22EE401 INDUSTRIAL ELECTRIC DRIVES

Source: https://electrical-engineering-portal.com/motor-types-electric-industrial-drives

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Basics of Power Electronics and Electrical Machines.

COURSE DESCRIPTION AND 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., and also 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.

MODULE–1

UNIT-1 **6L+0T+4P=10 Hours**

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-2 **18L+0T+12P=30 Hours**

RECTIFIER FED DC DRIVE AND CHOPPER FED DC DRIVE:

Rectifier Fed DC Drive: 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; Dual converter fed control.

Chopper Fed DC Drive: Review of DC chopper and duty ratio control, Chopper fed DC motor for speed control, Steady state operation of a chopper fed drive, Armature current waveform and ripple, calculation of losses in DC motor and chopper, Efficiency of DC drive, smooth starting; Closed-loop control of DC Drive Control structure of DC drive, Inner current loop and outer speed loop, Dynamic model of DC motor – dynamic equations and transfer functions.

PRACTICES:

- Dynamic braking of DC motor.
- Plugging of DC motor.
- Half-controlled converter fed DC motor.
- Fully controlled converter fed DC motor.
- Dual converter fed DC motor.

MODULE–2

UNIT-1 **12L+0T+8P=20 Hours**

CONTROL OF INDUCTION MOTOR:

Review of induction motor equivalent circuit and torque- speed characteristic, Variation of torque - speed curve with applied voltage, Frequency, Constant flux operation, Flux weakening operation; PWM methods; Slip power recovery, Rotor resistance control and their industrial applications.

SKILLS:

- ✓ *Suggest suitable converter for speed control of AC/DC drives.*
- ✓ *Design a converter for given load conditions of DC drive.*
- ✓ *Design a converter for given load condition of AC drive.*
- ✓ *Minimize current / torque ripple in a converter fed electric drive.*

UNIT-2 **12L+0T+8P=20 Hours**

CONTROL OF SYNCHRONOUS MOTOR:

Synchronous motor types, Open loop VSI fed drive and its characteristics, Self control model, Torque angle and margin angle control, Power factor control; Brushless excitation systems; Closed loop control of load commutated inverter fed synchronous motor drive.

PRACTICES:

- AC voltage controller fed induction motor using anti-parallel SCRs and TRIAC.
- Static rotor resistance control of induction motor.
- Speed control of induction motor using V/F control method.
- Open loop control of PMSM using voltage source inverter.
- Self control mode of PMSM using cyclo converter.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply power converters for electrical drives.	Apply	1	1, 2, 9, 11
2	Select of synchronous motor drives for different applications	Apply	2	1, 2, 9, 11
3	Design rectifier and chopper circuits for control of DC drive.	Create	1	1, 2, 3, 9, 11
4	Develop knowledge on how to design the speed control and current control loops of a DC drive.	Create	1	1, 2, 3, 9, 11
5	Analyse inverter circuits for variable speed control of Induction Motors.	Analyze	2	1, 2, 3, 9, 11

TEXT BOOKS:

1. Gopal K Dubey, “Fundamentals of Electric Drives”, 2nd Edition, Narosa Publishing House, 2010.
2. M D Singh and K B Khanchandani,” Power Electronics”, 2nd Edition, Tata Mc-Graw Hill Publishing Company, 2017.

REFERENCE BOOKS:

1. B K Bose, ”Power Electronic Control of AC Drives”,1st Edition, 2005.
2. M H Rashid, ”Power Electronics: Circuits, Devices and Applications”, 3rd Edition, Prentice Hall of India, 2011.

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