

EE415 ELECTRIC DRIVES

Course Description & Objectives:

This course describes the structure of Electric Drive systems and their role in various applications such as flexible production systems, industrial ac/dc drives, energy conservation, renewable energy, transportation etc., Understand the basic principles of power electronics in drives using switch-mode converters and pulse width modulation to synthesize the voltages in dc and ac motor drives.

Course Outcomes:

- I Apply power semiconductors for electrical drives.
- I Design rectifier and chopper circuits for speed control of DC machines.
- I Apply AC controllers for soft-starting of Induction Motors.
- I Analyze DC-AC inverter circuits for variable speed control of Induction Motors.

UNIT I - Fundamentals of electric drives:

Fundamentals of electric drives - block diagram of an electric drive - parts of electric drives - dynamics of electric drives - Fundamental torque equation, speed torque conventions and Multi-quadrant operation. Equivalent values of drive parameters, components of load torques, nature and classification of load torques, Load Equalization- control of electrical drives - closed loop control.

UNIT II - DC Drives - I :

DC Motors and their performance, starting, speed control, constant torque and constant power control, single phase controlled rectifiers with motor loads - fully controlled and half controlled rectifier fed dc drives - continuous operation, three phase controlled rectifier fed dc drives- Three phase semi and fully controlled converter fed dc drives – Speed and Torque expressions – Speed – Torque characteristics – Problems.

UNIT III - DC Drives - II :

Four Quadrant operation of DC Drives – dual converter fed control, Electric Braking – Plugging, Dynamic and Regenerative Braking operations – Closed

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loop operation of DC motor, Chopper fed DC Drives- Single quadrant, Two – quadrant and four quadrant chopper fed DC Drives – Continuous current operation– speed torque characteristics – Problems Three phase induction motor analysis and performance-starting, Braking speed control-variable frequency control from voltage source and from current source.

UNIT IV - Induction Motor Drives :

Various PWM methods. Slip power recovery, Rotor resistance control and their industrial applications.

UNIT V - Synchronous Motor Drives :

Operation from fixed frequency supply- variable frequency control - VSI and CSI fed drives- self-controlled synchronous motor drives employing cycloconverter.

TEXT BOOKS:

1. Gopal K Dubey, "Fundamentals of Electric Drives", 2nd ed., Narosa Publishing house, 2005.
2. MD Singh and K B Khanchandani, "Power Electronics", 2nd ed., Tata – Mc Graw- Hill Publishing company, 2009.

REFERENCE BOOK:

1. B K Bose, "Power Electronic Control of AC drives", 1st ed., 2005.