Mandsaur University

Subject Code: - EEE420
Subject Name: - Special Electrical Machines
Semester: - VI

L	T	P	C
3	-	-	3

Course Objective:
To impart knowledge on construction, principle of operation, control and performance of synchronous reluctance motors, stepping motors, switched reluctance motors, permanent magnet brushless D.C. motors and permanent magnet synchronous motors.

Unit-I Synchronous Reluctance Motors
Constructional features – Types – axial and radial flux motors – operating principles – variable reluctance motors – voltage and torque equations - phasor diagram - performance characteristics – applications.

Unit-II Stepper Motors
Constructional features – principle of operation – variable reluctance motor – hybrid motor – single and multi stack configurations – torque equations – modes of excitation – characteristics – drive circuits – Microprocessor control of stepper motors – closed loop control.

Unit-III Switched Reluctance Motors (SRM)
Constructional features – Rotary and linear SRM - principle of operation – torque production – steady state performance prediction- analytical method -power converters and their controllers – methods of rotor position sensing – sensor less operation – characteristics and closed loop control – applications.

Unit-IV Permanent Magnet Brushless D.C. Motors
Permanent Magnet materials –magnetic characteristics – Permeance coefficient -principle of operation – types – magnetic circuit analysis – EMF and torque equations –commutation - power converter circuits and their controllers – motor characteristics and control– applications.

Unit-V Permanent Magnet Synchronous Motors (PMSM)
Principle of operation – Ideal PMSM – EMF and torque equations – armature MMF – synchronous reactance – sine wave motor with practical windings - phasor diagram – torque/speed characteristics - power controllers - converter volt-ampere requirements.

Course Outcome:
The students will be able to understand the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines.

Reference Books:

1. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.
3. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
4. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
5. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.

Mandsaur University

Subject Code: - EEE460
Subject Name: - Power Electronics
Semester: - VI

L	T	P	C
2	1	2	4

Course Objectives:

- To understand and acquire knowledge about various power semiconductor devices.
- To gain knowledge of working of different switching devices with respect to their characteristics
- To prepare the students to analyze and design different power converter circuits.
- To analyze control strategies of converters with their applications.

Unit I: Introduction

Advantages and application of power electronic devices, characteristics, symbol & application of power diodes, power transistors, GTO, triac, diac, power MOSFET, IGBT, LASCR, fast recovery diode, schottey diode, MCT.

SCR: Principle of operation, two transistor analogy, IV and gate characteristics, turn on methods, different commutation techniques (Class A, B, C, D, E & F Commutation), thyristor ratings, thyristor protection, heating, cooling & mounting of SCR, series and parallel operation of SCR, problem associated with series and parallel operation of SCR.

Unit II: Phase Controlled Rectifiers

Principle of phase control, single-phase half-wave circuit with RL load, with RL load and freewheeling diode, with RLE load, single-phase full wave midpoint and bridge converter, three-phase half-wave controlled converter, three-phase full converter, three-phase semi converter

Unit III: Choppers

Principle of operation, various control strategies, classification, types of chopper circuits (Type A, B, C, D & E), thyristor chopper circuits.

Unit IV: Inverters

Quality of inverter, single-phase and three-phase voltage source bridge inverter, PWM inverter, single-phase current source inverter, series and parallel inverter.

Unit V:

Cycloconverters: Principle of operation, single-phase to single-phase circuit (step-up and step-down), three-phase half wave circuit, SMPS: principle of operation and classification UPS: principle of operation, classification and applications.

Course Outcomes:

Upon successful completion of this subject, students should be able to:

- Acquire knowledge about fundamental concepts and techniques used in power electronics.
- Ability to analyze various single phase and three phase power converter circuits and understand their applications.
- To develop skills to build and troubleshoot power electronics circuits.
- Ability to understand the use of power converters in commercial and industrial applications.

Reference Books:

1. M.H. Rashid, Power Electronics Circuits, Devices and Applications, Pearson 2 Education, Singapore, 1993.
2. M Ramsmoorthy, An Introduction to transistor and their application, Affiliated East-West Press.
3. P.C. Sen, Power Electonics, TMH.
4. M.D. Singh, K.B. Khanchandani, Power Electronics, TMH, Delhi, 2001.
5. Chakravarti A., Fundamental of Power Electronics and Drives, Dhanpat Ray & Co.
6. Dr. P.S. Bhimbhra, Power Electonics, Khanna Pub.
7. Vedam Subramanyam, Power Electronics New Age International Revised II ed. 2006
8. Mohan Undeland Robin, Power Electronics - Converters, Applications and Design, John Wiley & Sons, 2002.

