

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Advanced Power Electronics (Professional Elective-II)
Course Code:	2ET1090606T
Pre-requisite Course:	Power Electronics-I & Power Electronics-II

Course Objectives:

1. Students will learn to design gate drive circuits for various switches like SCR, MOSFET, IGBT, etc.
2. Students will learn and understand various applications of Power Electronics.
3. Students will also learn advanced techniques/topologies for converters for industrial applications.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Review of Power Semiconductor Devices Power Diodes, Power BJT, Power MOSFETs, Thyristor, GTOs, IGBT, MCT – Basic characteristics and controlling, Emerging devices and circuits, Power Integrated Circuits.	06	11
2	Practical Design Consideration Gate and Base drive circuits – Design Consideration for different Devices, DC-Coupled Circuits, Isolated Drive Circuits, and Protection in Drive Circuits. Snubber circuits Designing, Temperature control and Heat sink design consideration, Design of Magnetic Components, basic dc-dc voltage regulator configurations -buck, boost, buck-boost converters, fly back and forward Converter, half bridge & full bridge configurations, Push-pull converter, C'uk converter.	08	17
3	Static Power Electronics Applications Electronic Ballasts, Power Electronics in Capacitor Charging Applications, Power Electronics for Renewable Energy Sources, HVDC Transmission, Automotive Applications of Power Electronics.	07	17
4	Multi-level converters Need for multi-level inverters, Concept of multi-level, Topologies for multi-level: Diode Clamped, Flying capacitor and Cascaded H-bridge multilevel Converters configurations; Features and relative comparison of	09	23

	these configurations applications, Introduction to carrier based PWM technique for multi-level converters.		
5	Resonant Converters Introduction, Need of resonant converters, Classification of resonant converters, Load resonant converters, Resonant switch converters, zero voltage switching dc-dc converters, zero current switching dc-dc converters, clamped voltage topologies.	08	16
6	Multi-pulse Converters Concept of multi-pulse, Configurations for m-pulse converters, Different phase shifting transformer configurations for multi-pulse converters, Applications.	07	16

Text Books:

1. Power Electronics – Converters, Applications and Design, Ned Mohan, Tore M. Undeland and William P. Robbins, John Willey & sons, 2002.
2. Power Electronics - Circuits, Devices and Applications, Muhammad H. Rashid, Prentice Hall of India, 2013.
3. Modern Power Electronics, P. C. Sen, S. Chand and Co. Ltd, 2nd edition, 2005.

Reference Books:

1. High Power Converters and AC Drives, Bin Wu, John Willey & Sons Inc., Publication, 2016.
2. Power Electronics, Bimbhra P. S., Khanna Publishers, 2003.

List of Open Source Software/learning website:

- <http://nptel.ac.in/courses>
- MIT OPEN COURSEWARE by Massachusetts Institute of Technology – (ocw.mit.edu)

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Design gate drive circuits for different switching devices.	6 Creating
CLO2	Understand various applications of Power Electronics.	2 Understanding
CLO3	Analyze resonant converters.	4 Analyzing
CLO4	Select appropriate phase shifting converter for a multi-pulse converter.	4 Analyzing
CLO5	Evaluate various multi-level inverter configurations.	5 Evaluating
CLO6	Understand phase shifting transformer configurations for multi-pulse converters.	2 Understanding

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1			L	L	M		L		L		M			M	M	
CLO2	L		M	H		L	M					M	L			L
CLO3						L		L	L	M			L	L		M
CLO4	L	L		L	L	M	L	M	M			L	M			
CLO5	M			M			M		M				L		L	M
CLO6		L	L		L	L				H	M					L

H: High, M: Medium, L: Low