आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

NAAC ACCREDITED

IFTM UNIVERSITY
N.H.-24, Lodhipur Rajput, Delhi Road, Moradabad, Uttar Pradesh-244102
www.iftmuniversity.ac.in

Study & Evaluation Scheme of
Master of Technology
[Session 2020-21]

Programme:	**Electrical Engineering (Power System)**
Course Level:	**PG Degree**
Duration:	**Two Years (Four semesters) Full Time**
Medium of Instruction:	**English**
Minimum Required Attendance:	**75%**
Maximum credits:	**58**

Programme Outcomes (POs):

Students completing this programme will be able to:

- Apply the knowledge of science and mathematics in designing, analyzing and using power converters for various industrial and domestic applications.
- Design the modern electric machines, drives, power converters, and control circuits for specific application.
- Use modern tools, professional software platforms, embedded systems for the diversified applications.
- Solve the problems which need critical and independent thinking to show reflective learning.
- Explore ideas for inculcating research skills and undertake independent research in cutting edge technologies
- Visualize the larger picture and correlate the domain knowledge with the global industrial problems
- Understanding of the impact of electronics & communications in an economic, social and environment context.
- Understanding of intellectual property rights and overall professional & ethical responsibility.
- Ability to communicate effectively with a wide range of audience.
- Ability to learn independently and engage in life-long learning.

IFTM University, Moradabad
Master of Technology (M.Tech) Electrical Engineering
STUDY AND EVALUATION SCHEME (Effective from 2020-21)

YEAR I, SEMESTER- I

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total L	Credits T
						Internal Exam			End Sem Exam		
			L	T	P	Mid Sem Exam	AS +AT	Total			
THEORY											
1.	MIC-101/ MPS-101	Wind and Solar Power Systems	4	0	0	20	10	30	70	100	4
2.	MIC-102// MPS-102	Electrical Power Quality	4	0	0	20	10	30	70	100	4
3.	MIC-103/ MPS-103	Advanced Instrumentation	4	0	0	20	10	30	70	100	4
4.	MIC-104/ MPS-104	Neural Network, Fuzzy logic and Genetic Algorithms	4	0	0	20	10	30	70	100	4
		TOTAL	**16**	**0**	**00**	**-**	**-**	**-**	**-**	**400**	**16**

YEAR I, SEMESTER-II

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total L	Credits T
						Internal Exam			End Sem Exam		
			L	T	P	Mid Sem Exam	AS +AT	Total			
THEORY											
1.	MPS-201	Electrical Drives and Control	4	0	0	20	10	30	70	100	4
2.	MPS-202	EHV AC & DC Transmission	4	0	0	20	10	30	70	100	4
3.	MPS-203	Restructuring & Deregulation of power system	4	0	0	20	10	30	70	100	4
4.	MPS-204	Elective-I	4	0	0	20	10	30	70	100	4
		TOTAL	**16**	**0**	**00**	**-**	**-**	**-**	**-**	**400**	**16**

ELECTIVE – I

S. NO.	COURSE CODE	NAME OF THE COURSE
1.	MPS-204(A)	Power System Dynamics and Control
2.	MPS-204(B)	Advanced Electromagnetic Theory

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech I Year (I Semester)
MIC-101/MPS -101 WIND AND SOLAR POWER SYSTEMS

Objective:

1. To provide comprehension idea about wind and solar power generation.
2. To learn about the different electrical machines.

UNIT-I **(08 Sessions)**

Wind Speed and Energy Distributions: Speed and Power Relations, Power Extracted from the Wind, Rotor Swept Area, Air Density, Global Wind Patterns, Wind Speed Distribution-Weibull Probability distribution, Mean and Mode speeds, Root Mean Cube Speeds, Energy Distributions, Digital Data Loggers, Effect of Height, Wind Speed Prediction

Wind Power System: System Components, Turbine Rating, Variable-Speed Operation, System Design Features, Maximum Power Operation, System Control Requirements, Environmental Aspects

UNIT-II **(08 Sessions)**

Electrical Generator: Electromechanical Energy Conversion, DC Machine, Synchronous Machine, Induction Machine, Induction Generator, Self-Excitation Capacitance, Torque-Speed Characteristic, Transients,

Generator Drives: Speed Control Regions, Generator Drives, One Fixed-Speed Drive, Variable-Speed Using Gear Drive, Variable-Speed Using Power Electronics, Variable-Speed Drive, Drive Selection, Cut-Out Speed Selection

UNIT-III **(09 Sessions)**

Photovoltaic Power: Present Status, Building Integrated P-V Systems, P-V Cell Technologies

Solar Photovoltaic Power System: The P-V Cell, Module and Array, Equivalent Electrical Circuit, Open Circuit Voltage and Short Circuit Current, i-v and p-v Curves, Array Design, Electrical Load Matching, Sun Tracking, Peak Power Point Operation, P-V System Components,

Solar Thermal System: Energy Collection, Solar II Power Plant, Synchronous Generator, Commercial Power Plants,

