

Subject Code:1ET2130102	Subject Title: Advanced Power Electronics
Pre-requisite Subject	Fundamentals of Power Electronics

Course Objective: To understand working, analysis and control of some of the power electronics converters.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	Total
3	-	2	5	60	40	30	20	150

Subject Contents				
Sr. No.	Topic	Total Hours	Weight (%)	
1	DC to DC Converters: Introduction, Switching voltage regulators; Review of basic dc-dc voltage regulator configurations -Buck, Boost, Buck-Boost converters and their analysis for continuous and discontinuous mode, Other converter configurations like Flyback converter, Forward converter, Half bridge, Full bridge configurations, Push-pull converter.	9	25%	
2	DC to AC Converters (Inverters): Introduction and Classification, Concept of Unipolar and Bipolar PWM, Sine-triangular PWM, Space Vector Pulse Width Modulation, Selective Harmonics Elimination, Hysteresis Current Control, Harmonic reduction techniques, Current Source Inverters, Z- source inverters, Dead time for bridge inverters.	8	22%	
3	Multilevel Inverters: Introduction, Classification and Application, Cascaded H-Bridge Multilevel Inverters, Diode-Clamped Multilevel Inverters, Flying-Capacitor Multilevel Inverters, Comparison of Power Topologies, Neutral-Point Voltage Control, Carrier Based PWM Schemes, Space Vector Modulation for MLI.	6	10%	
4	AC to DC Converters (Rectifiers): Introduction, Single phase and three phase half wave and full wave, 1-phase and 3- phase half controlled and fully controlled converters, Analysis with R & RL load, Performance parameters for converters,, Operation in continuous and dis- continuous mode, Operation in conversion and inversion mode, Effect of source inductance, 12-Pulse SCR Rectifier, Power factor improvement techniques.	8	20%	
5	Three phase AC voltage controllers and Cycloconverters: AC voltage controllers: Review of On-off and phase control; Single phase full wave controllers and their analysis with resistive loads; Three phase full wave controllers, Analysis with R-load, Three phase bi-directional delta-connected controllers Cyclo-converters: single-phase to single-phase cyclo-converter, 3-phase to 1-phase cyclo-converter, 3-phase to 3-phase cyclo-converter circuits; circulating current operation; non-circulating current operation; mean output voltage and harmonics in supply current waveform.	9	23%	

Course Outcome:

After learning the course the students should be able to

1. Analyze and design of DC-DC converters, phase controlled converters, inverters and AC-AC converters.
2. Analyze and design of Multilevel Inverters.
3. Know about control schemes of power electronics converters.
4. Know about use of power electronics converters for power systems.

List of Reference Text Books:

1. Muhammad H. Rashid, "Power Electronics - Circuits, Devices and Applications", Prentice Hall of India, 3rd ed., 2003.
2. Mohan, Undeland and Robbins, "Power Electronics – Converters, Applications and Design", John Willey & sons, Inc., 3rd ed., 2003.

List of Reference Books:

1. Bin Wu, "High Power Converters and AC Drives", IEEE Press, A John Wiley & Sons, Inc., Publication. 2006.
2. P.C.Sen, "Modern Power Electronics ", S. Chand and Co. Ltd., New Delhi, 2012.

List of Experiments:

1. To Design, Simulation and analysis of DC to DC Buck converters and switching voltage Regulators.
2. To Design, Simulation and analysis of DC to DC Boost converters and switching voltage Regulators.
3. To evaluate the performance of unipolar and bipolar pulse width modulation technique.
4. To Simulate SPWM technique for three phase bridge inverter.
5. To Design, Simulation and Analysis of SVPWM method for three phase bridge inverter.
6. To simulate harmonics elimination technique for single phase bridge inverter
7. To Simulate SPWM technique for cascaded multilevel inverter.
8. To Simulate SPWM technique for diode clamped multilevel inverter.
9. To study the performance of 3-phase ac voltage controller with R and RL load.
10. To study the performance of 1-phase cyclo-converter circuit.
11. To simulate and analyze three phase controlled rectifiers.