ELECTRIC DRIVES AND STATIC CONTROL

VI Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB23	Core	2	1	-	3	30	70	100
Contact Classes: 30	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course deals with the basic theory, construction, operation, performance characteristics and application of electromechanical energy conversion devices such as synchronous and asynchronous machines. It also facilitates the study of the alternating machines which are the major part of industrial drives and agricultural pump sets

II. OBJECTIVES:

The course should enable the students to:

I	The steady state behavior and transient dynamics of the converter/chopper fedDC drive.
II	The steady state behavior and transient dynamics of the converter/chopper fedDC drive
III	The performance of different industrial drives considering issues such as energy efficiency, power quality, economic justification, environmental issues and practicalliabilities.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Illustrate** the speed control of DC motors with single phase and three phase-controlled rectifiers for verification of speed torquecharacteristics	Understand
CO 2	**Explain** the four-quadrant chopper fed dc motor drives for verification of speed torque characteristics	Understand
CO 3	**Describe** the working of stator voltage control of induction motor for speed control of the drive.	Understand
CO 4	**Identify** the variable frequency control methods for induction motor drive applications.	Apply
CO 5	**Summarize** the slip power recovery schemes, direct and indirect vector control methods for speed control of induction motors.	Understand
CO 6	**Demonstrate** the working of voltage source and current source inverter fed synchronous motor dive for speed control applications.	Understand

IV. SYLLABUS:

MODULE-I	CONTROL OF DC MOTORS THROUGH PHASE CONTROLLED RECTIFIERS	Classes: 09

Introduction to thyristor controlled drives: Single phase semi and fully controlled converters connected to DC separately excited and dc series motors, continuous current operation, output voltage and current waveforms, speed and torque expressions, speed torque characteristics, problems on converter fed DC motors; Three phase semi and fully controlled converters connected to DC separately excited and DC series motors, output voltage and current waveforms, speed and torque expressions, speed torque characteristics and problems.

MODULE-II	SPEED CONTROL OF DC MOTORS	Classes: 09

Introduction to four quadrant operation: Motoring operations, electric braking, plugging, dynamic and regenerative braking operations; Four quadrant operation of DC motors by dual converters, closed loop operation of DC motor; Chopper fed DC drives: Single quadrant, two quadrant and four quadrant chopper fed DC separately excited and series excited motors, continuous current operation output voltage and current wave forms, speed torque expressions, speed torque characteristics, problems on chopper fed DC motors and closed loop operation.

MODULE-III	SPEED CONTROL OF INDUCTION MOTORS THROUGH VARIABLE VOLTAGE AND FREQUENCY	Classes: 09

Variable voltage characteristics: Control of induction motor by AC voltage controllers, waveforms, speed torque characteristics.

Variable frequency characteristics: Variable frequency characteristics, variable frequency control of induction motor by voltage source and current source inverter and cycloconverters, pulse with modulation control, comparison of voltage source inverter and current source inverter operations, speed torque characteristics, numerical problems on induction motor drives, closed loop operation of induction motor drives.

MODULE-IV	SPEED CONTROL OF INDUCTION MOTORS THROUGH ROTOR RESISTANCE AND VECTOR CONTROL	Classes: 09

Static rotor Resistance control: Slip power recovery schemes, static Scherbius drive, static Kramer drive, their performance and speed torque characteristics, advantages and applications, vector control of induction motor drives: Principles of vector control, vector control methods, direct methods of vector control, indirect methods of vector control and problems.

MODULE-V	SPEED CONTROL OF SYNCHRONOUS MOTORS	Classes: 09

Separate control and self control of synchronous motors, operation of self controlled synchronous motors by voltage source inverter and current source inverter cyclo converters. Load commutated CSI fed synchronous motor, operation, waveforms, speed torque characteristics, applications, advantages and numerical problems, closed loop control operation of synchronous motor drives (block diagram only), variable frequency control, cycloconverter, PWM, variable frequency inverter and current source inverter.

Text Books:

1. G K Dubey, “Fundamentals of Electric Drives”, Narosa Publications, 2nd Edition, 2001.
2. SB Devan, GR Slemon, A Straughen, “Power Semiconductor drives”, Wiley Pvt. Ltd. 4th Edition, 2001.
3. PV Rao, “Power Semiconductor Drives”, BS Publications, 1st Edition, 2014.
4. B K Bose, “Modern Power Electronics and AC Drives”, Prentice Hall India Learning Private Limited, 2005

Reference Book

1. Vedam Subramanyam, “Thyristor Control of Electric Drives”, Tata McGraw Hill Publication, 5th Edition, 2008.
2. John Hindmarsh, Alasdair Renfew”, Electrical machines and drive systems”, Oxford Butterworth Heinemann, 3rd Edition.
3. Austin Hughes, “Electrical motors and drives Fundamentals Types and Applications”, Elsevier, 3rd Edition, 2006.
4. M D Singh, K B Kanchandhani, “Power Electronics”, Tata Mc Graw Hill Publishing Company, 2nd Edition, 1998.
5. M H Rashid, “Power Electronics, Circuits, Devices and Applications”, Pearson, 3rd Edition, 2001

J. Gnanavadivel, “Power Semiconductor drives”, Anuradha, 2nd Edition, 2007

Web References:

1. https://www.nptel.iitm.ac.in
2. https://www.iare.ac.in
3. https://www.bookboon.com/en/introduction-to-power-electronics-ebook

E- Text Books:

1. https://www.freebookcentre.net
2. https://www.amazon.in/Fundamentals of electrical drives
3. https://www.circuitstoday.com