UNIT-IV **(07 Sessions)**

Energy Storage: Battery, Types of Batteries, Equivalent Electrical Circuit, Performance Characteristics, Charge Regulators, , Superconducting Coil

Power Electronics Converters: Basic Switching Devices, AC to DC Rectifier, DC to AC Inverter, Grid Interface Controls, Battery Charge/Discharge Converters, Power Shunts

UNIT-V **(08 Sessions)**

Stand-Alone System: P-V Stand-Alone, Wind Stand-Alone, Hybrid System, Mode Controller, Load Sharing,

Grid-Connected System: Interface Requirements, Synchronizing with Grid, Operating Limit, Energy Storage and Load Scheduling

Electrical Performance: Voltage Current and Power Relations, Quality of Power, Renewable Capacity Limit

Course Outcomes:

Upon completion of the course, the student will be able to:

- Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
- Know the need of renewable energy resources, historical and latest developments.
- Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc.
- Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications
- Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.
- Simulation and verification techniques using industrial standard software shall be provided to the students.

Suggested Readings:

1. Mukund R. Patel “Wind and Solar Power Systems”, CRC Press, 1999.
2. Rai. G.D, “Non conventional energy sources”, Khanna publishes, 1993.
3. Rai. G.D,” Solar energy utilization”, Khanna publishes, 1993.
4. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995.
5. B.H. Khan “Non-conventional Energy sources” Tata McGraw-Hill Publishing Company, New Delhi

Website Sources:

- http://www.awea.org/Resources/Content.aspx?ItemNumber=900
- http://www.windpowerwiki.dk/
- http://learn.kidwind.org/teach
- http://www.renewables-made-in-germany.com/en/renewables-made-ingermany-start/solar-energy/solar-thermal-energy/overview.html

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech I Year (I Semester)

(MIC-102/MPS—102) ELECTRICAL POWER QUALITY

Objective:

1. To learn about the power quality monitoring concepts in power system.
2. To understand the effect of harmonics, overvoltage and surges on power system.

UNIT I **(08 Sessions)**

Introduction to Power Quality: Terms and definitions: Overloading, under voltage, sustained interruption; sags and swells; waveform distortion, Total Harmonic Distortion (THD), Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II **(08 Sessions)**

Voltage Sags and Interruptions: Sources of sags and interruptions, estimating voltage sag performance, motor starting sags, estimating the sag severity, mitigation of voltage sags, active series compensators, static transfer switches and fast transfer switches.

UNIT III **(08 Sessions)**

Over voltages : Sources of over voltages: Capacitor switching, lightning, Ferro resonance; mitigation of voltage swells: Surge arresters, low pass filters, power conditioners – Lightning protection, shielding, line arresters, protection of transformers and cables, computer analysis tools for transients, PSCAD and EMTP.

UNIT IV **(08 Sessions)**

Harmonics: Harmonic distortion: Voltage and current distortion, harmonic indices, harmonic sources from commercial and industrial loads, locating harmonic sources; power system response characteristics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive filters, active filters, IEEE and IEC standards.

UNIT V **(08 Sessions)**

Power Quality Monitoring: Monitoring considerations: Power line disturbance analyzer, per quality measurement equipment, harmonic / spectrum analyser; flicker meters, disturbance analyzer, applications of expert system for power quality monitoring

Course Outcomes:

Upon completion of the course, the student will be able to:

- To study various methods of power quality monitoring.
- To Study the production of voltages sags.
- To Study the interruptions types and its influence in various components.
- To Study the Effects of harmonics on various equipment's.
- Understand power quality monitoring and classification techniques

Suggested Readings:

1. Heydt, G.T., „Electric Power Quality", Stars in a Circle Publications, Indiana, 2nd edition 1994.
2. Bollen, M.H.J "Understanding Power Quality Problems: Voltage sags and interruptions", IEEE Press, New York, 2000.
3. Arrillaga, J, Watson, N.R., Chen, S., „Power System Quality Assessment", Wiley, New York, 2000.
4. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill, 2003.
5. PSCAD User Manual.

Website Sources:

- www.academia.edu
- www.researchgate.net

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech I Year (I Semester)

(MIC-103/MPS-103) ADVANCED INSTRUMENTATION

Objective:

1. To learn about the working and applications of transducer.
2. To be familiar with virtual instrumentation, recorders, industrial instruments and data acquisition system.

UNIT I **(08 Sessions)**

Review of Analog transducers, Digital transducers-Digital encoders & their classifications, Resolution enhancement Coding limitations, Digital measurement of frequency & time. Digital phase meter, Digital capacitance meter

Measurement of vibration-Necessity of vibration measurement, Analysis of vibration sensing devices, Measurement of shock, System characteristics.