Suggested List of Experiment:

1. To study introduction to power electronics and its applications.
2. To study of power semiconductor devices.
3. To plot and verify SCR characteristics.
4. To plot and verify V-I characteristics of a Triac.
5. To plot V-I characteristics of UJT.
6. To plot V-I Characteristics of a DIAC.
7. To study and perform single-phase half-wave circuit with RL load.
8. To study 3Φ fully controlled converter.
9. To perform speed control of DC motor using SCR.
10. To study and perform DC-DC step-up converter.
11. To study of type A, B & C chopper circuit.
12. To study and perform single-phase voltage source bridge inverter.
13. To study of three-phase 120˚mode voltage source inverter.
14. To study of three-phase to three-phase cyclo-converter.
15. Fabrication of three phase bridge rectifier using two SCR and two diodes.
16. Fabrication of three phase bridge rectifier using diodes.

Mandsaur University

Subject Code: - EEE440
Subject Name: - Power System II
Semester:-VI

L	T	P	C
2	1	2	4

Course Objective:
To impart learning of mathematical models of power system components, power system analysis techniques and optimal power flow.

Unit –I General:
Problems associated with modern interconnected power Systems, deregulation, power systems restructuring, distributed generation, congestion, available transfer capacities, pricing of energy and transmission services.

Unit – II Power Flow Studies:
Formulation of static power flow equations and solutions is using Gauss-Seidel, Newton Raphson and FDLF methods, comparison of these methods, Economic operation of power system- Economic dispatch, Emission dispatch, line loss, ITL, economic dispatch using lagrangian multiplier method.

Unit- III MW Frequency Control:
Coherency, control area, modeling of speed control mechanism, load damping, block diagrammatic representation of single and two area interconnected system, static and dynamic response, optimum parameter adjustment.

Unit-IV MVAR Voltage Control Problem:
Difference in control strategy over MW - f control, characteristics of an excitation system, DC AC and static excitation system, General block diagram representation of voltage regulators.

Unit- V Power System Stability:
Steady state, dynamic and transients stability, Swing equation , equal area criterion, solution of swing equation using step by step method modified Euler's method and Rnge-Kutta method, methods of improving transient stability.

Course Outcomes:
- Understanding with the mathematical modeling of power system components, the student will be able to carry out power system analysis techniques and optimal power flow.
- Student will understand the frequency, voltage control problems and power system stabilities

Reference Books:

1. Modern Power System Analysis-by I.J. Nagrath & D.P. Kothari Tata Mc Graw –Hill Publication Company Ltd 2nd edition.
2. A Chakrawarti Power System Analysis: Operation and Control PHI Learning 3rd edition.
3. Reactive power Control in Electric Systems- by T.J.E. Miller, John Wiley & Sons.

4. Electrical Power Systems-by C.L. Wadhwa New Age International (P) Limited Publishers, 2nd edition 1998.
5. Elgerd O.I., "Electric Energy Systems Theory", TMH, New Delhi, Second Edition 1983.
6. Prabha Kundur, "Power system stability and control", Mc-Graw Hill Inc, New York, 1993.
7. Taylor C.W., "Power System Voltage Stability", Mc-Graw Hill Inc, New York, 1993.
8. Nagrath IJ, Kothari D.P., "Power System Engineering", Tata Mc-Graw Hills, New Delhi 1994.
9. Weedy B.M. "Electric Power System" John Wiley and Sons, 3rd edition.
10. P.S.R. Murthy, "Power System Operation and Control", B S Publication.
11. Power Generation, Operation and Control by A.J. wood and B.F. Wallenberg John Wiley & Sons Inc. 1984.
12. T.K. Nagsarkar, M.S. Sukhiza, -"Power System Analysis", Oxford University Press.
13. Economic Operation of Power Systems-by L.K. Kirchmayer Wiley Eastern Ltd.

