mode system; Assembly language programming, Modular programming, assembler, linker libraries, macro system bus and timing diagram; functional description; Real and protected mode of memory addressing, Multitasking, task state, segment, task scheduling; interrupt processing; hardware and software interrupt vector table, sequence, multiple interrupt, interrupt service routine; Arithmetic coprocessor; Pentium Processor; registers, instruction, addressing mode, flags, data transfer, string instruction, arithmetic and logic operations, bit manipulation, program transfer and control operation; Pentium Preprocessor.

Book: - Advance Microprocessor & Computer; Douglas Hall

MT-EE 102 Advanced Power System

Natural frequency and free oscillations, forced mechanical oscillations; EHV AC transmission; protection and compensation; HV DC transmission; Design considerations; system; DC links; Mixed mode operation; performance in AC and DC mixed system; Power system transients in LV, HV and EHV system.

Sparse system, Theorems of sparse, Matrix Method, Applications Areas, Direct Solutions, Sparsifying and ordering.

Books:-

1. Advance Power System, Stevenson & Grainger; Wadha
2. E. W. Kimbark, 'Power System Stability, Vol. I, John Wiley & Sons, 1948-A Book
3. P. C. Magnusson, 'The Transient Energy Method of Calculating Stability', AIEE Trans, Vol. 66, pp. 747-755, 1947
4. P. D. Aylett, 'Energy Integral Criterion of Transient Stability Limits of Power System', Proc IEE, pt C Vol 105, pp 527-536, 1958

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5. Task Force on Discrete Supplementary Controls of the Dynamic System Performance Working Group of IEE power System Engineering Committee, 1978, "A Description of Discrete Supplementary Controls for Stability" IEEE Trans. PAS-97, pp 149-165.
6. K.R. Padiyar, "Power System Dynamics: Stability and Control", John Wiley and Interline, 1996-A Book
7. CIGRE Task force 38.02.17, 2000, "Advanced Angle Stability Controls", Technical Brochure, Ref. No. 155
8. N.G. Hingorani and L. Gyugi, 'Understanding FACTS', New York, 2000 (A Book)
9. 'Flexible AC Transmission Systems'-Edited by Y.H. Song and A.T. Johns. IEE, 1999 (A Book)
10. A.A. Edris, "Enhancement of First Swing stability using a high speed Phase Shifter", IEEE Trans. On Power Systems, Vol. 6, no. 3, 1991, pp. 1113
11. R. Mihalic, D. Povh, P. Zunko and I. Papic, 'Improvement of Transient stability by insertion of FACTS devices', Proc. Of Athens PowerTech-APT-93, IEEE-NUTA joint international power conference, Sept. 1993, Athens Greece, pp. 521-525.
12. Y.L. Tang and Y. Wang, 'Design of series and Shunt FACTS controller using adaptive nonlinear coordinated design techniques', IEEE Trans. on Power Systems, Vol. 12, no. 3, August 1997.
13. Y. Wang, A.A. Hashmani and T.T. Lie, 'Nonlinear coordinated excitation and TCPS controller for multi machine power system transient stability enhancement', IEE Proc. Gener. Trans. Distrib., vol. 148, no. 2, March 2001
14. L. Gyugi, 'A unified power flow control concept for flexible AC Transmission systems', IEE Proc- c, vol. 139, pp. 323-333, July 1992

MT-EE 103 Advance Control System

State variable analysis of continuous system, digital control system, state description of digital processor, state description of sampled continuous-time plants, state description of systems with dead-time, solution of state equation, canonical variables, controllability & observability, pole-placement design: state regulator design & servo design, design of state observer, compensator design by the separation principle, digital control system with state feedback.

Describing Function Analysis: Describing functions of common non-linearities, stability analysis by the describing function method.

Phase plane methods of obtaining trajectories for linear & non-linear systems (methods of Isocline, Delta method), stability analysis, limit cycles.

Series approximation method for small non-linearities, perturbation method for second order system.

Lyapunov stability analysis: Lyapunov stability theorem, Lyapunov instability theorem, Lyapunov functions for linear systems, Lyapunov functions for non-linear system: the Krasovskii method, the Variable-Gradient method, canonical form of Lure stability criteria, TVP system.

