

3/4 B.Tech. FIFTH SEMESTER**EE5T4****POWER ELECTRONICS****Credits: 3****Lecture: 3 periods/week****Internal assessment: 30 marks****Tutorial: 1 period /week****Semester end examination: 70 marks****Course Objective:**

This course covers fundamental principles of semiconductor devices, ac /dc, dc /dc, ac/ac, dc/ac converter sand use of PWM techniques to obtain high quality power supply

Course Outcomes:

Upon completing this course, students should be able to

1. Understand the principle of operation and characteristics of different power semiconductor devices
2. Learn SCR protection schemes, different configurations of 1- Φ & 3 – Φ controlled rectifiers with R, RL and RLE loads
3. Derive the RMS load voltage, current and power factors and know the basic principle of operation for 1- Φ AC voltage controllers and cycloconverters with R and RL loads.
4. Know the basic operation and characteristics of various choppers and inverters.

UNIT I**Power Semiconductor Devices**

Power Diode, Power BJT, Power MOSFET, IGBT, GTO, DIAC, TRIAC, Principle of operation and characteristics. Principle of operation of SCR, static, dynamic and gate Characteristics of SCR, two-transistor analogy, triggering methods of SCR- R, RC and UJT firing circuits, commutation techniques.

Snubber Circuits details, series and parallel connections of SCRs–static and dynamic equalizing networks, specifications and ratings of SCRs – numerical problems

UNIT II**Phase Controlled Rectifiers**

Phase angle control, single phase half wave controlled rectifiers with R and RL load, single phase full wave controlled rectifiers – midpoint connections and bridge connections – fully controlled bridge rectifier, half controlled bridge rectifier with R, RL loads - Derivation of average load voltage and current, line commutated inverters without and with Freewheeling diode, effect of source inductance, derivation of load voltage and current.

Three phase converters, three pulse and six pulse converters, midpoint and bridge connections, average load voltage with R and RL loads, effect of source inductance, dual converters (both single phase and three phase).

UNIT III**Inverters**

Single Phase inverters –Basic series inverter, parallel Inverter, Bridge Inverters, three phase bridge inverter with 120° and 180° conduction, PWM Techniques-single pulse, multiple pulse and sinusoidal PWM, three phase sinusoidal PWM. Introduction to multilevel inverter.

UNIT IV**DC-DC Converters**

Choppers – time ratio control and current limit control strategies – step down chopper, derivation of load voltage and currents with R, RL and RLE loads-,step up chopper, load voltage expression, high frequency DC-DC converter – buck, boost, buck-boost, Jones chopper (Principle of operation only) waveforms , AC chopper – problems.

UNIT V**AC Voltage Controllers & Cyclo Converters**

Single phase AC voltage controllers –two SCR's in anti parallel, Triac with R and RL loads, derivation of RMS load voltage, current and power factor wave forms numerical problems.

Cyclo converters – single phase mid-point cyclo converters with resistive and inductive load. Bridge configuration of single phase cyclo converter (Principle of operation only).derivation of rms load voltage and current.

Learning Resources**Text Books:**

1. Power Electronics by P.S.Bhimbra, Khanna Publishers.
2. Power Electronics : Circuits, Devices and Applications by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
3. Power Electronics: converters, applications & design by Nedmohan, Tore M. Undeland, Riobbins by Wiley India Pvt. Ltd.
4. Power Electronics MD Singh and K B Khanchandani, Tata – McGraw-Hill Publishing company, 1998.

Reference Books:

1. Power Electronics by Vedam Subramanyam, New Age International (P) Limited.
2. Power Electronics by V.R.Murthy , 1st edition -2005, OXFORD University Press
3. Power Electronics by P.C.Sen,Tata Mc Graw-Hill Publishing.
4. Thyristorised Power Controllers by G. K. Dubey, S. R. Doradra, A. Joshi and R. M. K. Sinha, New Age International (P) Limited Publishers, 1996.