SAMRAT ASHOK TECHNOLOGICAL INSTITUTE,
(ENGINEERINGCOLLEGE)
VIDISHA (M.P.) – 464001
DEPARTMENT OF ELECTRICAL ENGINEERING

Branch	Subject Title	Subject Code	Hours per week			Total Credits
			L	T	P	
B.E. Electrical VIII sem.	Advance Electrical Drives	EE-1881 (A)	3	0	0	3

Pre Requisites: Electrical Drive, Power Electronics & Electrical Machines

Course Objective:

1. To explain the Construction and working of special machines.
2. To classify the need and Requirement of special machines.
3. Illustrate controller of special machines..

Topic Covered:

Unit-I

STEPPER MOTORS: Types - Constructional features – principle of operation – variable reluctance motor – single and Multi-stack configurations – Permanent Magnet Stepper motor – Hybrid stepper motor. Different modes of Excitation - theory of torque predictions – Drive systems and circuit for open-loop and closed-loop control of stepper motor.

SWITCHED RELUCTANCE MOTORS: Constructional features – principle of operation –Torque Equation - Power Converters for SR Motor – Rotor Sensing Mechanism & Logic Controller – Sensorless Control of SR motor - Applications.

Unit-II

PERMANENT MAGNET BRUSHLESS DC MOTORS: Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Power controllers – Motor characteristics and control – Applications.

PERMANENT MAGNET SYNCHRONOUS MOTORS: Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power Controllers, Torque speed characteristics, Self control, Vector control, Current control Schemes – Applications.

Unit-III

LINEAR MOTORS : Linear Induction motor (LIM) classification – construction – Principle of operation – Concept of current sheet – goodness factor – DC Linear motor (DCLM) types – circuit equation - DCLM control applications – Linear Synchronous Motor (LSM) – Types – Applications.

SERVOMOTORS: Servomotor – Types – Constructional features, principle of operation - control applications.

Unit-IV

AC Drive: v/*f*control of induction motor, dynamic model, direct and indirect field orientation, direct torque control, direct self control, space vector direct torque and self control, machine Intelligence controller, sensorless operation of induction motor.

Unit-V

Review of electric motors & Solid state converters: Speed control techniques of DC, Induction & synchronous motor; Effects of power electronic equipments on load side & supply side. Power Quality & energy Conservation- Line Side pollution, standards, Harmonic elimination techniques in converter, Filters, Energy efficient electric motors, Pay back periods, Energy conservation through solid state control.

TEXT BOOKS:

1. Kenjo T, "Stepping Motors and their Microprocessor Controls", Clarendon Press London, 2003.
2. Miller T J E, "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, New Delhi, 1989

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3. Andrzej M. Trzynadlowski, Control of Induction Motors (Engineering), Academic Press, October 2000

REFERENCES:

1. Naser A and BoldeaL,"Linear Electric Motors: Theory Design and Practical Applications", Prentice Hall Inc., New Jersey 1987.
2. K. Venkataratnam,"Special Electrical Machines", Universities Press, India, 2009.
3. Kenjo, T and Naganori, S "Permanent Magnet and brushless DC motors", Clarendon Press, Oxford, New Delhi, 1989.
4. Floyd E Saner," Servomotor Applications", Pittman, London, 1993.
5. William H Yeadon, Alan W Yeadon, Handbook of Small Electric Motors, McGraw-Hill, New Delhi, 2001.
6. Energy-Efficient Electric Motors: Selection and Application, Second Edition, John C. Andreas, Marcel Dekker Inc., 1992
7. B.K. Bose, Modern Power Electronics and Ac Drives, Prentice Hall India Learning Private Limited (2005)

Course outcomes: After successful completion of this course student will understand following:

1. Need and choice of various drives.
2. Application of special machines according to load requirement.
3. Speed control of special machines.
4. Speed control of induction motor and sensorless operation
5. Energy efficient electric motor and energy conservation through solid state controller

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Branch	Subject Title	Subject Code	Hours per week			Total Credits
			L	T	P	
B.E. Electrical VIII sem.	Programmable Logic Controller	EE-1881 (B)	3	0	0	3

Pre Requisites: Digital Electronics and Microprocessor

Course Objective:

1. To familiarize the fundamentals of Data Acquisition system.
2. To illustrate the concept of PLC and its Programming using Ladder Diagram.
3. To examine the difference between SCADA and DCS.
4. To explain the basic concepts of Intelligent Automation.

Topic Covered:

Unit-I

Programmable Logic Controllers configuration of PLC Architecture, review of combinational circuits, sequential circuits, comparison of PLC with microprocessor, microcontrollers

Unit-II

Sensors for PLC:- Proximity sensors, Inducting Proximity sensors, Ultrasonic Proximity sensors, Optical Proximity sensors, Temperature, liquid level, force pressures/vacuum sensors, Linear displacement, angle position sensor, Push buttons, limit switch, lad cell single phase, three phase, D.C. contractors, timer, overload relay A/D, D/A contractors

Unit-III

Hard wire logic: - Graphical symbol, design and development of hard wire relay logic diagram for D.C. motor, 1φ A.C. motor, 3φ I/M for starting, forward/reverse motoring, breaking, jogging or inching circuits.

Unit-IV

Ladder diagram symbols of ladder diagram development of ladder diagram for different control operation of through PLC, timer block implementation, and count block implementation PLC software.

Unit-V

PLC based development system to control D.C. motors, single phase induction motor three phase induction motor and case study.

