

Course Name: Fundamentals of Electric Drives

Course Number: EE508

Credits: 3-0-0-3

Prerequisites: EE 309 (Power Electronics), EE 201 (Eletromechanics)

Intended for: UG/PG

Distribution: Elective for EE

Semester: Odd/Even

Course Preamble: This is an introductory course in the field of electric drives and control and is intended as a pre-requisite for an advanced course in this field. In addition to giving a comprehensive idea about drives, this course will be helpful for students interested in doing projects in the field of electric drives and control. It is strongly recommended that the students opting for this course should have the basic knowledge of electric machines and power electronics.

By the end of this course, students will have learned the following:

1. How to devise a control structure for a particular machine for a specified load
2. How to analyse the drive control structure with respect to speed of response and stability
3. Practical issues in drive operation

Course Modules:

Introduction to drives [2 Lectures]

Importance of drives, Factors governing the choice of drives, Basics of drive dynamics, Types of load, Selection of motor power rating, Applications

DC motor drives [17 Lectures]

Types of dc motors, starting and braking, transient analysis of separately excited motor with armature and field control [4 Lectures]

Controlled rectifier fed drives, multi-quadrant operation of separately excited dc motor fed from fully-controlled converter [4 Lectures]

Control of electric drives, closed loop torque, speed and position control, current and speed sensing [5 Lectures]

Chopper controlled dc drives [2 Lectures]

Supply harmonics, power factor and current ripple [2 Lectures]

Induction motor drives [18 Lectures]

Induction motor operation with non-sinusoidal voltage supply, starting and braking of induction machines [4 Lectures]

Methods of speed control –stator voltage control, variable frequency control, field weakening [4 Lectures]

Voltage Source Inverter (VSI) control of induction motors [3 Lectures]

Current Source Inverter (CSI) control of induction motors [3 Lectures]

Current regulated VSI control [2 Lectures]

Introduction to Vector Control [2 Lectures]

Synchronous motor drives [5 Lectures]

Types of synchronous motors – Cylindrical-rotor and Salient-pole motors, Operation from fixed frequency supply – starting, braking, load disturbance transients

Variable frequency control – true-synchronous mode, Self-controlled mode, Self-controlled Synchronous motor drive using Load Commutated Thyristor Inverter

Introduction to special machines – Permanent Magnet synchronous motor, Brushless dc motor etc.

Textbooks:

1. G. K. Dubey, Fundamentals of Electric Drives, Alpha Science International Ltd., 2001.
2. Dubey G. K., “Power Semiconductor Controlled Drives”, Prentice Hall International Edition. 1989.

Reference books

1. Mohan N., Undeland T.M. and Robbins W.P., “Power Electronics –Converters, Applications and Design”, 3rd Ed., Wiley India. 2008
2. Bose B.K., “Power Electronics and Variable Frequency Drives – Technology and Applications”, IEEE Press, Standard Publisher Distributors. 2001
3. Rashid M., “Power Electronics- Circuits, Devices and Applications”, 3rd Ed., Pearson Education, 2003.
3. Krause, P. C., Wasynczuk, O., Sudhoff, S. D., “Analysis of Electric Machinery and Drive Systems”, New York, Wiley-Interscience, 2002.
4. S. K. Pillai, A First Course on Electrical Drives, New Age International Pvt. Ltd., 2004
5. R. Krishnan, Electric Motor Drives: Modeling, Analysis, and Control, Prentice Hall, 2001.
6. N. K. De and P. K. Sen, Electric Drives, Prentice-Hall of India Pvt. Ltd., 1999