22EEOE02	INDUSTRIAL DRIVES		SEMESTER			VI
PREREQUISITES		CATEGORY	OE	Credit		3
Power Electronics, and Electrical Machines		Hours\Week	L	T	P	TH
			3	0	0	3

Course Objectives:

1.	To understand the basic components of electric drive system,
2.	To analyze the operation and performance of the chopper fed DC drive,
3.	To understand the operation and performance of AC motor drives
4.	To understand the advanced techniques in the control of industrial drives.

Unit I	BASICS OF ELECTRIC DRIVE	9	0	0	9

Electric drive - introduction and advantages, types and choice of electric drive, components of electric drive system, motor duty class classification continuous, short time and intermittent duty, speed-torque characteristics of DC and Induction motor drive.

Unit II	DC DRIVES	9	0	0	9

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting,

Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking

Unit III	AC DRIVES	9	0	0	9

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque speed curve with applied voltage, applied frequency and applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

Unit IV	CONTROL OF DC AND AC DRIVES	9	0	0	9

Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor dynamic equations and transfer functions, modeling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design.

Generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor. Operation of slip-ring induction motor with external rotor resistance, power electronic based rotor side control of slip ring motor, slip power recovery schemes.

Unit V	ADVANCED TECHNIQUES	9	0	0	9

Microcontroller based control of DC drive, Phase locked loop control of DC motor, AC/DC drive using microprocessor. Synchronous motor drives, Stepper motor - ratings, specifications, stepper motor drive employing microcontroller.

Total (45L+0T) = 45 Periods

Text Books:

1.	G. K. Dubey, "Fundamentals of Electrical Drives", CRC Press, 2002.
2.	Subrahmanyam, Vedam "Electrical Drives Concepts and Applications", Mc-Graw Hill Publishing, New Delhi, 2016
3.	S.K.Pillai, "A first course on Electric Drives", Wiley Eastern Ltd., New Delhi, 2016

Reference Books:

1.	G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
2.	W. Leonhard, "Control of Electric Drives", Springer Science & Business Media, 2001.
3.	Jai P.Agrawal, "Power Electronics Systems - Theory and Design", Pearson Education, Inc., New Delhi, 2016

Course Outcomes:			
Upon completion of this course, the students will be able to:			**Bloom's Taxonomy Mapped**
CO1	:	Identify the electric drive for the required speed-torque characteristics	L1: Remembering
CO2	:	Understand the functioning of DC drive using converters	L2: Understanding
CO3	:	Understand the functioning of AC drive using converters	L2: Understanding
CO4	:	Analyse the various control schemes for AC and DC drive	L4: Analyzing
CO5	:	To use microcontroller based system for motor control	L6: Creating

COURSE ARTICULATION MATRIX

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	1	2	1				0	0	0	1	1	2	
CO2	2	2	2	3	2		1		0	0	0	1	1	2	
CO3	2	2	2	3	2		1		0	0	0	1	2	3	
CO4	2	3	3	3	3	1	2	2	0	0	0	3	2	3	2
CO5	1	2	2	3	3		2		0	0	0	3	1	2	2
Avg	1.6	2	2	2.8	2.2	1	1.5	2	0	0	0	1.8	1.4	2.4	2
3/2/1-indicates strength of correlation (3- High, 2-Medium, 1- Low)															