

Static Power Converters and Applications

1.1 Course Number: EEV321

1.2 Contact Hours: 3-0-0 Credits: 9

1.3 Semester-offered: 4th Year-Odd

1.4 Prerequisite: Knowledge of Power Electronic Devices, basics of power converters

1.5 Syllabus Committee Member: Dr. Umakant Dhar Dwivedi, Dr. Vijay Kumar Singh, Dr. Saptarshi Ghosh, and Dr. Saurabh Pandey.

2. **Objective:** The objective of this course is developing an understanding of Power Electronics and switching mode power converters for various AC and DC applications.

3. Course Content:

Review of modern power devices; Phase-Controlled Rectifiers: Single-phase converters, Three-phase converters, effect of load and source impedances; Dual converter, 6-pulse and 12-pulse converter, multi-pulse converters. Converter Control: PWM inverter, power factor improvement techniques like; four-legged bridge converter, extinction angle control, Symmetrical angle control, PWM control.

DC-DC Converters: Design and analysis of buck converter, boost converter, buck-boost converter, Cuk converter.

Three-phase Regulators: Three-phase ac regulators, principle of operation and performance analysis with resistive load.

Cycloconverters: Single-phase and three-phase Cyclo-converters; Matrix converters.

Inverters: Three-phase voltage source inverters, voltage and frequency control; PWM Inverters: Harmonic reduction techniques in PWM inverters, different types of PWM techniques, Space Vector PWM.

Multilevel Inverters: Multi-level inverters, advantages, configurations, and applications, modular multilevel converters.

Current source inverter: Principle, operation, control of CSI, commutation circuits, transient voltage suppressing technique.

Overview of reactive power compensators: SVC (Static Var Compensator) and STATCOM (Static Synchronous Compensator).

4. Readings

Books:

- i. *Dubey G. K., Doradla S. R., Joshi A. and Sinha R. M. K., "Thyristorised Power Controllers", New Age International Private Limited, 2008.*
- ii. *Mohan N., Undeland T.M. and Robbins W.P., "Power Electronics – Converters, Applications and Design", 3rd Ed., Wiley India, 2008.*
- iii. *Bose B.K., "Power Electronics and Variable Frequency Drives – Technology and Applications", IEEE Press, Standard Publisher Distributors, 2001.*
- iv. *Lander C. W., "Power Electronics", 3rd Ed., McGraw-Hill International Book Company, 2007.*
- v. *Rashid M., "Power Electronics- Circuits, Devices and Applications", 3rd Ed., Pearson Education, 2008.*

5. Outcome of the Course: Upon successful completion of this course, students should be able to:

1. Design and analyze various single-phase and three-phase power converter circuits and understand their applications.
3. Learn the operation of power electronic circuits and different modulation techniques to enhance the overall performance of the system.
4. Develop a good insight about the modelling and control of power electronic converters.
5. Understand working principle and application of advanced power electronic converters such as multilevel converter, matrix converter, resonant converters etc. and their possible control methods.