



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 2960905

Semester – VI

Subject Name: Advanced Electric Drives

Type of course: Professional Elective Course

Prerequisite: Power Electronics

Rationale:

Electric motor is inevitable part of industries. High precision Control of this electric motors for various industrial applications are needed. Electric drive using power electronic converters with suitable control strategy can control the speed and torque of electric motor precisely. The course is aimed to provide exposure about the commonly used power electronic converters for electric drive applications and various control strategies used for the purpose of motion control.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Power Converters for AC drives PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.	10	20
2	Induction motor drives Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control (DTC).	10	20
3	Synchronous motor drives Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.	06	20
4	Permanent magnet motor drives Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.	06	20
5	Switched reluctance motor drives Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.	06	10
6	DSP based motion control Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.	06	10



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Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	30	30	15	10	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. B. K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, Asia, 2003.
2. P.C. Krause, O. Wasynczuk and S.D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, 2013.
3. H. A. Taliyat and S. G. Campbell, "DSP based Electromechanical Motion Control", CRC press, 2003.
4. R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, 2009.

Course Outcomes:

After completing the course, students will be able to;

Sr. No.	CO statement	Marks % weightage
CO-1	Select appropriate power electronic converters for drive applications.	25
CO-2	Analyze the vector control strategies for ac motor drives.	25
CO-3	Select appropriate control strategies for electric drives.	25
CO-4	Evaluate performance of electric drives under different control strategies.	25

List of Experiments:

This is a suggestive list only:

2. PWM inverter fed three phase induction motor control using PSPICE/MATLAB/PSIM software
3. VSI fed induction motor drive analysis using MATLAB/PSPICE/PSIM software
4. Study of V/f control operation of three phase induction motor
5. Study of vector controlled three phase induction motor drive.
6. Study of permanent magnet synchronous motor drive fed by PWM inverter using simulation software.



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7. Study of BLDC motor drive fed by PWM inverter using simulation software.
8. Study of SRM motor drive fed by PWM inverter using simulation software.
9. Regenerative/ Dynamic breaking operation for AC motor using simulation software
10. PC/PLC based AC/DC motor control operation

Major Equipment:

Power semiconductor devices, power electronic converter kits, CRO/DSO, choke coil, load bank, voltage and current probes, Simulation software like Scilab, MATLAB, PSIM etc. along with necessary toolbox.

List of Open Source Software/learning website:

- E-materials available at the website of NPTEL- <http://nptel.ac.in/>