**III B.Tech – I Semester**
**(20EE5008) POWER ELECTRONICS**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 30 | 70 | 100 | 3 | - | - | 3 |

**Pre-Requisites:** Analog Electronics, Electrical Circuit Analysis, Calculus

**Course Objectives**

- To study the characteristics of various power semiconductor devices and gate drive circuits.
- To understand the operation of single-phase full-wave converters and analyze harmonics in the input current.
- To study the operation of three phase full–wave converters.
- To understand the operation of different types of DC-DC converters.
- To understand the operation of inverters and the application of PWM techniques for voltage control and harmonic mitigation and to analyze the operation of regulators.

**UNIT-I: POWER SEMICONDUCTOR DEVICES**

Basic Theory of Operation - Static Characteristics-Two Transistors analogy -Turn on and Turn off Methods - Methods of SCR Triggering - Dynamic & Gate Characteristics of SCR - Series and Parallel Operation - Snubber circuit -Switching Characteristics of Power MOSFET and IGBT

**UNIT-II: Single Phase AC-DC Converters**

Single Phase half wave controlled rectifiers withR and RL loads, freewheeling diode - Single Phase fully controlled bridge converter with R, RL, RLE loads - Continuous and Discontinuous conduction - Effect of source inductance Expression for output voltages – Single Phase semi Converter with R, RL, RLE loads – Continuous and Discontinuous conduction - Harmonic Analysis - Single Phase Dual Converters - Numerical Problems

**UNIT-III: Three Phase AC-DC Converters**

Three Phase half wave Rectifier with R and RL load -Three Phase fully controlled rectifier with R and RL load - Three Phase semi converter with R and RL load - Expression for Output Voltage - Harmonic Analysis - Three Phase Dual Converters - Numerical Problems.

**UNIT-IV: DC-DC CONVERTERS**

Analysis of Buck, boost, buck-boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) – Output voltage equations using the volt-sec balance in CCM & DCM- output voltage ripple & inductor current ripple for CCM only – Principle operation of forward and flyback converters in CCM.

**UNIT-V: DC–AC CONVERTERS AND AC-AC CONVERTERS**

1- phase half-bridge and full-bridge inverters with R and RL loads – Unipolar and bipolar switching-Quasi-square wave pulse width modulation-3- phase square wave inverters – $120^0$ conduction and $180^0$ conduction modes of operation – Sinusoidal pulse width modulation –single-phase Current Source Inverter (CSI)- single-phase AC-AC voltage regulator.

**Course Outcomes:**

After successful completion of the course, the students will be able to:

| S.No | Course Outcome | BTL |
|---|---|---|
| 1. | Explain the characteristics of various power semiconductor devices and analyze the static and dynamic characteristics of SCR and design firing circuits for SCR | L2 |
| 2. | Explain the operation of single-phase full-wave converters and analyze harmonics in the input current | L2 |
| 3. | Explain the operation of three-phase full-wave converters. | L2 |
| 4. | Analyze the operation of different types of DC-DC converters | L4 |
| 5. | Explain the operation of inverters and application of PWM techniques for voltage control and harmonic mitigation and analyze the operation of AC-AC regulators. | L2 |

**Correlation of COs with POs& PSOs:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 1 | | | | | | | | | | 3 | |
| **CO2** | 2 | 2 | 1 | | | | | | | | | | 3 | |
| **CO3** | 1 | 3 | 1 | 1 | | | | | | | | | 3 | |
| **CO4** | 1 | 3 | 2 | 1 | | | | | | | | | 3 | |
| **CO5** | 1 | 3 | 1 | 2 | | | | | | | | | 3 | |

**Text Books:**


1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore M Undeland, William P Robbins, John Wiley & Sons
2. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998.
3. Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited, India, 2009.


**Reference Books:**


1. Elements of Power Electronics–Philip T.Krein.oxford.
2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996
4. Power Electronics: by Daniel W.Hart, Mc Graw Hill.