

Revised

UNIT I

9

Power Semiconductor Devices: Structure, Characteristics, ratings and protection of SCR, triac and Gate Turn Off Thyristor.

UNIT II

9

Cyclo-Converter: Single phase and three phase cyclo-converters, circulating and non-circulating current operations, performance characteristics, control of harmonics, voltage and frequency control, control circuit.

UNIT III

9

Line Commutated Converters: Single and three phase fully controlled and half controlled converters, performance characteristics, effect of source inductance, discontinuous current operation, inverter operation, power factor improvement techniques, sequence control, 12-pulse converters, dual converter, triggering circuits.

UNIT IV

9

AC Voltage Controllers: Single phase AC voltage controllers feeding resistive and resistive-inductive loads, sequence control, three phase AC voltage controllers.

EXPERIMENTS

1. Study of 1-phase AC to DC controlled converter (half controlled and full controlled).
2. Study the of 3- phase AC to DC full controlled converter.
3. Study of a Triac based single phase ac regulator and determine of Thyristor switching characteristics and pulse transformer characteristics.
4. Study of Thyristors based dc to dc converter (dc chopper).
5. Study of a 3 phase PWM inverter with fixed output frequency and study of a non -PWM type inverter with 120 degree conduction of switches.
6. Study of an inverter fed adjustable speed drive for a 3 phase induction motor.
7. Study of a Thyristor based dc-drive with closed loop speed control.
8. MOSFET based dc to dc converter (buck, boost and buck-boost types with non-isolated output voltage)
9. Study of an industrial type fly-back dc to dc converter with isolated and regulated voltage.
10. Study of a single phase PWM AC to DC converter.

Books & References:

1. Power Electronics-P. C. Sen (Tata McGraw Hill), 1987
2. Power Electronics-R. S. Ananda Murthy and V. Nattarasu (Pearson India Publication), 2010
3. Fundamental of Electrical Drives- G. K. Dubey (Alpha Science), 2001
- Power Electronics by M. D. Singh and K. B. Khanchandani, (Tata McGraw-Hill Publishing Company Limited), 2008
4. Textbook of Power Electronics by S. N. Singh (Dhanpat Rai & Co (P) Ltd) 2005

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UNIT I

DC-AC Inverters: Single phase and three phase voltage source and current source inverters, commutation methods, voltage and frequency control, harmonics reductions 9

UNIT II

Resonant Inverters: Classification, series and parallel resonant inverters, load resonant inverters, zero voltage switching and zero current switching resonant inverters, resonant dc link inverters 9

UNIT III

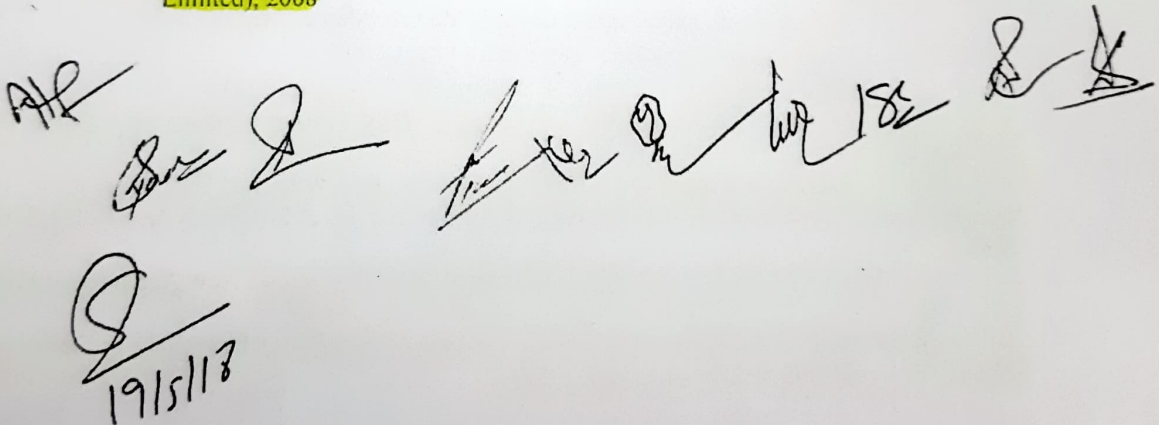
Power Semiconductor Devices: Structure, characteristics and ratings of Power Transistor, MOSFET, Insulated Gate Bipolar Transistor (IGBT) and MOS - Controlled Thyristor (MCT), drive and snubber circuits. 9

UNIT IV

DC-DC Converters: Review of chopper fundamentals, Step down chopper with resistive and resistive-inductive loads with continuous and discontinuous current operations, step up chopper, commutation techniques, impulse commutated and resonant pulse choppers, multi-quadrant and multiphase choppers. **Switching Mode Converters, Buck, Boost, Buck-Boost and Cuk regulators** 9

Books & References:

1. Power Electronics- M. H. Rashid (Pearson Prentice Hall), 2009
2. Fundamental of Electrical Drives- G. K. Dubey (Alpha Science), 2001
3. Power Electronics by M. D. Singh and K. B. Khanchandani, (Tata McGraw-Hill Publishing Company Limited), 2008



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UNIT I

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Introduction to restructuring of power industry. Key issues and challenges facing power industries, Power system restructuring models, Ancillary services in restructured electric market.

UNIT II

9

Transmission pricing in restructured electricity market, cost components of transmission system, congestion management, Electricity supply structure under deregulation in India

UNIT III

9

Concepts of FACTS devices & Controllers, General aspects of HVAC and HVDC transmission systems, Types of HVDC links – comparison, economic, technical performance ability & limitation, properties of thyristor converter based HVDC station, custom Power and custom power devices.