UNIT II **(07 Sessions)**

Review of Signal Conditioning Signal processing, basic instrumentation amplifier-Linear gain control, Applications of Instrumentation amplifier - Transducer bridges, Isolation amplifiers, Filters, chopped and modulated d.c. amplifier, Modulators and Demodulators, Solid state modulator and Demodulator circuit

UNIT III **(08 Sessions)**

Analog & Digital Data Acquisition System: Elements of digital data acquisition system. Magnetic tape recorders, F.M. recording, Digital recording methods – RZ & NRZ methods of recording, D/A & A/D converters, Simultaneous A/D converter, Counter type, Continuous type & Successive A/D converters. Sample & hold circuit, Multiplexing – TDM &FDM methods, Spectral encoders.

UNIT IV **(08 Sessions)**

Bio Medical Instrumentation: Sources of bio-electric potentials- Resting and action potentials, Propagation of action potentials, Transducers for biomedical applications, Bio-potential electrodes, Biochemical transducers.

Cardiovascular Measurements: The Heart and cardiovascular system**,** Electrocardiography, Measurement of blood pressure, Pacemakers- Pacemaker systems, Defibrillators

UNIT V **(08 Sessions)**

Industrial Instrumentation: Measurements of displacement, flow, moisture, liquid level & pressure/weight using digital transducers, **Methods of composition Analysis**: Spectroscopic methods, Absorption, Emission & Mass spectroscopy

Course Outcomes:

Upon completion of the course, the student will be able to:

- Get an adequate knowledge about selecting particular sensing elements for the measurement of physical parameters.
- Verify the characteristics of Thermocouple and RTD.
- Acquire knowledge about the principles different type of flow measurements.
- Understand the design, calibration and characteristics of various measuring systems/ instruments.
- Recognize the fundamental principles of various types of sensors including thermal, mechanical, electrical, electromechanical and optical sensors. Understand their general characteristics, terminologies, sensing and transduction principles.
- Analyze the measured data (resolution, error analysis etc) obtained from sensors and transducers. Review the cardiac, respiratory, nervous and muscular physiological systems.
- Learn several signals that can be measured from the human body and understand theory of signal conditioning.
- Familiarize students with various medical equipment and their technical aspects.
- Understand the medical imaging.

Suggested Readings:

1. Instrumentation System & Devices – Rangan, Sarma & Mani
2. Electrical and Electronic Measurements – G.K.Banerjee
3. Industrial Instrumentation – Donald. P. Eckman.
4. Biomedical Instrumentation & Measurements – Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer

Website Sources:

- www.academia.edu
- www.researchgate.net
- https://ieeexplore.ieee.org
- www.nptel.ac.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech I Year (I Semester)

MIC-104/MPS-104 NEURAL NETWORKS, FUZZY LOGIC AND GENETIC ALGORITHMS

Objective:

1. To learn about the neural network and its applications.
2. To learn about the fuzzy logic system and genetic theory.

UNIT-I **(09 Session)**

Neural Networks-1(Introduction & Architecture) : Introduction, Biological and Artificial Neuron Models, Nerve structure and synapse, Artificial Neuron and its model, Activation functions, Neural Network Architecture: Single layer and Multilayer Feed Forward networks, Recurrent networks, Various learning techniques, Perceptron Model and Perceptron Convergence theorem, Limitations and Applications of the Perceptron Model, Auto-associative and hetro associative memory

UNIT-II **(09 Sessions)**

Neural Networks-II (Back Propagation Networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training, Applications of neural network in load flow study, load forecasting, detection of faults in distribution system and electric drives control,.

UNIT-III **(08 Sessions)**

Fuzzy Logic-I (Introduction): Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory versus probability theory, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion

UNIT-IV **(08 Sessions)**

Fuzzy Logic –II (Fuzzy Membership, Rules): Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzifications, Fuzzy Controller, Industrial applications of fuzzy logic.

UNIT-V **(06 Sessions)**

Genetic Algorithm (GA): Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Course Outcomes:

At the end of the course the student should be able to

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures
- Understand perceptron's and counter propagation networks.
- Define the fuzzy systems
- Analyze the genetic algorithms and their applications. Understand soft computing techniques and their role in problem solving.
- Conceptualize and parameterize various problems to be solved through basic soft computing techniques.
- Analyze and integrate various soft computing techniques in order to solve problems effectively and efficiently.

Suggested Readings:

1. Yegnanarayana,B "Artificial Neural Networks," Prentice Hall of India.
2. Kumar Satish, "Neural Networks" Tata Mc Graw Hill
3. Siman Haykin,"Neural Networks", Prentice Hall of India

Website Sources:

- www.researchgate.net
- https://ieeexplore.ieee.org
- www.sciencedirect.com
- www.springer.com
- https://onlinelibrary.wiley.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech I Year (II Semester)

MPS-201 ELECTRICAL DRIVES AND CONTROL

Objective:

1. To learn about the power electronic devices and its applications.
2. To learn about DC and AC drives and the voltage controllers.

