

## 15AEE19-POWER ELECTRONICS

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**Course Objectives:**

This course enables the students to

- The basic power semiconductor switching devices and their principles of operation.
- To know about the characteristics of semi conductor devices, ac-dc, dc-dc, ac-ac and dc-ac converters.
- The importance of using pulse width modulated techniques to obtain high quality power supply.
- To know the AC – AC voltage control techniques.

**UNIT – I POWER SEMI CONDUCTOR DEVICES**

Power Semiconductor Diodes, Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power Transistor - Power MOSFET – Power IGBT - TRIACs, GTOs - Characteristics and Principles of Operation and other Thyristors – Basic Theory of Operation of SCR – Static Characteristics – Turn On and Turn Off Methods- Dynamic Characteristics of SCR - Two Transistor Analogy – Triggering Circuits— Series and Parallel Connections of SCR's – Snubber Circuits – Specifications and Ratings of SCR's, BJT, IGBT - Numerical Problems –Commutation Circuits.

**UNIT – II PHASE CONTROLLED CONVERTERS**

Phase Control Technique – Single Phase Line Commutated Converters – Mid Point and Bridge Connections – Half Controlled Converters, Fully Controlled Converters with Resistive, RL and RLE loads– Derivation of Average Load Voltage and Current – Line Commutated Inverters - Active and Reactive Power Inputs to the Converters without and with Free Wheeling Diode, Effect of Source Inductance – Numerical Problems.

Three Phase Line Commutated Converters – Three Pulse and Six Pulse Converters – Mid Point and Bridge Connections - Average Load Voltage with R and RL Loads – Effect of Source Inductance–Dual Converters (Both Single Phase and Three Phase) - Waveforms –Numerical Problems.

**UNIT – III DC – DC CONVERTERS**

Buck converters, boost converters and buck boost converters. Steady state analysis, voltage and current ripple, design of inductor and capacitor values.

**UNIT – IV INVERTERS**

Inverters – Single Phase Inverter – Basic Series Inverter – Basic Parallel Capacitor Inverter Bridge Inverter – Waveforms –sine-triangle PWM, Three Phase VSI in  $120^\circ$  And  $180^\circ$  Modes of Conduction. unipolar, bipolar inverter PWM techniques selective harmonic elimination - Voltage Control Techniques for Inverters Pulse Width Modulation Techniques – Numerical Problems.

**UNIT – V AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS**

**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,

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Current and Power Factor Wave Forms –Firing Circuits -Numerical Problems - Thyristor Controlled Reactors; Switched Capacitor Networks.

**Cyclo Converters** – Single Phase Mid Point Cyclo Converters With R and RL loads (Principle of Operation only) – Bridge Configuration Of Single Phase Cyclo Converter with R and RL loads (Principle of Operation only) – Waveforms