Linear Quadratic Optimal Control: Calculus of variations and minimum principle, Optimal Feedback Control: Optimal State Regulator through the Matrix Riccati equation, Numerical solution of the Riccati equation

BOOKS:

1. Gopal M.- Digital Control & State Variable Methods (2<sup>nd</sup> Edition); TMG

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2. Gopal M-Modern Control system Theory(2<sup>nd</sup> Edition);New Age International
3. Ogata K-Discrete Time Control System ; Pearson Education
4. Gibson J E- Non-linear Automatic Control ; MGH
5. Stefani – Design of feedback Control System;Oxford University Press
6. Sinha Naresh K.- Control Systems (3<sup>rd</sup> Edition);New Age International

MT-EE 104 Special Electromechanical Device :

Linear electro-mechanical devices of different geometry; levitation machines, Force machines and energy machines.

Linear induction motor; Edge and end effects; depth of penetration and its effects. Mathematical modeling.

Review of adjustable speed drives, square wave and sine wave permanent magnet, Brushless machines

and drives systems. Reluctance motors; Stepper motor; control circuit and operational characteristics.

Disc and claw motors; Hysteresis motors.

Servo motors; DC and AC; position control application; Tacho generators, Synchronous analysis.

High performance energy efficient machines.

Special machine associated with wind, solar, tidal, wave, micro hydel and other non-conventional energy sources.

Motor for robotic drive application.

Book:-Linear Induction Machines, Perfar Nasser, Laithwait

**SEMESTER-II**

1. MT - EE 201 Protection of Power system and Devices.

Relays and circuit breakers; Protection of generators; sequence filters; reverse, under frequency, loss of excitation; Rotor earth fault, pole slipping, protection of Turbine; Protection of Transformer; generalized differential protection, Protection due to switching; BUS and substation protection; distance relay, characteristics and critical applications; power swing conditions; Static relays; current, voltage and impedance relays, A standard relaying ; Computer and microprocessor application in protection schemes; Numerical relays.

Relays; reviews of relay characteristics and operating equations, protective CTs, PTs and mixing transformer; Basic construction of static relays, comparators and associated elements, system switching and transient effects, different type of relays, digital and computer aided relaying, BUS bars and switch gear, Bus bar arrangement and design consideration, review of earth formation and interruption of current in circuit breakers; study and operation of air-blast, SF<sub>6</sub> ; Vacuum and DC-circuit breakers; selection and design consideration, tests method as per standard.

Application of our electronically actuated strategies for improved protection and security.

Book:-

1. Power System Protection: Paithankar & Bhide
2. Power System Stability: E.W.Kimbark . Vol -I,II,III
3. Power System Dynamics & Stability Control: K.R.Padiyar, John Wiley and Interline, 1996
4. Flexible AC Transmission System: Y.H.Song and A.T.Jhons,IEE,1996(A Book)
5. Adaptive Control: S.Sastry and M.Boron, Prentice Hall of India Ltd. 1993
6. Power System Stability Control: P.Kundur,Mc Grawhill, New Tork, 1994
7. Power System Control & Stability: IEE Press, New York, 1994
8. IEEE Recommended Practice for excitation system models for power system stability studies, IEEE standard 421.5-1992

