EE602PC: POWER ELECTRONICS

B.Tech. III Year II Sem.   **L   T   P   C**
                                                                         4   1   0   4

Prerequisite: Electronic circuits

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: After completion of this course the student is able to

- Choose the appropriate converter for various applications

- Design the power converters suitable for particular applications

- Develop the novel control methodologies for better performance.

UNIT – I
Power Semi Conductor Devices and Commutation Circuits: Thyristors - Silicon Controlled Rectifiers (SCR's) - BJT - Power MOSFET - Power IGBT and their characteristics and other thyristors - Basic theory of operation of SCR - Static characteristics – Turn-on and Turn-off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points.
Two transistor analogy of SCR - R, RC, UJT firing circuits - Series and parallel connections of SCRs - Snubber circuit details – Specifications and Ratings of SCR, BJT, IGBT - Numerical problems – Line Commutation and Forced Commutation circuits.

UNIT – II
Single Phase Half Wave Controlled Converters: Phase control technique - Single phase Line commutated converters - Half wave controlled converters with Resistive, RL load and RLE load - Derivation of average load voltage and current -Active and Reactive power inputs to the converters without and with Freewheeling Diode - Numerical problems

Single Phase Fully Controlled Converters: Fully controlled converters, Midpoint and Bridge connections with Resistive, RL loads and RLE load - Derivation of average load voltage and current – Line commutated inverters, semi-converters, active and Reactive power inputs to the converters, Effect of source inductance – Expressions of load voltage and current - Numerical problems.

Three Phase Line Commutated Converters: Three phase converters - Three pulse and six pulse converters and bridge connections with R, RL load voltage and current with R and RL load and RLE loads - Semi Converters, Effect of Source inductance–Dual converters Waveforms - Numerical Problems

UNIT – III
AC Voltage Controllers: AC voltage controllers – Single phase two SCR's in anti parallel with R and RL loads , modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage, current and power factor- wave forms , Numerical problems- Single phase and three phase cycloconverters (principle of operation only).

UNIT – IV
Choppers: Choppers – Time ratio control and Current limit control strategies – Step down choppers- Derivation of load voltage and currents with R, RL and RLE loads- Step up Chopper – load voltage expression.
Morgan's chopper – Jones chopper - Oscillation choppers (Principle of operation only) - waveforms — AC Chopper – Problems

UNIT – V
Inverters: Inverters – Single phase inverter – Basic series inverter, parallel Capacitor inverter, bridge inverter – Waveforms,. Simple bridge inverters, Voltage control techniques for inverters- Pulse width modulation techniques – Numerical problems.

TEXT BOOKS:

1. M. D. Singh & K. B. Kanchandhani, "Power Electronics", Tata Mc Graw – Hill Publishing Company, 1998.

2. "M. H. Rashid", "Power Electronics : Circuits, Devices and Applications", Prentice Hall of India, 2nd edition, 1998

3. "V. R. Murthy", "Power Electronics", Oxford University Press, 1st Edition 2005.

REFERENCE BOOKS:

1. Vedam Subramanyam, "Power Electronics", New Age International (P) Limited, Publishers, 2nd Edition 2008.

2. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, 1997.

3. M. S. Jamil Asghar, "Power Electronics", PHI Private Limited, 2004.

4. P. C. Sen, "Power Electronics", Tata Mc Graw-Hill Publishing, 2001.

5. John G. Kassakian, Martin, F. Schlect, Geroge C. Verghese, "Principles of Power Electronics", Pearson Education, 1st Edition 2010.