B.E ELECTRICAL AND ELECTRONICS ENGINEERING(EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER -VIII

INDUSTRIAL DRIVES AND APPLICATIONS(Core Course)

Subject Code	15EE82	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

Credits - 04

Course objectives:

- To define electric drive, its parts, advantages and explain choice of electric drive.
- To explain dynamics and modes of operation of electric drives.
- To explain selection of motor power ratings and control of dc motor using rectifiers.
- To analyze the performance of induction motor drives under different conditions.
- To explain the control of induction motor, synchronous motor and stepper motor drives.
- To discuss typical applications electrical drives in the industry. ■

Module-1		**Teaching Hours**
Electrical Drives: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of dc and ac Drives. **Dynamics of Electrical Drives:** Fundamental Torque Equations, Speed TorqueConventions and Multiquadrant Operation. Equivalent Values of DriveParameters, Components of Load Torques, Nature and Classification of LoadTorques, Calculation of Time and Energy Loss in Transient Operations, SteadyState Stability, Load Equalization. **Control Electrical Drives:**Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-2		
Selection of Motor Power Ratings: Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating. **Direct Current Motor Drives:**Controlled Rectifier Fed dc Drives, Single Phase Fully Controlled Rectifier Control of dc Separately Excited Motor,SinglePhase 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 dcMotor, Chopper Control of Series Motor.■		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	
Module-3		
Induction Motor Drives: Analysis and Performance ofThree 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.■		**10**
Revised Bloom's Taxonomy Level	L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5 – Evaluating.	
Module-4		
Induction Motor Drives (continued): 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. **Synchronous Motor Drives:**Operation from fixed frequency supply-starting, synchronous motor		**10**
Revised Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

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15EE82 INDUSTRIAL DRIVES AND APPLICATIONS(Core Course) (continued)

Module-5	**Teaching Hours**
Synchronous Motor Drives (continued): 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. **Stepper Motor Drives**: Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor. **Industrial Drives:**Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools. ■	**10**
Revised Bloom's Taxonomy Level L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing.	

Course outcomes:

At the end of the course the student will be able to:

- Explain the advantages and choice of electric drive.
- Explain dynamics and different modes of operation of electric drives.
- Suggest a motor for a drive and control of dc motor using controlled rectifiers.
- Analyze the performance of induction motor drives under different conditions.
- Control induction motor, synchronous motor and stepper motor drives.
- Suggest a suitable electrical drive for specific application in the industry. ■

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Modern Tool Usage.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks. Each full question consisting of 16 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook

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.)	VedumSubrahmanyam	McGraw Hill	2nd Edition, 2011

Reference Books

1	Electric Drives	N.K De,P.K. Sen	PHI Learning	1st Edition, 2009