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9. L.Gyugi, C.D>Schander, S.L.Williams, T.R.Rietman, D.R.Torgerson and A.Edris, "The unified power flow controller : A New approach to power transmission control", IEEE Trans. on Power delivery, vol. 10, no.2, pp. m1085-1097, april. 1995
- 10.Mihalic, P.Zunko and D.povh, 'Improvement of transient stability using unified power flow controller', IEEE trans . on Power Delivery.
11. K.R.Padiyar and K.Uma Rao,'A control schem for unified power flow controller to improve stability of power system', Proc. Of Ninth National Power system confarance-npsc' 96, vol.1, Dept.IIT Khanpur,India.
12. Y.L.Kang, G.B.Shresta and T.T.Lie, 'Application of an NLOID controller on a UPFC to improve transient stability of ba power system'.
13. K.R.Padiyar and S.Krishna, 'transient stability augmentation by programmed power angle Transmission ( conf. Publ.No.485 ), 28-30 Nov,2001,pp. 244-249
14. T.K.Monk, Ni Yixin and F.F.Wu, 'A study of Fuzzy logic based damping controller for UPFC ', Proc. Of International Conference on Advances in Power System Control,Operation and Management (APSCOM) , 30 Oct.-1 Nov. 2000,vol.1, pp 290-294.
14. K.Schode, A.Hasanovic and A.feliachi, 'Enhancing transient stability using a Fuzzy control
15. scheme for for unified power flow controller(UPFC)  
Proc. Of 43<sup>rd</sup> IEEE , Midwest Sympsiom on circuits Systems, 8-11 August 2000, Vol.3, pp. 1382-1385.
16. H.Chen, Y.Wang and R.Zhou, 'Transient and voltage stability enhancement via coordinated excitation and UPFC control', IEE Proc. Generation,Transmission and Distribution, vol.148,issue 3,maay 2001, pp.201-208.

### 2. Power System Networking and Management MT-EE-202

Role of Reactive Power on Voltage and Voltage Regulation, Relation Between Incremental Reactive Power, Active Power and Voltage at a Node, Reactive Compensation in Power System, Types of Compensator, Sub-Synchronous Resonance, Flexible AC Transmission systems (FACTS), Control of Voltage-Control by Generators, Control by VAR generators, Control by Transformers.

Automatic Load Frequency Control of Single Area Systems, Speed Governing System, Model, Block Diagram, Static and Dynamic Response with and without Integral Control, Control Area Concept, Two Area Load Frequency Load Frequency Control, Digital LF controller, De-centralized Control, Automatic Voltage Control-Block Diagram.

Concept of Stability: Steady State, Dynamic and Transient Stability, Voltage Stability-Voltage Collapse.

The Synchronous Machine-Three Phase Generation, Synchronous Reactance and equivalent circuits, Real and Reactive Power Control, Loading Capability Diagram, The Two Axis Machine Model, Voltage Equations, Salient Pole-Machines, Transient and Sub-Transient Effects, Short Circuit Currents-Problem

Dynamic Analysis and Modeling of Synchronous Machines, Excitation System, the Prime Mover and Governing System, Induction Machine Modeling.

References:-

- E.W.Kimbark, 'Power System Stability, Vol. I, John Wiley & Sons, 1948
- Power System Engineering-I J Nagrath, D P Kothari, Tata McGraw-Hill
- Electrical Power System-C L Wadha, New Age International (Private) Limited Publication.
- Power System Analysis-John J Granger, Willium D Stevenson, Tata McGraw-Hill
- Electrical Energy system Theory-O. L. Elgerd Tata, McGraw-Hill
- AText Book on Power System Engineering-Sony Gupta Bhatnagar & Chakrabarti, Dhanpat Rai and Co.
- Advanced Power System Analysis and Dynamics-L P Sing, New Age International (Private) Limited Publication

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3. MT - EE 203 Measurement and Instrumentation in Power system drives:

Review of transducers and sensors, definition, classification of errors, their characteristics and parameters; Amplifiers and dividers. Timers, Multiplexes, Signal converters ADC and DAC, Instrumentations and Signal processing, Isolaters, Data acquisition system, Basic structure, Data acquisition of Drive related variables.

Book:- Swahani, Driscoll and Coughlin, Malvino;  
FACTS by Mathuer & Yerma, IEEE- Press

**ELECTIVE- I**

1. MT - EE 211 Signal processing and Application:

Discrete time Signal & System - Discrete time signal and sequences; resolution of discrete- time signal into impulses; analysis of discrete- time LTI system; convolution seem consality and stability; difference equations and their solutions; response to complex exponential signals; frequency response function  
Transforms - Representation of sequences by fourier transform ; Z transforms , ROC; LTI in Z domain;samplurg, frequency domain representation ; appliction of Z transform in transient A.C. signal filtering.  
Discrete-time system -- Block diagram representation of linear constant coefficient difference equation; direct form I and II, cascade form , parallel form ; finite precision ward- length effect , number representation ; effect of quantization and rounding of noise; zero input limit cycles in fixed point realization.  
Filter design -- Design of FIR filters by windowing ;Butterworth and chebyshev filters; IIR filters impuls invariance and bilinear transformation.  
Discrete fourier transform-- Frequency domain sampling ; The DFT ; linear and circular convolution; application in. A.C. transient signal analysis ; FFT algorithm, DIT and DIF.  
Applcation -- Dual tone multifrequency signal detection; spectral analysis ; application in power system ,image processing; multidimensional digital signal processing.