Suggested List of Experiment:

1. Computation of parameters and modeling of transmission lines.
2. To develop a program in Matlab for information of Y-bus matrix for N bus system.
3. To determine the bus impedance matrices for the given power system network.
4. Load flow solution for 3-bus system using Gauss-Seidel, Newton Raphson and FDLF methods up to 3 iteration.
5. Load flow solution for IEEE 6-bus and 30-bus system in Matlab using Newton Raphson method.
6. (i) To determine the positive sequence line parameters L and C per phase per kilometer of a three phase single and double circuit transmission lines for different conductor arrangements.
   (ii) To understand modeling and performance of medium lines.
7. To become familiar with modeling and analysis of power systems under faulted condition and to compute the fault level, post-fault voltages and currents for different types of faults, both symmetric and unsymmetrical.
8. To become familiar with modeling and analysis of the frequency and tie-line flow dynamics of a power system without and with load frequency controllers (LFC) and to design better controllers for getting better responses.
9. To become familiar with modeling and analysis of the frequency and tie-line flow dynamics of a two area power system without and with load frequency controllers (LFC) and to design better controllers for getting better responses.
10. To become familiar with various aspects of the transient and small signal stability analysis of Single-Machine-Infinite Bus (SMIB) system.
11. To understand the fundamentals of economic dispatch and solve the problem using classical method with and without line losses.
12. Effect of compensation on voltage profile of IEEE 6-bus system.
13. Study of any software tools (PSAT, EDSA, MY POWER, ETAP etc).
14. To carry out power flow calculations using *MATLAB* and *Power World* program.
15. To look at the influence of including a tap-changer and a phase-shifter on power flow and bus voltages.

Mandsaur University

Subject Code: - EEE450
Subject Name: - Electronics Instrumentation
Semester: - VI

L	T	P	C
2	1	2	4

Course Objectives:

- To learn the basic concept of transducers and their uses in engineering applications.
- To learn the concept of AC bridges and find the unknown values with different bridges.
- To understand students how to use CRO for different electrical signals.
- To understand working of different display devices.

Unit-I

Sensors & Transducers: definition and classification, mechanical devices as primary detectors, Characteristic & choice of Transducers, Electrical transducers, Advantages of electric transducers, Active and passive transducers, Classification, Resistive, inductive and capacitive transducers, Potentiometric, Metallic and semiconductor strain gauges, Gauge factor, types, material used and applications. Thermistor, RTD, Inductive, LVDT Thermocouples, Piezo-Electric transducers Opto- electronic transducers such as photo voltaic, Photo conductive, and photo conductive cells, constructional details, characteristics and applications.

Unit –II

A.C. Bridge: Sources and detectors, use of bridges for measurement of inductance, Capacitance & Q factor. Maxwell's bridge, Maxwell's inductance capacitance bridge, Hays bridge, Anderson's bridge, Owens's Bridge, De-sauty's Bridge, Schering Bridge, Wien's bridge, Universal bridge, Sources of errors in Bridge circuit.

Unit-III

CRO: Introduction to CRO, Block diagram, Electrostatic focusing, Electrostatic deflection, post deflection acceleration, Screen for CRTs, Graticule, Vertical & Horizontal deflection system, Time base circuit, Application of CROs, Lissajous patterns, Analog & Digital Oscilloscopes.

Unit-IV

Signal Conditioners: Purpose of signal conditioning, Classification, Operational amplifiers, Instrumentation amplifier, A/D and D/A converters. Introduction data acquisition system, generalized DAS, Single and multi channel DAS.

Unit-V

Display Devices and Recorders: Digital display system and indicators like CRT, Seven Segment LED, LED, and LCD. Analog and digital recorders, Strip and circular chart recorder and Magnetic tape recorder, X-Y plotters.

Course Outcomes:

After going through this course the student gets a through knowledge on:

- Understand the technical terms of transducers and their principles, working and constructions.
- Understand the balancing of different bridges and ability to find the unknown values.
- Ability to measure frequency, phase with CRO.
- Ability to use different display devices according to their applications.

Reference Books:

1. A. K. Sawhney, A course in Elect. & Electronic Measurement and Instrumentation, Dhapat Rai & Co.
2. Golding & Widis, Electrical Measurement and Measurement instrument, Wheelar Books
3. H.S. Kalsi, Electronic Instruments, Tata Mc-Graw hill.
4. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education.
5. D. Patranabis, Sensors & Transducers, PHI.
6. A.J. Bouwens, Digital Instrumentation, Tata Mc-Graw hill.
7. A.D. Heltric & W.C. Copper, Modern Electronic instrumentation & measuring instruments,
8. Wheeler Publication.

