# POWER ELECTRONICS (THEORY) EE-421

Pre-requisite: Electronic Circuit Design-II
Credit Hours 03
Contact Hours 48

## RECOMMENDED BOOKS

- Power Electronics by M.H. Rashid 3rd Edition
- Power Electronics by Daniel W. Hart
- Power Electronics: Devices, Drivers, Applications and Passive Components by Prof. Barry Wayne Williams

## REFERENCE BOOKS

Power Electronics: Converters, Applications and Design by Mohan, Undeland and Riobbins

## OBJECTIVE OF COURSE

This course deals with the techniques of designing high current electronic circuits using devices in the switching mode rather than in the linear mode. The subject starts with coverage of the full spectrum of modern power semiconductor devices, their characteristic-both static and switching. Topologies of power electronic circuits for application in controlled rectification, dc-dc conversion, inversion and their control techniques will be covered.

| S.NO | CLO/PLOS MAPPING | DOMAIN | PLO |
|---|---|---|---|
| 1 | **Explain** comprehensive knowledge of components, circuits and control techniques used in high current electronic circuits using devices in the switching mode rather than in the linear mode | C2 | 01 |
| 2 | **Illustrate** the topologies of power electronic circuits for application in controlled rectification, inversion, dc-dc conversion, and ac-ac conversion. | C3 | 01 |
| 3 | **Demonstrate** operation of components and circuits and mathematical designing concepts and applications of power electronics devices. | C3 | 01 |
| 4 | **Analyze** the designed circuits for their performance parameters | C4 | 02 |

## COURSE CONTENTS

**Review of Electronics**

- Basic Semiconductor Physics
- Conduction Processes in Semiconductors
- Pn Junctions
- Charge control Description of pn-Junction Operation
- Avalanche Breakdown
- Circuits with RL, L, RC, C, RLC and LC
- Free Wheeling Diode
- RMS and Average Values
- Phasor Calculations (Single and Three Phases)
- Switching Losses

**Power Semiconductor Devices**

- Introduction
- Power Diodes
- Power BJT
- Thyristor
- Power MOSFET
- IGBT

**Rectifiers**

- Half wave and Full wave Rectifiers
- Half wave rectifier with R-E Load. Application Battery Charging
- Half Wave rectifier with RL load
- Three Phase Rectifiers
- Controlled Rectifiers (Single Phase Only)

**Choppers**

- Introduction
- Control Strategies
- First Quadrant Chopper
- Second Quadrant Chopper
- Two Quadrant Chopper
- Four Quadrant Chopper

**Inverters**

- Single Phase Inverter
- Half Bridge Inverter with R and RL Load
- Full Bridge Inverter with R and RL Load
- Three Phase Inverters
- Half Bridge Configuration
- Full Bridge Configuration
- 120 and 180 Degree Operation