UNIT-I **(07 Sessions)**

Introduction, Power semiconductor devices- Thyristors- triggering methods, gate triggering, UJT triggering, PUT triggering, MoSFETs, TRIACS- Characteristics of TRIACs, Characteristics of GTOs, Characteristics of IGBTs, Characteristics of MCTCs. Converters-AC/AC converters, DC/DC converters, DC/AC converters. Dynamics of Electrical Drives, General configuration of a Motor Drive. Determination of Moment of Inertia, Numerical Examples

UNIT-II **(09 Sessions)**

D.C. Drives: Review of various types **of** d.c.motors and their characteristics, Ward Leonard method of speed control of a d.c.motor Controlled Rectifier Circuits- Chopper circuits, Single phase Dual converter drives, Electric braking, Electrical braking of rectifier controlled separately excited d.c. motor, Thyristor control of a d.c. series motor, Microprocessor based speed control of a separately excited d.c. motor, Chopper control of d.c. series motor, Multi quadrant Control of Chopper drives, Numerical Examples

UNIT-III **(07 Sessions)**

A.C Voltage controllers, A.C. Regulators- Half wave regulators, Delta connected regulators, Inverters- PWM Inverters, Variable Voltage Variable Frequency Control Method, Voltage source Inverter Drives, Current Source Inverter Drives, Cycloconverters, Rotor resistance control of SRIM, Numerical Examples.

UNIT-IV **(09 Sessions)**

A.C. Motor Drives- Review of Induction Motor Drives, Modified Speed-Torque Characteristics Three phase Induction motor, Methods of speed control-Stator voltage control, Rotor voltage control, V/F control, Soft starting, Static Scheribius Control and Static Kramer control of Induction Motor Drives, Industrial Microprocessor based speed control of three phase Induction motors, Single phase Induction motor Drives, Industrial applications, Numerical Examples.

UNIT-V **(08 Sessions)**

Synchronous Motor Drives- Steady state characteristics, Torque angle characteristics, Braking of Synchronous motors-Dynamics of braking. Types of Synchronous motors, VSI Drives, Load Commutated Inverter Drives (CSI Drives) Cycloconverter Drives, Stepping Motors-Vaiable Reluctance Stepping Motors and Drive circuits, Permanent magnet Stepping Motors, Hybrid Stepping Motors, Switched Reluctance Stepping Motors and Drive circuits, Brushless D.C. Motor Drives, Numerical Examples

Course Outcomes:

At the end of the course the student should be able to

- To learn the General characteristics of different types of electrical AC & DC Motors with respect to the applications.
- To understand the operation of different types of DC electrical drives.
- To understand the operation of Three Phase Induction Motors Drive.
- To understand the operation of Three Phase Synchronous Motor Drives.
- To learn the operation of control circuits and applications of Digital Control And Drive Application
- Describe the structure of Electric Drive systems and their role in various applications such as flexible production systems, energy conservation, renewable energy, transportation etc., making Electric Drives an enabling technology.
- Understand basic requirements placed by mechanical systems on electric drives.
- Understand the basic principles of power electronics in drives using switch-mode converters and pulse width modulation to synthesize the voltages in dc and ac motor drives.

Suggested Readings:

1. Electric Drives- N.K.De and P.K. Sen, PHI Learning
2. Power Semiconductor Controlled Drives- GK Dubey, S.Chand & Co.
3. A First Course in Electric Drives- S.K.Pillai , New Age International Publications

Website Sources:

- www.lecturenotes.in
- www.studentsfocus.com
- www.electrical-engineering-portal.com
- www.nptel.ac.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech I Year (II Semester)

MPS-202 EHV AC & HVDC TRANSMISSION

Objective:

1. To learn about the need of AC high voltage system in transmission line.
2. To learn about the HVDC transmission system and protection schemes for under-voltage and overvoltage surges.

UNIT-I **(05 Sessions)**

Introduction: Need of EHV AC Transmission, Comparison of EHV AC & HVDC Transmission, Mechanical Considerations of Transmission Line

UNIT-II **(10 Sessions)**

EHV AC Transmission: Parameters Of EHV Lines, Voltage Gradient In Bundle Conductors Lines, Conductor Sizing, Over-Voltages Due To Switching, Ferro-Resonance. Insulation Coordination Line Insulators and Clearances, Corona & Its Effects, Power Loss, Audible Noise and Radio-Interference, Long Distance Transmission With Series And Shunt Compensations, Principle Of Half Wave Transmission, Flexible Ac Transmission

UNIT-III **(08 Sessions)**

HVDC TRANSMISSION: General Aspects Of D.C. Transmission & its comparison with A.C. Transmission, Different Types Of Power Rectifiers & High Voltage Rectifiers (Converter Circuits), Analysis Of Bridge Converter, Converter Control & Operation, Inversion, Harmonics & Filters, Converter Fault & Protection

UNIT-IV **(10 Sessions)**

Protection of High Voltage D.C. Systems, D.C. Circuit Breakers, Cable Lines and Overhead Lines for D.C. Transmission, Steady State & Transient State Characteristics of D.C. Power Transmission Systems. Influence of A D.C. Transmission System on the Steady State Stability & Transient Stability of an Associated A.C. Power System.

