GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION AND CONTROL (APPLIED INSTRUMENTATION) (03)
ADVANCE INDUSTRIAL DRIVES AND CONTROL
SUBJECT CODE: 2710313
SEMESTER: I

Type of course: Major Elective: 1

Prerequisite: Electrical Machine & Power Electronics

Rationale: This course provides an overview and fundamentals of various electrical drives which includes its modelling and also different control strategies. Also covers special industrial drives and its control methods.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2	2	5	70	30	20	10	20	0	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introduction: Classification of Electric Drives, Requirements of Electric Drives , Modelling of dc machines, Modelling of induction machine, Modelling of synchronous machine	08	20%
2	DC motor drives : Speed-torque characteristics DC shunt, PMDC and series motors ,Dynamic model, Speed and position control methods	06	15%
3	Induction Motor Drive, Scalar control of induction motor, Principle of vector control, direct and indirect vector control, sensor less control and flux observers, model reference adaptive system (MARS), Direct torque and flux control of induction motor, Multilevel converter-fed induction motor drive, Utility friendly induction motor drive.	12	25%
4	Control of Synchronous Motor, Self-controlled synchronous motor, Vector control of synchronous motor, Cycloconverter-fed synchronous motor drive, Control of synchronous reluctance motor	08	20%
5	Control of Special Electric Machines, Permanent magnet synchronous motor, Brushless dc motor, Switched reluctance motor, Stepper motors and control	10	20%

Reference Books:

1. P.C. Krause, O. Wasynczuk, and S. D. Sudhoff, "Analysis of Electric Machinery", 2nd Edition, WILEY INDIA.
2. R. Krishnan, "Electric Motor Drives: Modelling, Analysis and Control", Prentice Hall.
3. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education.

Course Outcome:

After learning the course the students should be able to

1. Understand modelling of various electric motors.
2. Understand characteristics of various electric motors.
3. Understand different speed control techniques for DC motor, induction motor and synchronous motor.
4. Understand various advanced control technique like MARS.
5. Understand speed control techniques of advanced electric motors like BLDC, SRM and stepper motor.

List of Experiments:

1. To model DC shunt machine.
2. To model DC series machine.
3. To model induction machine.
4. To model synchronous machine.
5. To simulate V/f control technique for induction machine.
6. To simulate vector control technique for induction machine.
7. To simulate DTC technique for induction machine.
8. To simulate rotor resistance control of wound rotor for induction machine.
9. To simulate vector control technique for induction machine.
10. To study BLDC motor drive.
11. To study SRM drive.
12. To study stepper motor control techniques.

Open Ended Problem: Solution of the open ended problem(s) in guidance of course Instructor is mandatory. Few of the problems are specified as under.

(1) To develop model of DC machine, Induction machine and synchronous machine
(2) To develop model of flux observers for Sensorless control techniques. Check effect of various parameters on its performance.
(3) To check effectiveness of model reference adaptive systems (MARS) over other estimation techniques.
(4) Compare various induction motors control techniques like scalar control, direct torque control and vector control techniques.
(5) Compare performance of special electrical machines like BLDC, SRM and stepper motor for various applications area.

List of Open Source Software/learning website:

1. Scilab
2. www.nptel.ac.in/