

Power Electronics System

The course is intended for students who may want to further their knowledge on the analysis, analysis, design, control, efficiency analysis and switching techniques of power electronic converter circuits.

Course Code: EE-6703

Credit Hours: 3 + 0

Pre-requisite: Linear Control System, Fundamentals of basic power electronics

Target Audience: MS/PhD students wishing to pursue research in the field of Applied Power and Controls.

Synopsys:

Currently, power electronic circuits are essential for a variety of industrial electronics products. This includes switched-mode regulated power supplies for hand-held devices, TVs, light fittings, computers and other entertainment systems. Besides that, it is heavily exploited in diverse industrial applications, such as grid connections for wind generators and PV systems, high voltage DC transmission; welding, furnaces, smelting and power supplies for telecommunication equipment; Power converters for variable-speed drives in automotive industry. Electronic processing of electrical power for these applications also allows to control these processes to obtain certain desirable goals such as energy efficiency, better product quality and accurate control of the processes.

The first part of the course treats basic circuit operation, including steady-state converter modeling and analysis, switch realization, discontinuous conduction mode, and transformer-isolated converters. Next, converter control systems are covered, including AC modeling of converters using averaged methods, small-signal transfer functions, and classical feedback loop design. Finally, magnetics design for switched-mode applications is discussed, including: basic magnetics, the skin and

Brief Course Outline:

- Introduction to power electronics
- Principles of Steady State Converter Analysis
- Steady-State Equivalent Circuit Modeling, Losses, and Efficiency
- Switch Realization
- The Discontinuous Conduction Mode
- Converter Circuits
- AC Equivalent Circuit Modeling
- Converter Transfer Functions
- Controller Design
- Basic Magnetics Theory
- Inductor Design
- Transformer Design
- Layout and grounding principles

Instructor:

This course will be taught by Dr. Kashif Ishaque (kashif.ishaque@pafkiet.edu.pk). He received his B.E. in Industrial Electronics Engineering from Institute of Industrial Electronics Engineering, NEDUET, Karachi, Pakistan, in 2007. He received his M.E. and PhD degree from Universiti Teknologi Malaysia (UTM), Malaysia. His research interests include modelling and control of photovoltaic (PV) system, power electronics, intelligent control, nonlinear system control and application of optimization techniques such as genetic algorithm (GA), particle swarm optimization (PSO) and differential evolution (DE).

Text Book/Reference Material:

R. W. Erickson, "Fundamentals of Power Electronics", second edition, Kluwer Academic Publications, 2004.

Marks Distribution:

Final	Mid Term	Assignments	Quizzes	Total
50%	20%	20%	10%	100%