**Course Outcomes:**

*The students will have knowledge on the following concepts*

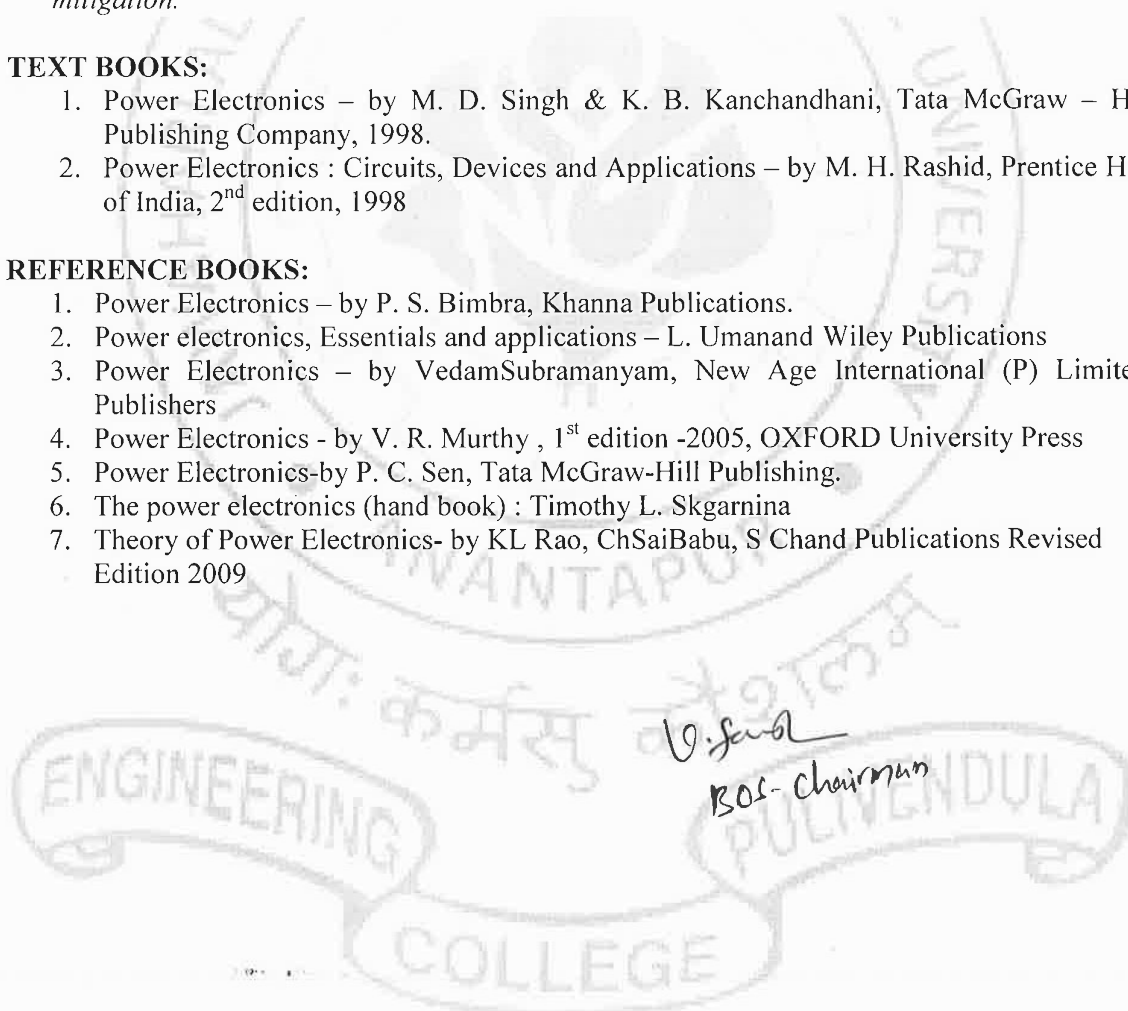
- *Basic operating principles of power semiconductor switching devices.*
- *The operation of power electronic converters, choppers, inverters.*
- *The operation of AC voltage controllers and cycloconverters and their control.*
- *The working of inverters and application of PWM techniques for voltage control and harmonic mitigation.*

**TEXT BOOKS:**

1. Power Electronics – by M. D. Singh & K. B. Kanchandhani, Tata McGraw – Hill Publishing Company, 1998.
2. Power Electronics : Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2<sup>nd</sup> edition, 1998

**REFERENCE BOOKS:**

1. Power Electronics – by P. S. Bimbra, Khanna Publications.
2. Power electronics, Essentials and applications – L. Umanand Wiley Publications
3. Power Electronics – by VedamSubramanyam, New Age International (P) Limited, Publishers
4. Power Electronics - by V. R. Murthy , 1<sup>st</sup> edition -2005, OXFORD University Press
5. Power Electronics-by P. C. Sen, Tata McGraw-Hill Publishing.
6. The power electronics (hand book) : Timothy L. Skgarnina
7. Theory of Power Electronics- by KL Rao, ChSaiBabu, S Chand Publications Revised Edition 2009



V. J. Somaiya

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