

## Department of Electrical and Electronics Engineering

### COURSE MODULES OF THE SUBJECT TAUGHT FOR THE SESSION SEP-JAN 2023-24

#### Course Syllabi with CO's

Academic Year: 2023-24							
Department: Electrical & Electronics Engineering							
Course Code	Course Title	Core/Elective	Pre requisite	Number of Lecture Hours/Week			Total Hrs/ Sessions
				L	T	P	
18EE741	Industrial Drives and Applications	Elective	Course knowledge of Electric Motors, Power Electronics	3	-	-	40
Course Objectives:	<ul style="list-style-type: none"><li>• To define electric drive, its parts, advantages and explain choice of electric drive.</li><li>• To explain dynamics and modes of operation of electric drives.</li><li>• To explain selection of motor power ratings and control of dc motor using rectifiers.</li><li>• To analyze the performance of induction motor drives under different conditions.</li><li>• To explain the control of induction motor, synchronous motor and stepper motor drives.</li><li>• To discuss typical applications electrical drives in the industry</li></ul>						
Topics Covered as per Syllabus							
Module-1							Teaching Hours
<b>Electrical Drives:</b> Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of dc and ac Drives. <b>Dynamics of Electrical Drives:</b> Fundamental Torque Equations, Speed Torque Conventions and Multi-quadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization. <b>Control Electrical Drives:</b> Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives							08
Revised Bloom's Taxonomy Level	L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing						
Module-2							
<b>Direct Current Motor Drives:</b> Controlled Rectifier Fed dc Drives, Single Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Single Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Multiquadrant Operation of dc Separately Excited Motor Fed Form Fully Controlled Rectifier, Rectifier Control of dc Series Motor, Supply Harmonics, Power Factor and Ripple in Motor Current, Chopper Control of Separately Excited dc Motor, Chopper Control of Series Motor							08
Revised Bloom's Taxonomy Level	L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing						
Module-3							
<b>Induction Motor Drives:</b> Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, Analysis of Induction Motor Fed From Non-Sinusoidal Voltage Supply, Starting, Braking, Transient Analysis. Speed Control Techniques-Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources							08
Revised Bloom's Taxonomy Level	L2 – Understanding, L3 – Applying, L4 – Analysing, L5 – Evaluating						
Module-4							

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<b>Induction Motor Drives (continued):</b> Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control, current regulated voltage source inverter control, speed control of single phase induction motors. <b>Synchronous Motor Drives:</b> Operation from fixed frequency supply-starting, synchronous motor variable speed drives. Variable frequency control of multiple synchronous motors				08
Revised Bloom's Taxonomy Level	L <sub>1</sub> – Remembering, L <sub>2</sub> – Understanding, L <sub>3</sub> – Applying, L <sub>4</sub> – Analysing			
Module-5				
<b>Synchronous Motor Drives (continued):</b> Self-controlled synchronous motor drive employing load commutated thruster inverter, Starting Large Synchronous Machines, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless dc Motor Drives. <b>Stepper Motor Drives:</b> Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor. <b>Industrial Drives:</b> Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools				08
Revised Bloom's Taxonomy Level	L <sub>1</sub> – Remembering, L <sub>2</sub> – Understanding, L <sub>3</sub> – Applying, L <sub>4</sub> – Analysing			
Course outcomes:	<b>Course Outcomes:</b> At the end of the course the student will be able to: <b>CO1-Explain</b> dynamics and different modes of operation of electric drives. [L4] <b>CO2- Illustrate</b> a motor for a drive and control of dc motor using controlled rectifiers. [L4] <b>CO3-Analyze</b> the performance of induction motor drives under different conditions. [L4] <b>CO4-Analyze</b> control operations of induction motor, synchronous motor and stepper motor drives. [L4] <b>CO5- Illustrate</b> a suitable electrical drive for specific application in the industry. [L3]			
<b>Graduate Attributes (As per NBA)</b> Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Modern Tool Usage				
<b>Textbook</b>				
1.	Fundamentals of Electrical Drives	Gopal K. Dubey	Narosa Publishing House	2nd Edition, 2001
2.	Electrical Drives: Concepts and Applications (Refer to chapter 07 for Industrial Drives under module 5.)	Vedum Subrahmanyam	McGraw Hill	2nd Edition, 2001
<b>Reference Books</b>				
1.	Electric Drives	N.K De, P.K. Sen	PHI Learning	1st Edition, 2009
<b>List of URLs, Text Books, Notes, Multimedia Content, etc</b>				
1. <a href="https://nptel.ac.in/courses/108102046/">https://nptel.ac.in/courses/108102046/</a> 2. <a href="https://nptel.ac.in/courses/108108077/">https://nptel.ac.in/courses/108108077/</a> 3. <a href="http://www.nptelvideos.in/2012/11/advanced-electric-drives.html">http://www.nptelvideos.in/2012/11/advanced-electric-drives.html</a> 4. <a href="http://eps-technology.blogspot.com/2011/02/online-video-courses-electric-drives.html">http://eps-technology.blogspot.com/2011/02/online-video-courses-electric-drives.html</a>				
<b>Internal Assessment Marks: 20</b> (3 Session Tests are conducted during the semester for 15 marks and marks allotted based on average of best two performances + 5 Marks is allotted for assignment)				
<b>University Exam Question paper pattern:</b> 1. The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks. 2. There will be two full questions (with a maximum of four sub questions) from each module. 3. Each full question will have sub question covering all the topics under a module. 4. The students will have to answer five full questions, selecting one full question from each module..				

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### The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Course Code:	18EE741	TITLE: Industrial Drives and Applications										
List of Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-		-	-	-
CO2	3	1	1	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	2	1	1	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-

**Note:** 3 = Strong Contribution    2 = Average Contribution    1 = Weak Contribution    '-' = No Contribution

### The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)

Course Code:	18EE741	TITLE: Industrial Drives and Applications
List of Course Outcomes	PSO1	PSO2
CO-1	-	2
CO-2	-	3
CO-3	-	2
CO4	-	2
CO5	-	2

**Note:** 3 = Strong Contribution    2 = Average Contribution    1 = Weak Contribution    '-' = No Contribution