GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRICAL ENGINEERING (07)

ELECTRICAL MACHINE MODELING AND ANALYSIS

SUBJECT CODE: 2720715

SEMESTER: II

Type of course: Master of Engineering

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)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Basic principle for Electrical Machine Analysis:** Introduction, magnetically coupled circuits, electromechanical energy conversion, Machine Windings & Airgap MMF, Winding Inductances & Voltage Equations	5	
2	**Reference frame theory:** Introduction, equations of transformation-change of variables, Stationary circuit variables transformed to the arbitrary reference frame, Commonly used reference frames and transformation between reference frames, transformation of a balanced set, Balanced steady state phasor relationships and voltage equations, Variables observed from various frames of reference	09	
3	**Symmetrical Induction machines:** Voltage and torque equations in machine variables, Equation of transformation for rotor circuits, Voltage & torque equations in arbitrary reference frame variables, Per unit system, Analysis of steady state equations, Free acceleration characteristics viewed from various reference frames, Dynamic model and analysis for sudden change in load torque, Dynamic model & analysis during three phase fault at the machine terminals, **Unbalanced operation at symmetrical Induction Machines,** Symmetrical component theory and analysis of unbalanced stator voltages, Analysis of steady state operation with unbalanced rotor conditions	12	
4	**Synchronous machines:** Voltage & torque equations in machine variables, Stator voltage equations in arbitrary reference frame variables, Voltage equations in rotor reference frame variables-Park's equation, Torque equation, rotor angle and angle between rotors, Per unit system, analysis of steady	08	

	state operation, Dynamic performance during a sudden change in input torque.		
5	**Analysis of PM BL D.C. machine:** Introduction to PM BL D.C. machine, Voltage and torque equations in machine variables, Analysis of steady state operations.	3	
6	**Computer Simulation of Electric Machines:** Simulation of symmetrical Induction and synchronous machines, Thermal model of induction machine, Induction machine dynamics during starting, braking and reversing	5	
7	**Linearized Machine Equations:** Introduction, Linearization of induction & synchronous machine equations	3	

Reference Books:

1. Paul C. Krause, Oleg Wasynczuk and Scott D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, New York, 2004.
2. Dynamic Simulation of Electric Machinery using MATLAB by ONG, Chee-Mun - Prentice Hall PTR
3. Generalized theory of electrical machines by P S Bimbhra, 5th edition, Khanna Publishers Delhi

Course Outcome:

Upon the successful completion of this course, students should be able to:

List of Experiments and Open Ended Problems:

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.