

18PEC22		MODERN ELECTRICAL DRIVES			L	T	P	C
					3	0	0	3
Course Objectives:								
1.	To understand steady state operation and transient dynamics of a motor load system							
2.	To study and analyze the operation of the converter / chopper fed DC drive, both qualitatively and quantitatively							
3.	To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.							
4.	To understand the implementation of control algorithms using microcontrollers and phase locked loop.							
Unit I		DC MOTORS FUNDAMENTALS AND MECHANICAL SYSTEMS			9	+	0	
DC motor, Types, induced emf, speed-torque relations; Speed control - Armature and field speed control; Ward Leonard control - Constant torque and constant horse power operations. Introduction to high speed drives and modern drives. Characteristics of mechanical system - dynamic equations, components of torque, types of load; Requirements of drives characteristics -multi-quadrant operation; Drive elements, types of motor duty and selection of motor rating.								
Unit II		CONVERTER CONTROL			9	+	0	
Principle of phase control - Fundamental relations; Analysis of series and separately excited DC motor with single-phase and three-phase converters - waveforms, performance characteristics. Continuous and discontinuous armature current operations; Current ripple and its effect on performance; Operation with freewheeling diode; Implementation of braking schemes; Drive employing dual converter.								
Unit III		INTRODUCTION TO INDUCTION MOTORS			9	+	0	
Steady state performance equations – Rotating magnetic field – torque production, Equivalent circuit– Variable voltage, constant frequency operation –Variable frequency operation, constant Volt/Hz operation. Drive operating regions, variable stator current operation, different braking methods.								
Unit IV		FIELD ORIENTED CONTROL			9	+	0	
Field oriented control of Induction machines – Theory – DC drive analogy – Direct and Indirect methods – Flux vector estimation - Direct torque control of Induction Machines – Torque expression with stator and rotor fluxes, DTC control strategy.								
Unit V		SYNCHRONOUS MOTOR DRIVES			9	+	0	
Wound field cylindrical rotor motor – Equivalent circuits – performance equations of operation from a voltage source – starting and braking, self control – Load commutated Synchronous motor drives - Brush and Brushless excitation.								
					Total (L+T)= 45 Periods			
Course Outcomes:								
<i>Upon completion of this course, the students will be able to:</i>								
CO1	:	<i>Understand selection of drives for industries.</i>						
CO2	:	<i>Analyse various characteristics of series and separately excited DC motor with single and three phase converters.</i>						
CO3	:	<i>Explain about different conventional speed control methods for induction motors.</i>						
CO4	:	<i>Explain about direct and indirect methods of field oriented control and direct Torque Control scheme for Induction motor.</i>						
CO5	:	<i>Formulate the control schemes for synchronous motor drives.</i>						
Text Books:								
1.	Dubey,G.K. "Power Semiconductor Controlled Drives ", PH International, New Jersey, 1989.							
2.	Sen, P.C. "Thyristor D.C Drives ", John Wiley & Sons, New York, 1981.							
3.	Bimal K Bose, "Modern Power Electronics and AC Drives", Pearson Education Asia 2004.							

4.	R.Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 2003.
Reference Books:	
1.	Subharamanyam V. "Electric Drives-Concepts and Applications ", TMH Publi., 1994
2.	Gobalk.Dubey, "Fundamentals of Electrical Drives", Narosal Publishing House, New Delhi, Second Edition ,2009.
3.	W.Leonhard, "Control of Electrical Drives", Narosa Publishing House, 1992.
4.	Murphy J.M.D and Turnbull, "Thyristor Control of AC Motors", Pergamon Press, Oxford, 1988

PO \ CO	CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	<i>Understand selection of drives for industries.</i>	1	1	1	1	2	1	2	1	2	1	2
CO2	<i>Analyse various characteristics of series and separately excited DC motor with single and three phase converters.</i>	1	3	3	2	2	1	2	2	1	1	1
CO3	<i>Explain about different conventional speed control methods for induction motors.</i>	1	1	1	2	2	1	1	2	1	1	1
CO4	<i>Explain about direct and indirect methods of field oriented control and direct Torque Control scheme for Induction motor.</i>	1	1	2	2	2	1	2	2	1	1	1
CO5	<i>Formulate the control schemes for synchronous motor drives.</i>	1	2	3	2	3	1	2	2	1	1	1