Suggested List of Experiment:

1. Measurement of temperature by using LM35.
2. Measurement of temperature by using Resistance Thermometer.
3. Measurement of linear displacement by LVDT and draw its characteristics.
4. Measurement of load/weight using strain gauge and cantilever.
5. Measurement of inductance of a coil using Maxwell's bridge.
6. Measurement of capacitance of a capacitor using Schering's bridge.
7. Study & measurement of frequency using Lissajous patterns.
8. Study and use of data conversion using Analog to digital Conversion.
9. Study and use of data conversion using digital to Analog Conversion.
10. Implementing inverting & non inverting mode of Op-amp 741 IC.
11. Implementing different mathematical operations using Op-amp 741 IC.
12. Study of Instrumentation Amplifier.
13. Study of different display devices like CRT, LED and LCD.

Mandsaur University

Subject Code: - EEE431
Subject Name: - Electrical Installations
Semester:- VI

L	T	P	C
3	-	-	3

Course Objective:
This course is about the installation of electrical equipments used in electrical power system such as transmission and distribution lines and cables.

Unit-I Installation of Transmission and Distribution Lines
Erection of steel structures, connecting of jumpers, tee-off points, joints and dead ends; crossing of roads, streets, power/telecommunication lines and railway crossings, clearances; earthing of transmission lines and guarding, spacing and configuration of conductors: arrangement for suspension and strain insulators, bird guards, anti-climbing devices and danger plates; sizes of conductor, earth wire, testing and commissioning. Laying of service lines, earthing, provision of service fuses, installation of energy meters

Unit-II Laying of Underground Cables
Inspection, storage, transportation and handling of cables, cable handling equipment, cable laying depths and clearances from other services such as: water, sewerage, gas, heating and other mains, and also a series of power and telecommunication cables and coordination with these services, excavation of trenches, direct cable laying (including laying of cable from the drum, laying cable in the trench, taking all measurements and making as installed drawings, back filling of trenches with earth or sand, laying protective layer of bricks etc), laying of cables into pipes and conduits and within buildings, introduction to cable filling compounds, epoxy resins and hardeners, cable jointing and terminations, testing and commissioning.

Unit-III
Elementary idea regarding, inspection and handling of transformers; pole mounted substations, plinth mounted substations, grid substation, busbars, isolation, voltage and current transformers, lightning arrestors, control and relay panels, HT/LT circuit breakers, LT switches, installation of power/distribution transformers, dehydration. Earthing system, fencing of yard, equipment foundations and trenches.

Unit-IV
Testing of various electrical equipment such as electrical motor, transformers cables and generator and motor control centers, medium voltage distribution panels, power control centres, motor control centers, lighting arrangement, storage, pre-installation checks, connecting and starting, pre-commissioning checks, drying out.

Course Outcomes:
After learning the course, the students will be able to understand installation of various electrical equipments in different electrical systems, including:

- Procedure of installation of different types of earthing for different types of systems.
- Installation of different types of lines and underground cables.
- Familiar about electrical safety regulations and rules during Installation.

Reference Books:

1. Bill Atkinson, Roger Lovegrove, Gary Gundry: “Electrical Installation Designs”.
2. V.K. Jain, Amitabh Bajaj, “A Text Book of Design of Electrical Installations”.
3. Brian Scaddan “Electrical Installation Work, 8th edition” Routledge.

Mandsaur University

Subject Code: - EEE432
Subject Name: - High Voltage Direct Current Transmission
Semester: - VI

L	T	P	C
3	-	-	3

Course Objectives:

- To deal with the importance of HVDC Transmission and HVDC Converters.
- To deal with firing angle of HVDC System.
- To deal with reactive power control of HVDC system.
- To deal with the protection of HVDC system.

Unit-I: Introduction

DC Power transmission technology, comparison of AC and DC transmission, application of DC transmission, description of DC transmission system, planning for HVDC transmission, modern trends in HVDC technology, DC breakers, operating problems, HVDC transmission based on VSC, types and applications of MTDC systems.

Unit-II: Analysis of HVDC Converters

Line commutated converter, analysis of Graetz circuit with and without overlap, pulse number, choice of converter configuration, converter bridge characteristics, analysis of a 12 pulse converters, analysis of VSC topologies and firing schemes.

Unit-III: Converter and HVDC System Control

Principle of DC link control, converters control characteristics, firing angle control, current and extinction angle control, effect of source inductance on the system, starting and stopping of DC link, power control.