Book recommended:

1. openheim & Schafer -- Discrete time signal processing; PH
2. proakes & Manolakes --Digital signal processing ; PHI
3. Mitra , S.k. --Digital signal processing ; TMH.
4. B.C.Kuo-- Digital signal processing
5. M.Gopal--Digital signal processing

2. MT- EE-212 Energy System.

Energy ecology and balance; Energy management and accounting ; Energy conservation ; Energy conversion process ; Energy transportation; non-conventional energy resources; Solar, geothermal ,wind, hydrogen, nuclear energy.

Book:- Power Plant, NagPal

3. MT - EE 213 Artificial intelligence and Neural Networking:

Problem solving methods; control strategy, Heuristic search, reasoning, Breadth, depth, and best search;structure, interaction and experts, design examples; perception, feed forward, back propogation,Hopfield model, Applications; Fuzzy logic; Fuzzy set, member ship function, rules and algorithm, defuzzification, application.

Book:- Artificial intelligence and Neural Networking,Patesson

4. MT-EE 214 Computer Interfacing and Networking--On line Computer Application:

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Architecture, typical instruction set and special features of advanced microprocessors.  
Personal computer organization and facility.  
Digital transmission techniques, media and multiplexing LAN and WAN definitions Topologies and communication protocols.  
Series and parallel data transfer; DMA; Interfacing ADC and DMA Z transformers.  
Digital controllers, MARC, neuro and fuzzy controllers.  
Languages for real time application and language programming.  
Case studies.

Book:- On line Computer Application

### 5. MT-EE 215 Generalise Theory of Electrical Machines:

Matrix analysis of Electrical machines, invariance of power, Modeling and their solutions, Generalised of first kind: quasi holonomic reference frame, impedance matrices, torque matrix, flux and current density matrices; modeling DC machines: steady state and transient analysis; repulsion and universal machines, cross field generator; steady state and transient analysis; Matrix analysis of single and three phase transformer under steady state and transient conditions; rectifier transformer. Generalised theory of electrical machines in rotational frame; Holonomic and nonholonomic reference frame; Torque matrix, voltage and impedance matrix, analysis of single phase and three induction machines; analysis using revolving field theory; sequence reference frame; state space modeling of electrical machines; Equivalent circuits, synchronous generator under sudden short circuit; generalized fault analysis.

Book:-Bhimra; Theraja; M.G.Say; Kleton

### **ELECTIVE-II**

#### 1. MT-EE 216 Power Conditioning

Concepts of nonlinear loads and electric power conditioning, unity power factor rectifier, STATCON, SMPS: analysis design and control, Ups; On line and OFF line, power supplies in telecommunication systems. High frequency induction heating, dielectric heating, power supply in auto mobiles

Passive filters, active filters for harmonic and reactive power compensation in two wire, three wire four wire AC systems. Harmonic standard, power quality, Surge suppress, compensation of arc furnace and traction loads. Micro wave ovens, light and temperature controllers, power supply for appliances such as camera, X-rays equipments. Case studies on micro computer and DSP control in active filters and power supplies.

Book:- Power conditioning, F.F.Kuo

#### 2. MT-EE 217 Selected Topics in Electric Drives and Power Electronics:

LCI-IM Drive : Drive configuration; Communication at different speed; Control structure.  
FOC-IM Drive :Drive Configuration; mathematical modeling; direct and indirect FOC  
Stepper motor and Drive configurations. Brush less DC drive configuration. Low speed commutation. Inverter control strategies.  
Permanent magnet SM drive converter configuration. Synchronization, Trapezoidal and sinusoidal drive control structure.  
Principle of soft switching in inverters.  
Resonant converters; Modeling strategies. Analysis and design of Power Electronics Circuit .

