

# Fundamentals of Power Electronics

- 1.1 Course Number: EEV221
- 1.2 Contact Hours: 3-0-0 Credits: 9
- 1.3 Semester-offered: 3<sup>rd</sup> Year-Even
- 1.4 Prerequisite: Basic Electronics, circuit Analysis.
- 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 to develop an understanding of power semiconductor devices and various types of power converters. The course deals with a detailed discussion of semiconductor devices and their operation along with a detailed discussion of the design and operation of all types of conventional power converters.

### 3. Course Content:

Power semiconductor devices (Power Diode, Thyristors, DIAC, TRIAC, GTO, MOSFET, IGBT, IGCT, SIT, SITH, MCT): structure and characteristics; protection circuits, switching loss.

Phase Controlled (AC to DC) Converters: Principle of phase control, Full wave controlled Converters. Single phase full wave converters, Single phase two pulse converters with discontinuous load and its performance, three phase thyristor converters: half wave, full and semi converters. Dual Converters.

DC to DC Converters: Introduction, Classification, Principle and Operation; Switched mode power supply: step down (buck), Step up (boost) and step down/step up (buck/boost) converters and Cuk converter.

DC to AC Converters: Introduction, Classification, single phase half and full bridge voltage source inverter (VSI), three phase VSI 120- and 180-degree conduction mode, harmonic analysis, filters, Voltage control of single phase and three phase Inverter, Current source inverter.

AC Voltage Controllers: Introduction, Principal of On-Off control and Phase Control, Single phase Bidirectional Controllers with R and R-L Loads, Three phase full wave controllers.

### 4. Readings

Books:

- i. Lander C. W., "Power Electronics", 3rd Ed., McGraw-Hill International Book Company, 2007.
- ii. Rashid M., "Power Electronics- Circuits, Devices and Applications", 3rd Ed., Pearson Education, 2008.
- iii. Mohan N., Undeland T.M. and Robbins W.P., "Power Electronics – Converters, Applications and Design", 3rd Ed., Wiley India, 2008.

- iv. *Bose B.K., "Power Electronics and Variable Frequency Drives – Technology and Applications", IEEE Press, Standard Publisher Distributors,2001.*

**5. Outcome of the Course:**

Upon completion of the course, the students will be able to

1. Study and analyze the transient response of basic power electronic circuits.
2. Understand the working of commonly used power converters.
3. Analyze and design various power converter systems.