GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3724504
SUBJECT NAME: Advanced Electrical Machines
SUBJECT CODE:
M.E. 2st SEMESTER

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)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	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	08	20%
5	**Other Special Machines:** Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear induction motor – Permanent magnet DC and AC motors, Applications	06	15%

Reference Books:

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

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the dynamic behaviour rotating machines.	25
CO-2	Understand reference frame theory and its application	25
CO-3	Understand modeling and equivalent circuit of synchronous machines.	25
CO-4	Analyse dynamic characteristics of various electronically commutated machines.	25

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).

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