UNIT IV

9

Automatic generation control, load frequency control (LFC), VAR Control, Economic Operation of Power Systems, Reactive Power management, shunt compensation, series compensation, power factor improvement

Books & References:

1. Electric Power Applications of Optimization - James A. Momoh (Marcel Dekker), 2001
2. Optimization of Power System Operation - Jizhong Zhu (Wiley), 2009
3. Power system Optimization - D. P. Kothari, J. S. Dhillon (PHI Publication), 2011
4. K. R. Padiyar, "HVDC Power Transmission System", Wiley Eastern Limited, New Delhi, First Edition 1990.
5. T.J.E. Miller, "Reactive Power Control in Electrical System", John Wiley and Sons, New York, 1982.
6. N.G.Hingorani, "Understanding FACTS: Concepts and Technology of FACTS Systems", IEEE Press, 2000.
7. K.R.Padiyar "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd, 2007.
8. NarinG.Hingorani, "Power Electronics in Electric Utilities: Role of Power Electronics in Future power systems", Proc. of IEEE, Vol.76, no.4, April 1988.

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19/5/13

MEE-152 POWER SEMICONDUCTOR CONTROLLED INDUSTRIAL DRIVES (3-1-0) 4 Credits

UNIT I

9

Need for Industrial drives, Solid state controlled electric drive-Concept, elements and salient features, power converter motor system, closed loop control of electric drives, sensing of speed and current, performance parameters.

UNIT II

9

Control of D.C. separately and series excited motor drives using controlled converters (single phase and three phase) and choppers, static Ward-Leonard control scheme, solid state electric braking schemes, closed loop control of solid state DC drives.

UNIT III

9

Operation of induction and synchronous motor drives from voltage source and current source inverters slip power recovery, pump drives using AC line controllers, self-controlled synchronous motor drives, brushless DC motor drive, switched reluctance motor drive.

UNIT IV

9

Function of microprocessor in electric drive control, salient features of microprocessor control microprocessor based control scheme for D.C. induction and synchronous motor drives, applications.

Books & References:

1. Power Semiconductor Drives- S. Sivanagaraju, M. Balasubba Reddy and A. M. Prasad (PHI), 2009
2. Fundamental of Electric Drives- G. K. Dubey (Alpha Science), 2001

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MEE-158A Modeling and Simulation of Power Electronic Circuits

Max. Marks: 100

(Credit=5)

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UNIT I

(9 Lecture)

Simulation Tools: General overview and understanding of SPICE/PSPICE and MATALB SIMULINK software.

Overview of Power electronics converters: Overview of basic and advanced power electronics converters for ac and dc supply, types of power converter models.

UNIT II:

(9 Lecture)

Modeling of Power Electronic Drives: Criteria for switch selection, modeling of diode, SCR, Power Transistor, MOSFET for ac and dc circuits, snubber circuit for protection scheme.

Modelling of advanced DC supplies: Simulation and design of fly back converter, forward converter, Push-pull converter, full bridge and half bridge converter.

UNIT III:

(9 Lecture)


Modeling of advanced PWM Converters for AC supplies:Modelling of Pulse Width Modulation (PWM) voltage source inverter,types and need of PWM technique, Feedback control design, voltage mode and current mode controller design.


UNIT IV

(9 Lecture)

Review of basic control theory –Simulation and design of control design techniques such as P, PI, PID and lead lag compensator design, state feedback controller design.

Simulation of Power Electronic Circuits: Simulation and design of AC-DC rectifier for R and RL load,ac voltage controllers and cyclo-converters.


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Lists of Experiment

- 1-phase AC to DC controlled converter (half controlled and full controlled)using MATLAB / SIMULINK
 - a. For R and RL load
 - b. R-L-E load


2. Three phase fully controlled converter (half controlled and full controlled) using MATLAB / SIMULINK for R and RL load
3. Single phase AC voltage regulator using MATLAB / SIMULINK for R and RL load
4. MOSFET/IGBT based dc to dc converter (Buck mode, boost mode and buck-boost mode) using MATLAB Software
 - a. For R and RL load
 - b. R-L-E load
5. MOSFET/IGBT based non isolated Cuk, Sepic dc to dc converter using MATLAB Software.
6. Industrial type fly-back dc to dc converter with isolated and regulated voltage using MATLAB Software.
7. 3 phase PWM inverter with fixed output frequency and study of a non -PWM type inverter with 120-degree conduction of switches using MATLAB Software feeding resistive and resistive-inductive
8. 3 phase PWM inverter with fixed output frequency and study of a non -PWM type inverter with 180-degree conduction of switches using MATLAB software feeding resistive and resistive-inductive
9. Single phase cyclo-converters feeding resistive and resistive-inductive using MATLAB Software
10. 1 phase Inverter fed adjustable speed drive for a 1 phase induction motor using MATLAB Software.


Text Books:

1. M. D. Singh and K. B. Khanchandani "Power Electronics," Tata McGraw Hill, 2007.
2. P.C Sen., 'Modern Power Electronics', Wheeler Publishing Company, 1st Edition, New Delhi, 2005.

References

3. M. H. Rashid "Power Electronics Handbook," Prentice Hall India, New Delhi, 2009.
4. Ned Mohan, Undeland and Robbin, 'Power Electronics: Converters, Application and Design', John Wiley and sons. Inc, New York, 2006.
5. Denial W. Hart, "Power Electronics" McGraw Hill, 2011


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