UNIT-V **(07 Sessions)**

Extra H.V.D.C. Transmission, H.V.D.C. Thyristors, Their Constructional Details & Operating Principles, Analysis of Converter & Inverter Operation: Control of H.V.D.C. Link

Course Outcomes:

At the end of the course the student should be able to

- Qualitative comparison of AC and DC transmission system with all aspects
- Understand the need of EHV AC transmission and various issues related with it
- Reactive power management, Stability of AC and DC systems
- Understand In depth converter analysis, faults, protections, harmonic considerations, grounding system
- Understand the Journey from conventional HVDC control to modern HVDC control schemes to identify the electrical requirements for HVDC lines.
- Understand the operation of HVDC conversion technology.
- Understand the fundamental requirements of HVDC transmission line design.
- can analyze travelling waves
- Understand the effects of corona like Audible noise.
- To identify factors affecting AC-DC transmission.

Suggested Readings:

1. EHV-AC and HV DC Transmission Engineering Practice". S. Rao"
2. H.V.D.C Power Transmission System" - K.R. Padiyar
3. "Extra High Voltage AC Transmission Engineering" Rakosh Das Begamudre

Website Sources:

- www.lecturenotes.in
- www.scribd.com
- www.researchgate.net
- https://ieeexplore.ieee.org
- www.sciencedirect.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech I Year (II Semester)

MPS-203 RESTRUCTURING AND DEREGULATION OF POWER SYSTEM LTP

Objective:

1. To learn about power scheduling in electrical systems.
2. To learn about the electricity market characteristics and the role of different parameters which affect its cost of distribution.

UNIT-I **(07 Sessions)**

Open access in electricity sector, types of open access- medium term. Competitive Electricity Market and Balancing Mechanism, Scheduling.

UNIT-II **(09 Sessions)**

Traditional Central Utility Model, Reform Motivations, Separation of Ownership and Operation, Central Dispatch versus Market Solution, Independent System Operator (ISO), Components of Restructured Systems: Gencos, Discos and Retailers

UNIT-III **(08 Sessions)**

Wholesale Electricity Market Characteristics: Central Auction, Bidding, Market Clearing and Pricing, Bilateral Trading, Scheduling, Gaming, Ancillary, Maximalist ISO, Minimalist ISO Model. Deregulation in Distribution.

UNIT-IV **(08 Sessions)**

Role of TP: Vertically Integrated Utility, Three Models of the Electricity Market, For-profit TP. Incentive Rate Design, Priority Insurance Scheme, Transmission Expansion in deregulated Environment, Transmission Owners

UNIT-V **(08 Sessions)**

ISOs, Power Exchange (PX), Scheduling Coordinators. PX and ISO: Functions and Responsibilities, Trading Arrangements: The Pool, Pool and Bilateral Trades, Multilateral Trades, Congestion Management in Open-access Transmission Systems, Open-access Coordination Strategies.

Course Outcomes:

At the end of the course, the student will be able to:

- Understand the need for restructuring of Power Systems, discuss different market models, different stakeholders and market power
- Understand and generalize the functioning and planning activities of ISO
- Understand transmission open access pricing issues and congestion management.
- Define transfer capability and estimate the transfer capability of a small power systems. (Numerical examples)
- Define ancillary services and understand reactive power as ancillary service and management through synchronous generator.
- Choose appropriate risk management instruments
- Analyze market power
- Choose appropriate congestion management mechanisms

Suggested Readings:

1. Loi Lei Lai, "Power System Restructuring and Deregulation: Trading Performance and Information Technology", John Wiley & Sons Ltd.
2. CERC Regulations on Grand og Connectivity, Medium term Open Access and Long Term Open Access; Regulations.
3. CERC Regulation on Open Access-2008 [CERC Compendium].
4. POSOCO Manual on Electricity Market.

Website Sources:

- www.researchgate.net
- https://onlinelibrary.wiley.com
- https://ieeexplore.ieee.org
- www.nptel.ac.in
- www.academia.edu
- https://link.springer.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech I Year (II Semester)

MPS-204 (A) POWER SYSTEM DYNAMICS AND CONTROL

Objective:

1. To learn about the modelling of synchronous machine and park transformation.
2. To learn about the different types of excitation system and their applications.
3. To learn about the concept of power compensation.

UNIT-I **(10 Sessions)**

Synchronous Machine Modelling: Schematic Diagram , Physical Description: armature and field structure, machines with multiple pole pairs, mmf waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 trans formation,

UNIT-II **(06 Sessions)**

Excitation Systems: Excitation System - Requirements, Elements of Excitation System, types of Excitation System: Rotating Rectifier and Potential-source controlled-rectifier systems: hardware block diagram and IEEE (1992) Type ST1A block diagram

UNIT-III **(08 Sessions)**

Automatic Generation Control: Fundamentals of speed governing - control of generating unit Power output– composite regulating characteristic of Power Systems – Response rates of turbine – governing systems– fundamentals of automatic generation control –Implementation of AGC.