TEXT BOOK:

1. Handbook of Electrical motor control systems by US eswar, Tata mc graw hill publishing company Ltd.
2. Programmable logic controllers operation interfacing and programming by job Den offer prentice hall

REFERENCE BOOK:

3. Programmable logic controllers programming methods and applications by john K Hackworth Frederick D Hackworth Jr. Pub. Pearson Education

Course Outcomes - At the end of this course, students will demonstrate the ability to:

1. Programmable logic controller, configuration and comparison.
2. Various sensors, timer, DC contractors, A/D & D/A contractors.
3. Graphical symbol, design and development of hard wire, relay logic diagram, AC & DC motor for starting.
4. Ladder diagram for different control operation through PLC.
5. PLC based development system to control DC motor, induction motor and case study.

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Branch	Subject Title	Subject Code	Hours per week			Total Credits
			L	T	P	
B.E. Electrical VIII sem.	Line- Commutated and Active PWM Rectifiers	EE-1881 (C)	3	0	0	3

Pre Requisites: Power Electronics, Electronics-1
Course Objective: To prepare the students to

1. Rephrase Diode and thyristor rectifier with filter.
2. Impart knowledge of multiple converters.
3. Analyze different type of boost converter
4. Introduce flyback converter

Topic Covered:

Unit 1:

Diode rectifiers with passive filtering

Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, Cand LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuousconduction, input current waveshape, effect of source inductance; commutation overlap.

Unit 2:

Thyristor rectifiers with passive filtering

Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LCfilter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuousconduction, input current waveshape.

Unit 3:

Multi-Pulse converter

Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

Unit 4:

Single-phase ac-dc single-switch boost converter

Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, unity power factor operation, closed-loop control structure.

Ac-dc bidirectional boost converter

Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase ac-dcboost converter, steady state analysis, operation at leading, lagging and unity power factors.Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.

Unit 5:

Isolated single-phase ac-dc flyback converter

Dc-dc flyback converter, output voltage as a function of duty ratio and transformer turnsratio. Power circuit of ac-dc flyback converter, steady state analysis, unity power factoroperation, closed loop control structure.

Text / References:

1. G. De, "Principles of Thyristorised Converters", Oxford & IBH Publishing Co, 1988.
2. J.G. Kassakian, M. F. Schlecht and G. C. Verghese, "Principles of Power Electronics", Addison-Wesley, 1991.
3. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

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4. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
5. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science &Business Media, 2001.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Analyze controlled rectifier circuits.
2. Understand the operation of line-commutated rectifiers – 6 pulse and multi-pulse configurations.
3. Understand the operation of PWM rectifiers – operation in rectification and regeneration modes and lagging, leading and unity power factor mode.
4. Analyze DC-DC converter at different power factor and closed loop operation.
5. Analyze DC/DC and AC/DC flyback converter with unity power factor and closed loop operation.

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Branch	Subject Title	Subject Code	Hours per week			Total Credits
			L	T	P	
B.E. Electrical VIII sem.	EHV A.C. and D.C. Transmission	EE-1882 (OC-5)	3	0	0	3

Pre Requisites: Power System, Power Electronics
Course Objective:

1. Importance of HVDC Transmission and HVDC Converters
2. Power conversion between Ac to DC and DC to AC.
3. Firing angle of HVDC System
4. Reactive power control of HVDC system
5. Power factor improvement of HVDC system
6. Protection of HVDC system

Topic Covered:

Unit-I
Constitution of EHV a.c. and d.c. links, Kind of d.c. links, Limitations and Advantages of a.c. and d.c. transmission, Principal application of a.c. and d.c. transmission, Trends in EHV a.c. and d.c. transmission, Power handling capacity. Converter analysis gratez circuit, Firing angle control, Overlapping.

Unit-II
FACTS devices, basic types of controller, series controller, static synchronous series compensator(SSSC), thyristor-controlled series capacitor(TCSC), thyristor controlled series reactor(TCSR), shunt controller (STATCOM), static VAR compensator(SVC), series-series controller, combined series-shunt controller, unified power flow controller(UPFC), thyristor controlled phase shifting transformer(TCPST).

Unit-III
Components of EHV d.c. system, converter circuits, rectifier and inverter valves, Reactive power requirements, harmonics generation, Adverse effects, Classification, Remedial measures to suppress, filters, Ground return. Converter faults & protection harmonics misoperation, Commutation failure, Multiterminal D.C. lines.

Unit-IV
Control of EHV d.c. system desired features of control, control characteristics, Constant current control,Constant extinction angle control. Ignition Angle control. Parallel operation of HVAC & DC system. Problems & advantages.

Unit-V
Travelling waves on transmission systems, Their shape, Attenuation and distortion, effect of junction and termination on propagation of traveling waves. Over voltages in transmission system. Lightning, switching and temporary over voltages: Control of lighting and switching over voltages

Text book:

1. S. Rao,- "EHV AC & DC Transmission" Khanna pub.
2. Kimbark,-" HVDC Transmission" john willy& sons pub.

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3. Arrillaga,- "HVDC Transmission"2nd Edition ,IEE londan pub.

Reference Books:

1. Padiyar, -"HVDC Transmission" 1st Edition ,New age international pub.
2. T.K. Nagsarkar,M.S. Sukhiza, -"Power System Analysis", Oxford University
3. Narain.G. Hingorani, l. Gyugyi-"Undustanding of FACTS concept and technology", John Wiley & sons pub.
4. P.Kundur- "H.V.D.C. Transmission" McGraw Hill Pub.

Course Outcomes - At the end of this course, students will demonstrate the ability to :

1. EHV AC & DC links, types, pros and cons, converter analysis, gratez circuit.
2. FACTS devices, types of controller, thyristor controlled phase shifting transformer.
3. Converter faults, protection, commutation failure, multi terminal DC link.
4. EHVDC system desired feature control, constant current and extinction angle control, ignition angle control.
5. Travelling wave, shapes, attenuation, distortion, control of lighting and switching over voltage.

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