

Devi Ahilya University, Indore, India Institute of Engineering & Technology				ME I Year Electronics (Sp. Digital Instrumentation) Semester- B			
Subject Code & Name	Instructions Hours per Week			Credits			
DIR2E4: Advanced Industrial Drives and Control	L	T	P	L	T	P	Total
Duration of Theory Paper: 3 Hours	3	1	2	3	1	1	5

Objective: To study the different motors used in industry and their driving circuits.

COURSE CONTENTS

Unit I

Introduction to Power Devices: Construction, Working, Characteristics, Specifications and applications of SCR, TRIAC, DIAC, Power MOSFET, IGBT and UJT. SCR gate triggering and commutation circuits. Series and parallel connection of SCR and its triggering arrangement. Choppers: Principle, Working, Classification, Thyristorised Choppers- Jones Chopper, Morgan Chopper, Single Phase and Three Phase Controlled rectifiers, (Half wave, full wave and bridge configuration with resistive and Inductive Load. Inverters and choppers, Single-phase rectifiers and single phase controlled Inverters: Classification, Single Phase half bridge and full bridge Inverters, PWM Inverters

Unit II

Motors Fundamentals and Mechanical Systems: DC motor - Types, induced emf, speed-torque relations; Speed control – Armature and field control; Ward Leonard control – Constant torque and constant horse power operations. Review of Induction Motor operation – Equivalent circuit – Performance of the machine with variable voltage, rotor resistance variation, pole changing and cascaded induction machines, slip power recovery – Static Kramer Drive. Synchronous, Brush less DC and Switched Reluctance Drives

Unit III

Converter and Chopper Control: Principle of phase control – Series and separately excited DC motor with single phase and three phase converters – waveforms, performance parameters, performance characteristics - Operation with free wheeling diode schemes; Drive employing dual converter. Introduction to time ratio control and frequency modulation; Class A, B, C, D and E chopper controlled DC motor – performance analysis, multi-quadrant control.

Unit IV

VSI and CSI Fed Induction Motor Control: AC voltage controller fed induction machine operation – Energy conservation issues – V/f operation theory – requirement for slip and stator voltage compensation. CSI fed induction machine – Operation and characteristics - PWM controls. Field oriented control of induction machines – Theory – DC drive analogy – Direct or Feed back vector control - Indirect or Feed forward vector control – Flux vector estimation - Space Vector Modulation control, Direct torque control of Induction Machines – Torque expression with stator and rotor fluxes, DTC control strategy – optimum switching vector selection – reduction of torque ripple methods

Unit V

Special purpose Machines and control: Stepper motor: Working principle, construction, types, application and characteristics. Half and full step sequence, driving circuit using L297, L298 Servo motor: Working principle, construction, types, application and characteristics, Universal Motor: Working principle, construction, types, application and characteristics

Text and Reference Books:

- [1] Gopal K Dubey, “Power Semiconductor controlled Drives”, Prentice Hall Inc., New Jersey, 1989.
- [2] Bimal K Bose, “Modern Power Electronics and AC Drives”, Pearson Education Asia 2002.
- [3] Vedam Subramanyam, “Electric Drives – Concepts and Applications”, Tata McGraw Hill, 2000.
- [4] R.Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice- Hall of India Pvt. Ltd., New Delhi, 2003.
- [5] Austin Hughes, “Electric Motors and Drives – Fundamentals, Types and Applications”, Elsevier – a division of Reed Elsevier India private Limited, New Delhi, 2006.