

GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS (29) SPECIAL ELECTRICAL MACHINES SUBJECT CODE: 2722907 SEMESTER: II

Type of course: Major Elective-II

Prerequisite: Fundamental of Electrical Engineering, Electromechanical Energy Conversion, Electromagnetic Laws, Fundamental knowledge of Rotating Magnetic Circuit.

Rationale: This course offers knowledge about construction and working principles of different types of Special Electrical Machines. PG students will acquire Torque-Speed characteristics and control of various types of special machines.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	SYNCHRONOUS RELUCTANCE MOTORS Operating principle, Types, Constructional features: axial and radial air gap Motors, Reluctance torque, Phasor diagram, Motor characteristics.	7	18
2	SWITCHED RELUCTANCE MOTORS Principle of operation, Constructional features, Torque prediction, Power controllers, Microprocessor based control, Characteristics, Computer control.	8	18
3	STEPPING MOTORS Principle of operation, Constructional features, Types of stepper Motors, Various modes of operation of Variable reluctance (VR) stepper motors, torque production in Variable Reluctance (VR) stepping motor, Multi stack VR stepper motor, Construction and working of Permanent Magnet (PM) stepper motor, Construction and working of Hybrid stepper motor, Torque-angle characteristics of the stepper motor.	9	20
4	PERMANENT MAGNET SYNCHRONOUS MOTORS Principle of operation, EMF, power input and torque expressions, Phasor diagram. Power controllers, Torque speed characteristics,	7	15
5	PERMANENT MAGNET BRUSHLESS DC MOTORS Fundamentals of Permanent Magnets, Principle of operation, Magnetic circuit analysis, EMF and Torque equations, Characteristics and control.	7	15
6.	OTHER SPECIAL MACHINES Hysteresis motor, AC series motors, Linear induction motor-Principle of operation, characteristics, and Applications.	7	14

Reference Books:

1. T.J.E. Miller, Reluctance Motor and their Controls, USA, Oxford University Press, 1995
2. T. Kenjo, Stepping Motors and their Microprocessor Control, England, Clarendon Oxford Press, 1985
3. T. Kenjo and S. Nugatory, Permanent Magnet and Brushless DC motors, England, Clarendon Oxford Press, 1989.
4. R. Krishnan, Permanent Magnet Synchronous and Brushless DC Motor Drives, New Delhi, Prentice, Hall of India, 2009
5. B.K. Bose, "Modern Power Electronics & AC drives", Prentice Hall Publisher, 2002
6. Venkataratnam, "Special Electrical Machines", Taylor and Francis, 2009

Course Outcome:

After learning the course the students should be able to:

- Understand the fundamental concepts and the Operation of permanent magnet brushless DC motors
- Understand the basic concepts of other special machines

List of Tutorials:

- To study the construction and operating principle of various types of special machines.
- To study the speed torque characteristics of various special machines.
- To study the different types of control techniques for various special machines.
 - Micro controller based speed control of Stepper motor.
 - Speed control of BLDC motor.
 - DSP based speed control of SRM motor.

Major Equipment's:

- Stepper motor, PIC Microcontroller, controller circuit, Interface circuit, CRO.
- Power module, BLDC, motor (0.5HP) Controller circuit, sensor circuit, display meter, CRO/DSO.
- SRM motor-0.5 HP, PIC, DSP/TMS DSP Processor, speed sensor, Power module, Display meter, DSO.

List of Open Source Software/learning website:

- <http://nptl.ac.in>

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