UNIT-IV **(10 Sessions)**

Reactive Power And Voltage Control: Modelling of AVR loops : Components – stability compensation - Production and absorption of reactive Power – methods of voltage control - shunt reactors – shunt capacitors – series capacitors – synchronous condensers – static var systems-Principle of transmission system compensation – modeling of reactive compensating devices – Application of tap changing transformers to transmission systems- distribution system voltage regulation – modeling of transformer ULTC control systems

UNIT-V **(06 Sessions)**

Voltage stability: - Basic concept, transmission system characteristics, generator characteristics, load characteristics, PV curve, QV curve and PQ curve, characteristics of reactive power compensating devices. Voltage collapse and prevention of voltage collapse.

Course Outcomes:

At the end of the course, the student will be able to:

- Remember the dynamic characteristics of power system equipment,
- recognize dynamic performance of power systems
- Illustrate the system stability and controls.
- Choose the fundamental dynamic behaviour and controls of power systems to perform basic stability analysis.
- Comprehend concepts in modelling and simulating the dynamic phenomena of power systems Interpret results of system stability studies

Suggested Readings:

1. P. Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.
2. P.M Anderson and A.A Fouad, “Power System Control and Stability”, Iowa State University Press, Ames, Iowa, 1978
3. Elgerd O.I, “Electric Energy System Theory: an Introduction” - Tata McGraw Hill, New Delhi – 2002Mahalanabis A.K., Kothari. D.P. and Ahson.S.I., “Computer Aided Power System Analysis and Control”, TMH,1984.

Website Sources:

- www.academia.edu
- www.springer.com
- www.nptel.ac.in
- www.onlinelibrary.wiley.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech I Year (II Semester)

MPS-204(B) ADVANCED ELECTROMAGNETIC THEORY

Objective:

1. To learn about the behaviour of EM-wave in electrostatic and magnetic field.
2. To analyze the behaviour of EM- wave in different media and also obtain their characteristic.

UNIT I **(06 Sessions)**

Maxwell equations for varying fields, Retarded potentials, Electromagnetic waves, Fields in anisotropic media

UNIT II **(09 Sessions)**

Review of electrostatic & steady magnetic fields, Inconsistency of Ampere's law. Maxwell's equations, Conditions at a boundary surface, Electromagnetic plane wave. Interaction of electron beams & e.m. fields.

UNIT III **(09 Sessions)**

Wave Equations, General solution of a wave Equations, Polarization, Reflection by a perfect conductor – Normal Incidence, Reflection by a perfect dielectric- normal Incidence. Reflection at the surface of a conductive medium, Poynting Vector and Power flow

UNIT IV **(08 Sessions)**

Wave propagation in gyro tropic media, Magnetic properties of ferrites, Tensor permeability, Faraday rotation, Ferrite Junction circulator, Symmetrical circulator, scattering matrix theory

UNIT V **(08 Sessions)**

Numerical Electromagnetism, The Finite Difference method, The Moment method, The Finite element method Scattering & Diffraction of E.M. waves

Course Outcomes:

- Develop the knowledge of Electromagnetic Wave Transmission, transmission lines: frequency domain analysis of radio frequency and microwave transmission circuits including power relations and graphical and computer methods.
- Acquainting the students with the knowledge of Electromagnetic waves: planar optical components, pulse dispersion, phase front considerations for optical components, conducting waveguides, dielectric waveguides.
- To make students familiar with the concept of Radiation: retarded potentials, elemental dipoles, radiating antenna characterization, receiving mode.

Suggested Readings:

1. E.M. Field theory, Antenna & Wave Propagation – P.C. Dhar.
2. E.M. Waves & Radiating Systems – Jordan & Balman.
3. Electromagnetic Fields and Applications - Babu. R. Vishwakarma

Website Sources:

- www.ocw.mit.edu
- www.springer.com
- www.britannica.com
- www.electrical-engineering-portal.com
- www.nptel.ac.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (M.Tech) Electrical Engineering
STUDY AND EVALUATION SCHEME (Effective from 2020-21)
YEAR II, SEMESTER-III

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total L	Credits T
						Internal Exam			End Sem Exam		
			L	T	P	Mid Sem Exam	AS +AT	Total			
THEORY											
1.	MPS-301	SCADA & Energy Management System	4	0	0	20	10	30	70	100	4
2.	MPS-302	Power System Transients	4	0	0	20	10	30	70	100	4
3.	MPS-303	Elective-II	4	0	0	20	10	30	70	100	4
PRACTICALS / PROJECT											
4.	MPS-304	Seminar	0	0	4	-	100	100	-	100	2
5.	MPS-351	Pre-dissertation*	0	0	4	-	50	50	50	100	2
		TOTAL	**12**	**0**	**08**	**-**	**-**	**-**	**-**	**500**	**16**

Preliminary to finalize the topic and dissertation to be continued in IV Semester.

