

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Power Electronics and Drives – II
Course Code:	1ET1090601
Pre-requisite Course:	Fundamental Knowledge of Basic Electronics and Power Electronics and Drives- I is required

Course Objectives:

1. To learn the generalized concepts of power electronics invertors including their operation and control which are most commonly used in technical world of power electronics.
2. To learn applications of various switching voltage regulator.
3. To study about various mode operation of cycloconvertors and its application in power electronics.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)								
Lecture	Tutorial	Practical	Credit	Theory				Practical				Total
				University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	-	2	4	28	70	12	30	12	30	08	20	150

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	DC to AC Converters (Inverters): Classification of Inverters: Voltage source inverters and Current source inverters; Performance parameters of Inverters; Single phase inverters: series, parallel and bridge type (Half wave and Full wave) inverters; Three phase bridge inverters: 180 degree conduction, 120 degree conduction and their comparison, PWM Inverters: Principle of PWM control, PWM techniques classifications, Unipolar and Bipolar PWM, Sinusoidal PWM, Third harmonic PWM, Selective Harmonic Elimination, Hysteresis band current control PWM, Space vector pulse width modulation technique, Comparison of PWM techniques, Voltage and frequency control of single phase and three-phase inverters, Current Source Inverters: single phase and three phase ASCI and self- controlled switch based inverters; Comparison of Voltage and Current source Inverters.	14	30
2	AC Voltage Controllers (Switching Voltage Regulators): Concept of On-Off or integral cycle control and Phase control; Various single phase full wave ac-ac controllers with R, L and RL load; Analysis for phase control and integral cycle control; Gating requirements; Sequence Control of AC regulators; 3-phase full wave converter configurations with Y and Δ connected loads and their analysis with R load; AC Voltage controller with PWM control; Basic principle of matrix converter.	09	20

3	Cycloconverters (Frequency Converters): Introduction; Basic Principle; Single to single-phase Cycloconverters; Three-phase half-wave Cycloconverters; Cycloconverters for three phase output; Output voltage equation; Output harmonics in Cycloconverters; Comparison between Cycloconverters and DC link Converter.	07	16
4	Switching mode power supply: DC Power Supplies: Switched-Mode DC Power Supplies, Fly back converter, Push pull converter, Forward converter, Full bridge converter, AC Power Supplies: Basic of Uninterruptible Power Supplies (UPS).	07	17
5	Induction Motor Drives: Analysis and Performance, Speed Control of three-phase Squirrel-cage Induction Motors (SCIMs): Stator Voltage Control, Stator Frequency Control, Stator Voltage and Frequency Control, Stator Current Control, Speed Control of three-phase Wound Rotor Induction Motors (WRIMs): Static Rotor Resistance Control, Slip-energy recovery Control, Scalar control techniques, Review of V/f control; VSI based Induction Motor control; Advantages of V/f control over other scalar control techniques; CSI fed Induction Motor drive.	07	17

Reference Books:

1. M. D. Singh and K. B. Khanchandani, "Power electronics", TMH, New Delhi, 2nd ed., 2007.
2. M. S. Jamil Asghar, "Power Electronics", PHI, New Delhi, 2004.
3. Muhammad H. Rashid, "Power Electronics - Circuits, Devices and Applications", Prentice Hall of India, 3rd ed., 2003.
4. P. S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi, 2012.
5. G. K. Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House, New Delhi, 2nd ed.2001.
6. Dr. B. R. Gupta and V. Singhal, "Fundamentals of Electrical Drives and Control", S.K. Kataria & Sons (2014), New Delhi, 5th ed.2001.
7. V. R. Moorthi, "Power Electronics", Oxford University press, 2005.

List of Experiments:

1. To simulate and understand operation of 1-phase AC Voltage Controller in (I) Integral Cycle Control Method (II) Phase Angle Control Method.
2. To simulate 1-phase Half Wave AC Voltage Regulator with R, L and R-L Load and observe various waveforms.
3. To simulate 1-phase Full Wave AC Voltage Regulator with R, L and R-L Load and observe various waveforms.
4. To simulate 3-phase AC Voltage Regulator with R Load and observe various waveforms.
5. To generate gate pulses for inverter using comparison of Sine-wave and Triangular wave (SPWM).
6. To simulate and perform Single Phase Half Wave Inverter with R, L and R-L Load.
7. To simulate and perform Single Phase Full Wave Inverter with R, L and R-L Load.
8. To simulate 3-phase Full Bridge Inverter operating with 180-degree conduction mode.
9. To simulate 3-phase Full Bridge Inverter operating with 120-degree conduction mode.
10. To simulate 1-phase Cycloconverters using PSIM/MATLAB.

List of Open Source Software/learning website:

http://nptel.iitm.ac.in/coursecontents_elec.php

[Ocw.mit.edu/courses/electrical.../6-334-power-electronics-spring-2007](http://ocw.mit.edu/courses/electrical.../6-334-power-electronics-spring-2007)

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

CLO	Description	Bloom's Taxonomy Level
CLO1	Analyze, operate and control DC-to-AC Converters.	4 Analyze
CLO2	Application, operation and control AC-to-AC Converters.	3 Applying 4 Analyze
CLO3	Apply the knowledge of power electronic converter for speed control of AC motors.	3 Applying
CLO4	List out the power electronic converters and their control scheme.	1 Remembering
CLO5	Understand operation of 1-phase Half Bridge & Full Bridge Inverter in Unipolar PWM and Bipolar PWM methods.	2 Understanding
CLO6	Apply plugging of three phase induction motor at different voltages.	3 Applying

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					L			M			L		
CLO2	L			L		H				L					M	M
CLO3		L			L				M			L	L			
CLO4	M		H				M				L				L	
CLO5		M		L		L					M			M		
CLO6					L			L		M		M				M

H: High, M: Medium, L: Low