Unit-IV: Reactive Power and Harmonics Control

Sources of reactive power, static VAR system, reactive power control during transients, generation of harmonics, types and design of various AC and DC filters.

Unit-V: Power Flow Analysis in AC/DC System

Per unit system for DC quantities, DC system model, inclusion of constraints, power flow analysis, case study.

Course Outcomes:

- Students will be able to understand the importance of transmission power through HVDC.
- Ability to discuss firing angle control.
- Ability to control reactive power through HVDC.
- Ability to discuss power flow analysis HVDC.

Reference Books:

1. Kundur P., “Power System Stability and Control”, McGraw-Hill, 1993.
2. Colin Adamson and Hingorani N G, “High Voltage Direct Current Power Transmission”, Garraway Limited, London, 1960.
3. Arrillaga, J., “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
4. S. Kamakshaiah, V. Kamaraju, ‘HVDC Transmission’, Tata McGraw Hill Education Private Limited, 2011.
5. Padiyar, K. R., “HVDC power transmission system”, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
6. Edward Wilson Kimbark, “Direct Current Transmission”, Vol. I, Wiley inter science, New York, London, Sydney, 1971.
7. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, New Age International (P) Ltd., New Delhi, 1990.

Mandsaur University

Subject Code: - EEE433
Subject Name: - Communication Engineering
Semester:-VI

L	T	P	C
3	-	-	3

Course Objectives:

- To understand the fundamental characteristics of signals and systems.
- To understand the basics of communication system and analog modulation techniques
- To understand the concept of Frequency modulation.
- To understand TDM and Pulse Modulation techniques.
- To understand various aspects in the design of communication & multiple access systems for satellite communication and the concept of launchers and design of Earth station and satellite link.

Unit-I Signal Processing: Types of signal, deterministic & random, periodic & non Periodic, analog & discrete, energy & power signals, Representation of sinusoid in different forms & their conversion. Fourier series, Fourier Transform and its properties, Probability and random variables: Overview of probability, types of probability, axioms of probability, concept of Random variable, Random process, Correlation function (auto & cross) cumulative distribution function, Probability density function, joint cumulative & distribution and probability density.

Unit-II Block schematic of a typical Communication system. Need of modulation in a communication system, Amplitude (Linear) Modulation: AM, DSB-SC, SSB-SC and VSB-SC. Methods of generation and detection. Angle (Non-Linear) Modulation: Frequency and Phase modulation. Relationship between phase & freq. modulation, FM wave & its spectrum, methods of generation & detection of FM, pre-emphasis & de- emphasis

.

Unit-III Transmitter and Receiver: Classification of radio transmitters, Block diagram of AM transmitter, Armstrong FM transmitter, Simple FM transmitter using Reactance modulator. Classification of radio receivers, TRF receivers, Superheterodyne receivers, Tracking and alignment of receivers, Intermediate frequency, AGC, AFC, SSB receiver.

Unit-IV: Nyquist sampling theorem, TDM, Pulse modulations & PCM, Quantization error, Necessity of nonlinear quantizer, A-law, μ -law, FSK & PSK, QPSK, QAM, Source of noise, Noise figure, Noise bandwidth, effective noise temperature, Performance of AM, FM & digital system in presence of noise.

Unit-V Satellite system block diagram, satellite freq. bands, Elements of orbital mechanics. Equations of motion. Satellite multiple access Format like TDMA, FDMA, transponders, earth station & satellite eclipses, Satellite link design.

Course Outcomes:

The students will be able to

- Apply Fourier transform techniques to signals, and probability & stochastic theories to noise
- Understand the need of modulation in transferring a signal through either wireless or wired communication systems
- Apply analog modulation techniques and receiver fundamentals in analog communication.
- Understand the performance of communication systems in the presence of noise and interference
- learn the dynamics of the satellite, learn the keplerianelements, study the design of Earth station and tracking of the satellites.

Reference Books:

1. Simon Haykins, Communication system, John Wiley
2. Taub and Schilling, Principles of Communication Systems , Tata McGraw Hill
3. Singh & Sapre, Communication System, TMH
4. B.P. Lathi, Modern Digital and Analog communication system
5. Wayne Tomasi, Electronic Communication system.
6. Schaum outline Series, Analog and digital communication
7. John G. Prokis,MasoudSalehi, Gerhard Bauch, Contemporary communication sytems using MATLAB, Cengage learning 2004.
8. D.Roddy,“Satellite Communication (4/e)”, McGraw-Hill, 2009.