Nirma University
Institute of Technology
Department of Electrical Engineering
Subject: 2EE405- Power Electronic Converters and Applications
Lesson Planning

Course Learning Outcome:

At the end of the course, students will be able to-

1. analyze operation of devices and choose the same suitable for an application
2. evaluate various performance parameters of converters
3. implement and analyze different control techniques for power electronic converters
4. choose and apply converter topology suitable for an application

Sr.No.	Topic	Reference Book	Hours	CLO Mapped with Topic
0	**Introduction to Course**		**01**	
	Overview of power electronic converters and their applications			
1	**Power Semiconductor Devices**	**7**	**08**	**1**
1.1	Thyristor family, Silicon Control Rectifier (SCR) and its construction		1	
1.2	V-I characteristics and two transistor analogy of SCR		1	
1.3	Turn–On and Turn-Off Characteristics of SCR		1	
1.4	Various Ratings of SCR and its Datasheet interpretation		1	
1.5	Construction, characteristics and ratings of MOSFET		1	
1.6	Insulated Gate Bipolar transistors (IGBTs)		1	
1.7	Gate turn-off Thyristors (GTOs), Integrated Gate-Commutated Thyristors (IGCTs), MOS-controlled thyristor (MCT),		1	
1.8	Silicon carbide (SIC), Gallium nitride devices, Power Integrated circuits (PICs), Intelligent Modules		1	
2	**AC to DC Converters**	**1, 2, 3**	**07**	**2, 3**
2.1	Single Phase Half Wave and full wave Controlled Rectifiers with R, RL and RLE loads		2	
2.2	Three Phase Half Wave and Full Wave Controlled Rectifier with R, RL, RLE loads		2	
2.3	Dual Converter with circulating and non-circulating current mode		2	
2.4	Effect of source inductance in controlled rectifiers, Introduction to PWM rectifiers		1	

3	**Non Isolated and Isolated DC-DC Converters**	**2, 3, 4**	**6**	**2, 3**
3.1	Importance & Requirement of DC Power Supply		1	
3.2	Analysis of Buck converter, Boost converter, Buck-Boost Converter		2	
3.3	Analysis of Cük Converter, SEPIC and Zeta converters		1	
3.4	Need of isolated converter, Analysis of Forward Converter, Flyback Converter, Push-Pull Converter		1	
3.5	Analysis of Half Bridge Converter, Full Bridge Converter and examples on dc to dc converters		1	
4	**DC-AC Converter**	**2, 5, 8, 9**	**7**	**1, 2, 3**
4.1	Basic concept of inverters – Single phase inverters, Three Phase Full Bridge Configuration for 180^0 and 120^0 Mode of Operation		2	
4.2	Multilevel inverters- Diode Clamped, Flying Capacitor & Cascaded H-Bridge		2	
4.3	Analysis of Inverter with Single and Multiple Pulse Width Modulation, Sinusoidal Pulse Width Modulation (Unipolar, Bipolar)		2	
4.4	Analysis of Inverter with Multi carrier PWM and introduction to Space Vector Pulse Width Modulation Technique		1	
5	**AC-AC Converters**	**1, 2, 8, 10**	**5**	**2, 3**
5.1	Principle of Phase Control – Single Phase AC Voltage Controllers with R and RL loads		1	
5.2	Three Phase AC Voltage Controllers with R and RL loads, Principle of On-Off (ICC) Control.		2	
5.3	Basic principle of operation-Single phase to single phase, Three phase to single phase Cycloconverter, Three phase to three phase cycloconverter		2	
6	**Electric Drives**	**2, 5, 8**	**3**	**1, 2, 3, 4**
6.1	Analysis of Semi-converter and Fully Controlled converter based dc motor drives		2	
6.2	Analysis of chopper control based dc motor drives		1	
7	**Power Electronic control for Utility Systems**	**6, 8, 11, 12, 13**	**5**	**1, 2, 3, 4**
7.1	Operation of High voltage DC Transmission		1	
7.2	Operation of Static VAR compensators		1	
7.3	Analysis of Renewable energy based systems – solar & wind		1	
7.4	Analysis of Power Quality improvement devices – active power filter & active front end converter		2	
8	**E-mobility**	**2, 14, 15**	**3**	**2, 3, 4**

8.1	Power Electronic converters & their control for Electric vehicles		2	
8.2	Control of electric motors for traction applications		1	
	Total		**45**	

Faculty:

Dr. Siddharthsingh. K. Chauhan Div. A
Dr. M. T. Shah Div. B

References:

1. Muhammad H. Rashid, Power Electronics: Circuits, Devices and Applications, Pearson Education, New Delhi
2. Ned Mohan, Tore M. Undeland and William P. Robbins, Power Electronics: Converters, Applications and Design, John Wiley & Sons, Inc., New York
3. L Umanand, Power Electronics, Essentials & Applications, Wiley India
4. M. S. Jamil Asghar, Power Electronics, Prentice-Hall of India Pvt. Ltd., New Delhi
5. M. D. Singh and K. B. Khanchandani, Power Electronics, Tata McGraw-Hill Publishing Company Ltd., New Delhi
6. G. K. Dubey, S. R. Doradla, A. Joshi, R. M. K. Sinha, Thyristorized Power Controllers, New Age International, Delhi
7. B. Jayant Baliga, Power Semiconductor Devices, Thompson Course Technology, Singapore.
8. P. S. Bhimbra, Power Electronics, Khanna Publishers, New Delhi
9. C. W. Lander, Power Electronics, McGraw-Hill, UK
10. P. C. Sen, Modern Power Electronics, S. Chand, New Delhi
11. Mukund R. Patel, Wind and Solar Power Systems, CRC Press, Florida
12. Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, Prentice Hall, New Delhi
13. Joseph Vithayathil, Power Electronics, Principles and Applications, Indian Edition, McGraw- Hill
14. Research Papers on IEEE/IET/Science Direct etc.
15. Product Literatures