

## EE3202PC: Power Electronics

B.Tech. III Year II Sem.

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**Prerequisite:** Analog Electronics, Digital Electronics

### Course Objectives:

- To Design/develop suitable power converter for efficient control or conversion of power in drive applications
- To Design / develop suitable power converter for efficient transmission and utilization of power in power system applications.

**Course Outcomes:** At the end of this course students will demonstrate the ability to

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers. Analyze the operation of voltage source inverters

### UNIT-I

**Power Switching Devices:** Concept of power electronics, scope and applications, types of power converters; Power semiconductor switches and their V-I characteristics - Power Diodes, Power BJT, SCR, Power MOSFET, Power IGBT; Thyristor ratings and protection, Series and parallel connections of SCRs, Two transistor analogy of SCR, methods of SCR commutation, UJT as a trigger source, gate drive circuits for BJT and MOSFETs.

### UNIT-II

**AC-DC Converters(Phase Controlled Rectifiers):** Principles of single-phase fully-controlled converter with R, RL, and RLE load, Principles of single- phase half-controlled converter with RL and RLE load, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, General idea of gating circuits, Single phase and Three phase dual converters.

### UNIT-III

**DC-DC Converters (Chopper/SMPS):** Introduction, elementary chopper with an active switch and diode, concepts of duty ratio, average inductor voltage, average capacitor current. Buck converter -Power circuit, analysis and waveform at steady state, duty ratio control of output voltage. Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage. Buck-Boost converter-Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

### UNIT-IV

**AC-DC Inverters:** Introduction, principle of operation, performance parameters, single phase bridge inverters with R, RL loads, 3-phase bridge inverters - 120- and 180- degrees mode of operation, Voltage control of single-phase inverters–single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation.

**UNIT-V**

**AC-AC Converters:** Phase Controller (AC Voltage Regulator) - Introduction, modes of operation of Triac, principle of operation of single-phase voltage controllers for R, R-L loads and its applications. Cyclo-converter-Principle of operation of single phase cyclo-converters, relevant waveforms, circulating current mode of operation, Advantages and disadvantages.

**TEXT BOOKS:**

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.

**REFERENCE BOOKS:**

1. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
2. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.