

GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS (29)

POWER CONVERTERS-II

SUBJECT CODE: 2722910

SEMESTER: II

Type of course: Core Subject

Prerequisite: Fundamental Knowledge of Calculus; Basics of Electrical & power electronics Engineering; Concepts of Fourier Series, Solution of Integral-differential equations, Laplace Transformation

Rationale: This is the one of the subject which accompanying laboratory, serves to the student of power electronics on analysis point of view and the advancement in to the field of power electronics. Power Electronics which is a rapidly growing and day by day the requirement of the power converter is increasing very rapidly for most of the industry. It is also a prominent strength of the Power Electronics Engineering Department.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			C	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.	Resonant Converters and Switch-Mode Converter Power Supplies: Sinusoidal Analysis of Resonant Converters, Soft Switching, Basic Resonant Circuits, Load-Dependent Properties of Resonant Converters, Resonant Switch Topologies, Soft Switching in PWM Converters, High-Frequency Switching, High-Frequency Isolation Transformer, Push-Pull Converter, Full-Bridge Converter, Single-Switch Forward Converter, Single-Switch Fly back Converter.	8	20
2.	Multilevel converter: Introduction To Multilevel Converters, Overview Of Multilevel Topologies, Configurations With Diode Clamps, Capacitor Clamped Converters, Multilevel Multiple Three-Phase Converters, Overview Of Modulation Strategies, Synchronous Modulation, Asynchronous Modulation, Switching Signals And Load Currents, Loss Calculations, Harmonics.	8	15
3.	Matrix Converters: Principle Of The Matrix Converter, Matrix Converter Switches, Matrix Converter Circuit, Switching Control Strategies For modulation technics, PWM Matrix Converters, Hybrid AC-AC Frequency converter, Matrix Converters In Three-phase Motor Applications, Specimen Simulation.	6	15
4.	Multipulse converter: Introduction, uncontrolled and controlled multipulse converter, Three-Phase Multi-pulse Converter with different configuration, Six-Pulse Converter, Twelve-Pulse Converter, Twenty-Four Pulse Converter, Three-Phase Multi-pulse	6	15

	Converter with different control configuration.		
5.	Dynamic modelling of switched converters: Power electronics devices modelling, different types, modelling type, Switched models, Classical average model, Methodology of averaging, analysis of averaging, generalized averaged model, advantage and limitations of averaged model, methodology of averaged modelling.	8	20
6.	Feedback Control of Controllers: About feedback control systems, Advantage of close loop system over open loop, Transfer Function Representation of linear systems, PI Controllers, PID Controllers, Adaptive control, hysteresis control for the controller.	6	15

Reference Books:

1. Mohan & Robbins, "Power Electronics: Converters, Applications, and Design", John Wiley & Sons
2. Robert W. Erickson, "Fundamentals of Power Electronics Second Edition", Kluwer Academic Publishers
3. V.R. Moorthi, "Power Electronics Devices, Circuits and Industrial Applications", Oxford,.
4. William Shephed, "Power Converter Circuis", Taylor & Francis Group. Seddik Bacha, Iulian Munteanu, Antoneta Iuliana Bratcu, "Power Electronic Converters Modeling and Control with Case Studies", springer

Course Outcome:

After learning the course the students should be able to:

1. Understand Basic Structure of Advance Power Electronics Converter
2. Understand concepts and operating principles of different modern modelling.
3. Design procedures and techniques of different Converters.
4. Understand concepts modelling of switched converters.
5. Design and analyses of switched converters.
6. Organize and make technical presentations.

List of Experiments and Open Ended Projects:

1. After learning the course the students should be able to:
2. To study the Load-Dependent Properties of Resonant Converters.
3. To design the Push–Pull Converter.
4. To study the Configurations of Multilevel converter With Diode Clamps.
5. To study the Configurations of Multilevel converter With Capacitor Clamped Converters.
6. To study the different Matrix Converter Circuit.
7. To design the uncontrolled and controlled multipulse converter.
8. To study the Three-Phase Multi-pulse Converter with different configuration.
9. To design the modelling of switched converters.
10. To study the average modelling of switched converters.
11. To study the PI Controllers and PID Controllers with converter.

Major Equipments: Digital Storage Oscilloscopes, Circuit Simulation Tools: open source software to simulate power electronic converter circuits, Basic equipment for measurement, Different loads: R, RL, and Motors etc.

List of Open Source Software/learning website:

http://nptel.iitm.ac.in/coursecontents_elec.php

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