EE404: POWER ELECTRONICS - II
CREDITS = 5 (L=3, T=0, P=2)

Course objective:

The subject aims to provide the student of electrical engineering discipline with:

C1. An understanding of basic abstractions of state of the art AC Drive.
C2. The capability to comprehend and analysis of inverters.
C3. The capability to comprehend and analyze various control circuits for AC Drive.
C4. The capability to comprehend and analyze synchronous motor drives.
C5. The understand the concept and analysis of AC power supply.

Teaching and examination scheme:

Teaching Scheme			Credit	Marks Distribution				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
3	0	2	5	ESE	CE	ESE	CE	150
				70	30	30	20	

Course contents:

Unit No.	Topic	Teaching Hours
1	**DC-AC Inverters:** Review of assumed knowledge on DC-AC inverter circuits; advanced modulation techniques, SVM; Compensation for dead time and device voltage drops. PSIM Models; Current source inverters, multi-level and Z-source inverters. Rectifier/inverter with bi-directional power flow.	05
2	**AC motor drives:** D-q model of induction motor, constant flux speed control structure, vector control model, vector control structure.	06
3	**Soft starting:** Stator voltage control with AC voltage controller; Six-step VSI inverter based drives; PWM-VSI drives; Braking and multi-quadrant operation of VSI drives; Cycloconverter based induction motor drive; Variable frequency control from a current source; Slip power control using Rotor resistance along-with chopper; Closed loop control schemes; Effect of non-sinusoidal wave form on AC machine performance.	08

4	**Synchronous Motor Drives:** Three phase synchronous motors; variable speed drives; variable frequency control; self-controlled synchronous motor drive employing load commutated thyristor inverter, self-controlled synchronous motor drive employing a cycloconverter. BLDC machine drive-Introduction.	08
5	Multiple Pulse and Sinusoidal PWM, Trapezoidal, Stepped Harmonic Injection and Delta Modulation, Space Vector PWM, Current Hysteresis Controlled PWM. Harmonic elimination schemes. Dead-time, Snubber and Gate Drive circuit. Multilevel Inverters, Basics of Matrix converter. Resonant Converter: Series Resonant Inverters, Parallel Resonant Inverters, Class E Converter, Two Quadrant ZVS Converter and Resonant DC link Inverter.	08
6	**AC Power Supplies:** Switched Mode AC Power Supplies, Resonant AC Power Supplies and Bi-Directional AC Power Supplies. Induction Motor Drives: Dynamic modeling of Induction machines, Scalar control (V/f), Vector control, Sensor-less vector control, Direct Torque and Flux control. Introduction to Simulink.	08
	TOTAL	**45**

List of References:

1. B. K. Bose, "*Modern Power Electronics and AC Drives*", Pearson, 2005.
2. Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff: "*Analysis of Electric Machinery & Drive Systems*", 2nd Edition, IEEE Press, 2002.
3. J.M.D. Murphy & F.G. Turnbull, "*Power Electronic Control of AC Motors*", Pergamon Press, 1990.
4. W. Shephard, L.N. Hulley & D.T.W. Liang, *"Power Electronics and Motor Control*", 2nd Edition, Cambridge University Press, 1996.
5. Rama Krishnan: "*Electric Motor Drives: Modelling, Analysis, and Control*,"1st Edition, Prentice Hall, 2001. 5.
6. P.S. Bimbhra, "*Generalized Theory of Electrical Machines*", Khanna Publishers.
7. P.S. Bhimbhra, "*Power Electronics*", Khanna Publishers, Delhi, 2012.

Course Outcomes (COs):

After learning the course the students will be able to:

CO1. Demonstrate the knowledge about state of the art AC Drive.
CO2. Assess the theory and practices of various types and control of inverters.
CO3. Assess the theory and practices of various control circuits of AC Drive
CO4. Determine the applications of synchronous motors drive.
CO5. Assess the theory and practices of various circuits of AC power supply.