Book:-Power Electronics,Rashid, P.C.Sen, Nedmoohan

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### 3. MT-EE 218 Selected Topics in Process Control:

Process control and system design: flow diagram, instrument diagram, plant design for controllability and absorbability, dynamic nonlinearity degree of freedom, pairing of variables, design of multivariable system; Measurement of dynamic response, steady state and random technique, pulse technique, model fitting technique; Dynamic modeling of process system; timer and time function controller, control time, time fluctuation characteristics, time cycle controller; components, functions and usages; application of processes computer; system design, optimization, direct digital control, distributed control, Fuzzy technique of control; Audics: Fluid control device, bstable amplifier, control valve flowmeter; Turbine control and protection; Numerical control; major classes and operating principle.

### 4. MT EE-219 Robotics:

Introduction: Robot ,its evaluation; definition and laes of robotics, present application status.

Robot anatomy: configuration, robot motions, work volume.

Robot drives, actuators and control; Functions and types of drives and actuators; concept of basic control systems, open loop, close loop, different type of controllers, ON-OFF, proportional, integral, PI, PD, PID.

Robot end effectors: Types of end effectors, mechanical gripper, tools and end effectors.

Robot sensors: Transducers and sensors; analog and digital transducers; types of sensors, tachfile sensors, proximity and rough sensors ; miscellaneous sensors; vision systems; use of sensors

in robotics.

Rbot kinematics: Position representations; forward and reverse kinematics of three and four degrees of freedom; robot arm; homogeneous transformations and robot kinematics ; kinematics equations using homogeneous transformation .

Industrial application: Capabilities of robots; robot applications; materials handling; pick and place operation; palletizing and depalletizing; machine loading and unloading; machine casting; welding;painting,assembly; inspection; maintenance.

### Books recommended:

- 1.Schilling-Fundamental of robotics; PH
- 2.Yoshikawa- Fundamental of robotics; PH
3. S.R.Deb-Robotics Technology and Flexible Automation
4. Introduction to Robotics, John J Craig; Pearson Education

## **SEMESTER- III**

### 4. MT-EE 314 Modeling Simulation and Evolutionary Techniques:

Modeling classification: mathematical, physical and analog models. Estimation of model parameter. System identification.

Experimental nature of simulation. Step involves in simulation studies validation of simulation models.

Computer simulation of continuous and discrete system.

Neral network. Different network configurations. Feed forward and recurrent networks; Training algorithms; identification; pattern recognition; system modeling and state estimation.

Fuzzy logic concept; Fuzzy relations and membership functions; Defuzzification; Fuzzy controllers.

Genetic Algorithm concepts; schemata; coding; Reproduction; Cross over mutation; Scaling and fitness.

Nuero Fuzzy networks, Genetic algorithm in Fuzzy controllers.

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Book:- Rajaraman

**ELECTIVE-III**

1. MT-EE 311 Non conventional Energy System and Energy Converters:

Review of energy source, Importance of non conventional source such as Solar, Bio gas, Wind, Tidal and associated systems. Study of typical energy converters such as High performance machine, special generator driven by Bio gas engine, wind turbines etc, mini hydro generators, MHD, Fuel Cells, Bulb generators. Modern state-of-art and futuristic system.

Book:- Nagpal

2. MT-EE 312 Power System Reliability:

Fundamental concepts of reliability, generation system reliability, operating research, evaluation, transmission and distribution system reliability, inter connected system reliability, bulk power system reliability. Application of power electronically actuated strategic for enhancement of reliability and security.

Book:- Testing Method of Reliability, A.Simpson, K.C.Kapur & L.R.Labenson

3. MT-EE 313 Selected Topics in Machines:

Design limitations in large electrical machines. Effect of discontinuity in magnetic circuit on performance. Design of high performance, high efficiency machines. Effect on other design parameters. CAD on electrical machines. Winding configurations and computer aided design of distributed windings. Multy phase configuration in synchronous and induction machines-security consideration and economics. Abnormal operation of induction machines. Excitation spectra aspects on induction generator in rush current phenomenon in transformer, effect of space harmonics.

Book:- M.G.Say, Dr S.K.Sen, A.K.Sawney