



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code: 3730716

Semester – III

ELECTRICAL ENGINEERING

Subject Name: Advanced Electric Drives

Type of course: Program Elective V

Prerequisite: Electrical Machines, Power Electronics at UG level

Rationale: The present course “Advanced electric drives” focuses on the dynamic control of dc and ac motor from solid state converters for better torque and speed response. The dynamic models of the dc and ac motors are useful for understanding the dynamic control of Electric Drives. Advanced control techniques needed to optimize the performance of ac motor drives. Since majority of modern drives are ac motor drives, the course centers around the control of ac motor drives. Finally, control aspects of some special motors, such as permanent magnet synchronous motor, brushless dc motor, switched reluctance motor, etc. are presented

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Vector Control of Induction Motor: Principles of vector control, direct vector control, derivation of indirect vector control, implementation-block diagram, estimation of flux, flux weakening operation. DTC principle, operation and control and its comparison with vector control of IM	8
2	Sensorless Vector Control of Induction Motor: Slip and speed estimation at low performance, rotor angle and flux linkage estimation at high performance, rotor speed estimation scheme, estimators using rotor slot harmonics, model reference adaptive systems, extended Kalman filter, injection of auxiliary signal on salient rotor.	10
3	Control of Synchronous Motor Drives: Synchronous motor and its characteristics- Control strategies-Constant torque angle control-power factor control, constant flux control, flux weakening operation, Load commutated inverter fed synchronous motor drive, motoring and regeneration, phasor diagrams. Sensorless control and flux observer	8



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering

Subject Code: 3730716

4	Control of Switched Reluctance Motor Drives: SRM Structure-Stator Excitation-techniques of sensor less operation-converto topologies-SRM Waveforms-SRM drive design factors-Torque controlled SRM-Torque Ripple-Instantaneous Torque control -using current controllers-flux controllers.	8
5	Control of BLDC Motor Drives: Principle of operation and control of BLDC and PMSM Machine, Sensing and logic switching scheme, These motors as Variable Speed Synchronous motor-methods of reducing Torque pulsations -Three-phase full wave Brushless dc motor - current controlled Brushless dc motor Servo drive.	8

Reference Books:

1. Electric Motor Drives Modeling, Analysis & control -R. Krishnan- Pearson Education
2. Modern Power Electronics and AC Drives –B. K. Bose-Pearson Publications
3. Sensorless Vector Direct Torque control –Peter Vas, Oxford University Press
4. Power Electronics control of AC motors – MD Murphy & FG Turn Bull Pergman Press -1st edition-1998.
5. Fundamentals of Electrical Drives – G.K. Dubey – Narosa Publications -1995
6. Power Semiconductor drives- G.K. Dubey-Prentice hall

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	To understand vector control and direct torque control of induction motor.	15
CO-2	To understand various speed and flux estimation techniques for sensorless vector control of induction motor.	25
CO-3	To understand control strategies of synchronous motor.	20
CO-4	To understand control strategies of reluctance motor.	15
CO-5	To understand control techniques of Permanent Magnet Synchronous Motor (PMSM), Brushless DC Motor (BLDC).	25

List of Open Source Software/learning website: SCILAB or its equivalent,

MATALB is preferable.