YEAR II, SEMESTER-IV

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total L	Credits T
						Internal Exam			End Sem Exam		
			L	T	P	Mid Sem Exam	AS +AT	Total			
PRACTICALS / PROJECT											
1.	MPS-451	Dissertation	0	0	20	-	250	250	250	500	10
		TOTAL	**-**	**-**	**20**	-	**-**	-	**-**	**500**	**10**

ELECTIVE –II

S. No.	Course Code	Name of the Course
1.	MPS-303 (A)	Transmission & Distribution Automation
2.	MPS-303 (B)	Power System Reliability

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech II Year (III Semester)

MPS-301 SCADA & ENERGY MANAGEMENT SYSTEM

Objective:

1. To learn about the supervisory control and data acquisition control in power system.
2. To learn about the SCADA system and energy management center.

UNIT-I **(08 Sessions)**

SCADA: Purpose and necessity, general structure, data acquisition, transmission & monitoring. general power system hierarchical Structure, Overview of the methods of data acquisition systems, commonly acquired data, transducers, RTUs, data concentrators, various communication channels- cables, telephone lines, power line carrier, microwaves, fiber optical channels and satellites

UNIT-II **(08 Sessions)**

Supervisory and Control Functions: Data acquisitions, status indications, majored values, energy values, monitoring alarm and event application processing. Control Function: ON/ OFF control of lines, transformers, capacitors and applications in process in industry - valve, opening, closing etc., Regulatory functions: Set points and feedback loops, time tagged data, disturbance data collection and analysis, Calculation and report preparation

UNIT-III **(08 Sessions)**

MAN- Machine Communication: Operator consoles and VDUs, displays, operator dialogues, alarm and event loggers, mimic diagrams, report and printing facilities

UNIT-IV **(08 Sessions)**

Data basis- SCADA, EMS and network data basis, SCADA system structure - local system, communication system and central system, Configuration- NON-redundant- single processor, redundant dual processor, multi-control centers, system configuration, Performance considerations: real time operation system requirements, modularization of software programming languages

UNIT-V **(08 Sessions)**

Energy Management Center: Functions performed at a centralized management center, production control and load management economic dispatch, distributed centers and power pool management

Course Outcomes:

At the end of this course, the students will be able to:

- Understand the fundamentals of energy management functions
- Understand the economic analysis and system energy management for electrical system and equipment.
- Enhance the knowledge in lighting and cogeneration.
- Expose to the concept of supervisory control and data acquisition.
- Familiarize the application of SCADA in power systems

Suggested Readings:

1. Torsten Cergrell, “Power System Control Technology", Prentice Hall International.
2. George L Kusic "Computer Aided Power System Analysis",, Prentice Hall of India,
3. A. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley & Sons.
4. Sunil S Rao, "Switchgear Protection & Control System" Khanna Publishers 11th

Website Sources:

- www.sciencedirect.com
- www.iitm.ac.in
- www.nptel.ac.in
- www.springer.com
- www.researchgate.net
- www.academia.edu

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech II Year (III Semester)

MPS-302 POWER SYSTEM TRANSIENTS

Objective:

1. To learn about the wave equations and its terminologies with its applications.
2. To learn about the high voltage equipment used in power system.

UNIT –I **(08 Sessions)**

Wave terminology, development of wave equations, terminal problems, lattice diagrams, Origin and nature of power system surges, wave shapes, attenuation, effect of shielding by ground wires and masts, tower footing resistance

UNIT –II **(08 Sessions)**

Traveling waves, multi-velocity waves, methods of measuring tower footing resistance, voltages across insulator strings, Dynamic over voltages during surges and system faults, system recovery voltage characteristics

UNIT –III **(08 Sessions)**

Methods of neutral grounding and their effect on system behavior, Insulation coordination, requirement in surge protection of lines and equipment

UNIT –IV **(08 Sessions)**

Impulse generator development, Impulse testing technique, Power frequency h.v. transformers, cascade connection, H.V.D.C. generators, tests with power frequency and d.c. voltages, Large current generating and measurement techniques, Partial discharge testing

UNIT –V **(08 Sessions)**

High voltage and high current testing of power equipment, Field investigations, Magnetic links their calibration and mounting, klydenographs, potential dividers and cathodes ray oscillography

Course Outcomes:

At the end of this course, the students will be able to:

- To provide the students a detailed knowledge of the types of the faults existing in the distribution & transmission system.
- Ability to do calculation of resistance, Inductance and Capacitance of Transmission Lines.
- Able to do calculation of power system Transients.
- Ability to do calculation of sag for different types of Transmission systems.
- Ability to discuss construction of Underground Cables.
- Describe the formation and characteristics of travelling waves in transmission line
- Apply the ATP/EMTP software for transient studies.
- Model power apparatus under transient conditions
- Apply insulation co-ordination principles.

Suggested Readings:

1. Advance Power System, Stevenson & Grauger Wadha
2. E.w. Kimbark, 'Power System Stability, Vol. I, John Wiley & Sons, 1948-A Book
3. P.C. Magnusswon, 'the Transient Energy Method of Calculating Satability', AIEE Trans,
4. P.D. Aylett, 'Energy Integral Creation of Transient Stability Limits of Power System', Proc IEE
5. O.I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill.
6. P. Kundur, "Power System Stability and Control Mc Graw Hill.

