

COURSE TITLE	HIGH POWER CONVERTER AND SEMICONDUCTOR DEVICES
COURSE CODE	01EE0715
COURSE CREDITS	3

Objective:

- 1 This subject presents the latest cutting-edge technology in high-power converters and semiconductor devices, and provides a complete analysis of various converter topologies, modulation techniques, practical drive configurations, and advanced control schemes.

Course Outcomes: After completion of this course, student will be able to:

- 1 Compare various high power semiconductor devices.
- 2 Investigate the performance parameters related to Multipulse converters.
- 3 Identify the correct phase shifting converter to be utilized in a multi-pulse converter.
- 4 Analyze different topologies of multi-level inverters for medium level voltage applications.
- 5 Analyze the diverse modulation schemes utilized in Current Source Converters to evaluate their suitability and efficiency.

Pre-requisite of course:Power Electronics

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	High-Power Semiconductor Devices Introduction, High-Power Switching Devices – Diodes, Silicon-Controlled Rectifier (SCR), Gate Turn-Off (GTO) Thyristor, Gate-Commutated Thyristor (GCT), Insulated Gate Bipolar Transistor (IGBT), Other Switching Devices, Operation of Series Connected devices	8
2	Multipulse Diode and SCR Rectifiers Introduction, Six-Pulse Diode Rectifier, Series-Type Multipulse Diode Rectifiers - 12-Pulse Series-Type Diode Rectifier, 18 and 24-Pulse Series-Type Diode Rectifier, Separate-Type Multipulse Diode Rectifiers - 12-Pulse Separate-Type Diode Rectifier, 18- and 24-Pulse Separate-Type Diode Rectifiers, Phase-Shifting Transformers	12

Contents : Unit	Topics	Contact Hours
3	Multilevel Voltage Source Converters Introduction, Two-Level Voltage Source Inverter - Sinusoidal PWM, Space Vector Modulation, Cascaded H-Bridge Multilevel Inverters - H-Bridge Inverter, Multilevel Inverter Topologies, Carrier Based PWM Schemes, Staircase Modulation, Diode-Clamped Multilevel Inverters - Three-Level Inverter, Space Vector Modulation, Neutral-Point Voltage Control, Discontinuous Space Vector Modulation, SVM Based on Two-Level Algorithm High-Level Diode-Clamped Inverters	10
4	Other Multilevel Voltage Source Inverters Multilevel Flying capacitor inverter, Active Neutral-Point Clamped Inverter, Neutral- Point Inverter, Nested Neutral-Point Inverter, Modular Multilevel Inverter	4
5	PWM Current Source Converters PWM Current Source Inverters – Introduction, Space Vector Modulation, Parallel Current Source Inverters, Load-Commutated Inverter (LCI), PWM Current Source Rectifiers – Introduction, Single-Bridge Current Source Rectifier, Dual-Bridge Current Source Rectifier, Power Factor Control, Active Damping Control	8
Total Hours		42

Textbook :

- 1 High-Power Converters and AC Drives, Bin Wu, Mehdi Narimani, John Wiley & Sons, 2017
- 2 Power Electronics Handbook, M. H. Rashid, Academic Press, New York, 2001
- 3 Power Electronic—Converters, Applications and Design, N. Mohan, T. Undeland and W. P. Robbins, John Wiley & Sons, New York, 2003

References:

- 1 Power electronics handbook, Power electronics handbook, Rashid, Muhammad H, Butterworth-Heinemann, 2017
- 2 Power electronics: a First Course, Power electronics: a First Course, Mohan, Ned., Wiley, 2011
- 3 Power Electronics Essentials and Applications, Power Electronics Essentials and Applications, L. Umanand, Wiley India Ltd, 2009
- 4 Power Electronic Converter Harmonics – Multipulse Methods for Clean Power, Power Electronic Converter Harmonics – Multipulse Methods for Clean Power, Derek A. Paice, IEEE Press, 1996

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery
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Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
15.00	20.00	25.00	20.00	10.00	10.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs, etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and classroom.
- 3 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory.

Supplementary Resources:

- 1 <https://nptel.ac.in/courses/108/102/108102157/>
- 2 <https://nptel.ac.in/courses/108/108/108108035/>
- 3 <https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-ee13/>
- 4 <https://www.pearsonhighered.com/assets/samplechapter/0/1/3/0/0130167436.pdf>