III B.Tech II Semester

15AEE31-POWER SEMICONDUCTOR DRIVES

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Course Objectives:

This course enables the students to

- *To understand the Application of power electronics.*
- *The operation of the chopper fed DC drive and characteristics.*
- *To understand the basic concept and advanced speed control techniques using power electronic converters that are used in industry.*
- *Distinguishing features of synchronous motor drives and induction motor drives.*

UNIT – I CONTROL OF DC MOTORS BY PHASE CONTROLLED CONVERTERS

Introduction to Thyristor Controlled Drives, Single Phase, Three Phase Semi and Fully Controlled Converters Connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics- Problems.

UNIT – II FOUR QUADRANT OPERATION OF DC DRIVES

Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only)

UNIT – III CONTROL OF DC MOTORS BY CHOPPERS

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 D.C Motors – Closed Loop Operation (Block Diagram Only)

UNIT – IV CONTROL OF INDUCTION MOTOR

Stator Voltage Control - Variable Voltage Characteristics-Control of Induction Motor by AC Voltage Controllers – Waveforms – Speed Torque Characteristics - Stator Frequency Control-Variable Frequency Characteristics – Variable Frequency Control of Induction Motor by Voltage Source and Current Source Inverter and Cyclo Converters – PWM Control – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Numerical Problems on Induction Motor Drives – Closed Loop Operation of Induction Motor Drives (Block Diagram Only) Static Rotor Resistance Control – Slip Power Recovery – Static Scherbius Drive – Static Kramer Drive – Their Performance and Speed Torque Characteristics – Advantages- Applications – Problems

UNIT – V CONTROL OF SYNCHRONOUS MOTORS

Separate Control & Self Control of Synchronous Motors – Operation of Self Controlled Synchronous Motors by VSI and CSI 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, Cyclo Converter, PWM, VSI, CSI.

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Course Outcomes:

The students will have knowledge on the following concepts

- *Identify the choice of the electric drive system based on their applications*
- *Analyzation of single phase and three phase rectifiers fed DC motors as well as chopper fed DC motors.*
- *The concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.*
- *The principles of static rotor resistance control and various slip power recovery schemes.*
- *The speed control mechanism of synchronous motors.*

TEXT BOOKS:

1. Power semiconductor controlled drives by G K DubeyPrentice Hall
2. Power Electronic Circuits, Devices and applications by M. H. Rashid, PHI.

REFERENCE BOOKS:

1. Power Electronics – MD Singh and K B Khanchandani, Tata – McGraw-Hill Publishing company, 1998
2. Modern Power Electronics and AC Drives by B. K. Bose, PHI.
3. Thyristor Control of Electric drives – VedamSubramanyam Tata McGraw HillPublications.
4. A First course on Electrical Drives – S K Pillai New Age International (P) Ltd. 2nd Edition.

B.S.
BOS - Chairman