Website Sources:

- www.learnengineering.in
- www.nptel.ac.in
- www.routledgehandbooks.com
- www.springer.com
- www.lecturenotes.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech II Year (III Semester)

MPS-303 (A) TRANSMISSION AND DISTRIBUTION AUTOMATION

Objective:

1. To learn about power distribution system and substation layout.
2. To learn about SCADA system and its application in electrical system.

UNIT I **(08 Sessions)**

Overview of transmission system, SCADA in Power systems, AGC, Energy Management Systems, FACTS, HVDC, Under Frequency Relay (UFR), df/dt control, Islanding. Regional grids, Specifications and details, Functions of the SCADA hierarchical levels in Transmission Master Stations

UNIT II **(08 Sessions)**

Utility distribution system, Types of distribution feeder configurations; Grid network, radial, loop, grounding, Load and fault characteristics, Distribution transformers and regulators, Application of capacitors for distribution system,. Losses and loss reduction in Distribution systems, Over-voltages in Distribution systems

UNIT III **(08 Sessions)**

Introduction to Distribution Automation (DA), Constituents of DA, Feeder automation application functions, Outage management, customer information systems, AMI, Distribution load flow & fault location algorithms for distribution system

UNIT IV **(08 Sessions)**

Substations, Bus Switching Schemes, Types of substations; GIS, Air Insulated, HV Power Electronic, Smart Grid; Smart Transmission (WAMS, Smart Distribution, Demand Side Integration (Demand Response & Demand Side Management), Energy Storage, Renewable Source Integration

UNIT V **(08 Sessions)**

Substation integration and automaton, Application functions Interface between substation and automation, Open systems, architecture functional data paths, new v/s existing substations

Course Outcomes:

- Understand issues, opportunities & challenges in Smart grid
- Develop skills required for smart grid planning & formulation of regulations.
- Understand Power distribution sector framework in India and its comparison globally.
- Learn processes for execution and control of regulation in power distribution business in India.

Suggested Readings:

1. Power Distribution Engineering: James J. Burke, Marcel Dekker, Inc.
2. Electric Power Substation Engineering John D. Mc Donald CRC Press, , Taylor and Francis
3. Control and Automation of Electrical Power Distribution systems, James Northcote-Green, R Wilson, CRC Press, Taylor and Francis.
4. Electric Power Distribution, Automation, Protection and Control, James Momoh, CRC press, Taylor and Francis.

Website Sources:

- www.learnengineering.in
- www.nptel.ac.in
- www.routledgehandbooks.com
- www.springer.com
- www.lecturenotes.in
- www.researchgate.net

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IFTM University, Moradabad
Master of Technology (Electrical Engineering) Programme
M.Tech II Year (III Semester)
MPS-303(B) POWER SYSTEM RELIABILITY

Objective:

1. To learn about the basics of probability theory & its implementation in power system.
2. To learn about the composite, complex and parallel networks and analyze their behavior.

UNIT –I **(08 Sessions)**

Basics of Probability theory & Distribution: Basic probability theory, rules for combining probabilities of events, Bernoulli's trials, probabilities density and distribution functions binomial distribution, expected value and standard deviation of binomial distribution.

Network Modeling and Reliability Analysis: Analysis of Series, Parallel, Series-Parallel networks, complex networks, decomposition method.

UNIT –II **(08 Sessions)**

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

UNIT –III **(08 Sessions)**

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

Frequency & Duration Techniques : Frequency and duration concept – Evaluation of frequency of encountering state, mean cycle time, for one , two component repairable models – evaluation of cumulative probability and cumulative frequency of encountering of merged states.

UNIT –IV **(08 Sessions)**

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

UNIT –V **(08 Sessions)**

Composite Systems Reliability Analysis: Decompositions method, Reliability Indices, Weather Effects on Transmission Lines Distribution System and Reliability Analysis: Basic Concepts, Evaluation of Basic and performance reliability indices of radial networks.

Course Outcomes:

At the end of this course, the students will be able to:

- Design and develop electric power and energy systems
- Deliver technological solutions in the field of power systems by assimilating advances in allied disciplines
- Simulate and experiment in the field of power systems using modern tools
- Design renewable energy systems to protect environment and ecosystems
- Practice professional ethics with social sensitivity
- Develop innovative and entrepreneurial solutions
- Communicate effectively at all levels and demonstrate leadership qualities
- Pursue research to enhance the existing pool of knowledge

Suggested Readings:

1. Reliability Evaluation of Engg. System – R. Billinton, R.N.Allan, Plenum Press, New York.
2. Reliability Evaluation of Power systems – R. Billinton, R.N.Allan, Pitman Advance Publishing Program, NY.
3. An Introduction to Reliability and Maintainability Engineering.- Charles E. Ebeling, TATA Mc Graw – Hill.

Website Sources:

- www.learnengineering.in
- www.nptel.ac.in
- www.routledgehandbooks.com
- www.springer.com
- www.lecturenotes.in

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