

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: POWER ELECTRONICS
SUBJECT NAME: INDUSTRIAL DRIVES SYSTEM
SUBJECT CODE: 3712912
M.E. 1st SEMESTER

Type of course: Engineering

Prerequisite: DC Motors and Induction Motor at UG level

Rationale:

This course offers an overview and fundamentals of various DC and AC electrical drives which includes its modelling and different speed control strategies. Also, it covers advanced concepts of industrial drives. This is the core subject accompanying laboratory, serves to introduce electrical drives used in industrial and household applications on analysis point of view to the post graduate students who will use the concepts from this course during their graduate studies.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weight
1	<ul style="list-style-type: none">Dynamics of Electric Drives: Fundamentals of torque equation.Speed torque convention and multi-quadrant operation, components of load torque.	6	15
2	<ul style="list-style-type: none">Classification of load torques steady state stability.Load equation, Speed control and drive classification.Close loop control of drives.	6	15
3	<ul style="list-style-type: none">DC motor Drives-Modeling of DC machines.Steady state characteristics with armature and speed control.Phase controlled DC motor drives, chopper-controlled DC motor drives.	6	15
4	<ul style="list-style-type: none">Poly-phase induction machines- Dynamic modeling of induction machines.Small signal equations, control characteristics of induction machines.Phase-controlled induction machines. Stator voltage control.Slip energy recovery scheme, frequency control and vector control of induction motor drives	10	25
5	<ul style="list-style-type: none">Traction motor: Starting Speed-Time characteristics Braking.Traction motors used in practice.	6	15
6	<ul style="list-style-type: none">Industrial Drives-Digital Control of Electric Drives.Stepper motor. Servo motor and their Applications.	6	15

Reference Books:

1. G.K. Dubey, "Power semiconductor-controlled Drives", Prentice Hall international, New Jersey, 1989.
2. R. Krishnam, "Electric motor drives modeling, analysis and control", PHI-India-2009.
3. G. K. Dubey, "Fundamentals of electric Drives, Narosa Publishing House", 2nd edition, 2011.
4. W. Leonhard, "Control of Electrical drives", Springer, 3rd edition, 2001.
5. P.C. Krause –, "Analysis of Electric Machine", Wiley-IEEE press 3rd edition.
6. K. Bose, "Modern Power Electronics and AC Drives", Prentice Hall publication, 1st edition, 2001.

Course Outcome:

After learning the course, the students should be able to:

Students will be able to:

1. Model and simulate electric drive systems.
2. Design modulation strategies of power electronics converters, for drives application.
3. Design appropriate current/voltage regulators for electric drives

List of Experiments:

1. Simulation of dc drive
 2. Simulation of IM drive
 3. Generating modulation signals using hardware for different modulation schemes
 4. Designing and simulation of current regulator for electric drive
 5. Designing and simulation of voltage regulator for electric drive
 6. Controlling DC motor speed through power electronic converter at different load
 7. Controlling induction motor speed through power electronic converter at different load
- The teacher can decide other experiments also related to theory of the subject.

Major Equipment:

DC Motor with loading, Induction Motor with loading, Stepper motor
DC Drive trainer, Phase controlled drive trainer, Stepper motor drive trainer
Power Oscilloscope with necessary probes, Voltmeter, Ammeter, DMM
PC with necessary simulation software

List of Open Source Software/learning website:

1. <https://www.nptel.ac.in>
2. <https://www.mathworks.com/>
3. <https://powersimtech.com>
4. <https://www.scilab.org/>