GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Electrical Engineering

Subject Name: Electrical Drives (Power Electronics Group)

Sr.No	Course content
1	Fundamentals of Electrical Drives Dynamics of electrical drives, components of load torque, classification of load torque, concept of multi-quadrant operation, steady-state stability criteria.
2	DC Drives with phase controlled converters 1-phase fully controlled converter fed separately excited DC motor, modes of operation, steady-state motor performance equations, mode identification, speed-torque characteristics, operation with controlled fly-wheeling; operation with 1-phase half controlled converter; 3-phase fully controlled converter fed separately excited motor; Pulse width modulated rectifiers, equal pulse-width modulation, sinusoidal pulse width modulation; current control; multi-quadrant operation of fully-controlled converter fed DC motor; Dual converters based drives; Closed loop control of DC drives.
3	DC drives with dc-dc converters Principle of Motoring operation of separately excited and series motor with DC-DC converter, Steady-state analysis for time ratio control and current limit control; Regenerative braking; Dynamic and composite braking; multi-quadrant operation with dc-dc converters
4	Fundamental of Induction Motor (IM) and its control Review of IM: Steady-state analysis of an Induction motor; Starting and Braking methods; Speed control methods: variable terminal voltage, variable frequency control, rotor resistance control, injection of voltage in the rotor circuit; operation with a current source: operation with fixed frequency, variable frequency control.
5	Control of IM with solid state converters Control of IM using VSI : Six step inverter, PWM inverter, braking and multi-quadrant control, VVVF control Control of IM using CSI:Three-phase CSI, Braking, PWM in a thyristor CS inverter, PWM with GTO based CSI, Variable frequency drives, Comparison of

	CSI and VSI based drives. Current controlled PWM inverters:AC voltage controllers : AC voltage controller circuits, four quadrant control and closed-loop operation; fan/pump and crane/hoist drives; ac voltage controller starters Slip power controlled IM drives:analysis of stator rotor resistance control, Static scherbius drive: power factor considerations, rating and applications, performance
6	Synchronous motor drives (6 Hrs) Wound field cylindrical rotor motor, equivalent circuits, operation with constant voltage and frequency response : motoring and regenerative braking operations, power factor control and V-curves, operation with current source; Wound field salient pole motor; operation with variable voltage source and constant frequency; Starting and braking when fed from constant freq source; brushless excitation of wound field machines; Permanent magnet motor operating from a fixed frequency source; Operation with non-sinusoidal supplies.

References:

1. “Power semiconductor controlled drives”, Prentice Hall, New Jersey, 1989- G.K. Dubey
2. 'Fundamentals of Electrical Drives', Narosa, N. Delhi and Toppan Singapore, 1994- G.K. Dubey
3. “Modern Power Electronics and AC Drives”, Prentice Hall India, New Delhi, 2002- B.K. Bose
4. “Power Electronics - circuits, devices and applications”, Prentice Hall of India, 2nd ed., 2000- Muhammad H. Rashid
5. “Thyristor DC Drives”, John Wiley and Sons Ltd., April 1981- P.C. Sen