GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS & ELECTRICAL DRIVES (45)

ADVANCE ELECTRICAL MACHINES

SUBJECT CODE: 2724504

SEMESTER: II

Type of course: Engineering Science (Electrical)

Prerequisite: NA

Rationale: NA

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)	
					PA	ALA	ESE	OEP		
3	2#	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Brushless DC Machines:** Construction and working principle, Equivalent magnetic analysis, EMF and torque equations, Types of converter and speed control, Comparison between the axial and radial Permanent magnet motors, applications	**08**	**20**
2	**Stepper Motors**: Constructional features – Principle of operation – Variable reluctance motor –Hybrid motor – Single and multi stack configurations – Theory of torque predictions – Linear and non-linear analysis – Characteristics – Drive circuits, close loop control	**08**	**20**
3	**Switched Reluctance Motor**: Construction details and classification, Working principle, Equivalent circuit, Motor speed-torque characteristics and modification with advance angle and dwell angle variation, Position sensing, Converter topologies, Speed Control, Applications	**10**	**25**
4	**Wind Mill Generator**: Characteristics of wind power. Wind power parameters, Classification of wind mill generators, Configuration of variable slip wind turbine generator and Doubly Fed induction Generator	**8**	**20**
5	**Other Special Machines:** Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear induction motor – Permanent magnet DC and	**6**	**15**

	AC motors, Applications		

Reference Books:

- T. Kenjo and S. Nagamori , "Permanent Magnet And Brushless DC Motors", Oxford Science publications, 1985
- R. Krishnan, "Electric Motor Drives", Prentice Hall, 2001.
- A. E. Fitzgerald, Charles Kingsley and Stephen D Umans, "Electric Machinery", TMH Publication, 2012
- Irving L. Kosow , "Electric Machinery and Transformers", Pearson, 2009
- R. Krishnan, "Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design, and Applications", CRC press, 2014
- R. Krishnan, "Permanent Magnet Synchronous and Brushless DC Motor Drives", CRC Press, 2009

Course Outcome:

After learning the course the students should be able to:

- Understand working principle and characteristics of special motors used for specific applications.
- Analyze different strategies adopted for speed control, torque production by governing motor parameters.
- Simulate a typical feedback based control model for normal and transient operation of the motors.

List of Experiments:

- BLDC Motor Open loop control
- Modeling of Brushless DC Motor Drive Using Sensor and Sensor less Control (Zero detection technique) with PI controller
- Modeling and simulation of BLDC speed control using PID Controller
- Characteristics of fixed speed Wind Mill Generators model
- Characteristics of variable slip wind turbine generator model
- Analysis of DFIG Model for normal operation.
- Obtain speed, current, torque characteristics for stepping motor fed by H-bridge PWM converter.
- Analysis of performance characteristics of BLDC motor for transient condition (sudden change in load torque).

Design based Problems (DP)/Open Ended Problem:

Course coordinator has to define at least 3 open ended problems related to the course.

Major Equipment:

Necessary instruments, kits and apparatus are to be provided for conducting above said practical in a group of maximum four students.

List of Open Source Software/learning website:

- E-materials available at the website of NPTEL- http://nptel.ac.in/
- MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website