

PPE101POWER SEMICONDUCTOR DEVICES

L	T	P	Cr
3	1	0	3.5

Course Objectives: To understand structure of power devices, to understand design of snubber and firing circuits, to impart knowledge about converters and their analysis.

OVERVIEW OF POWER SEMICONDUCTOR SWITCHES : Introduction - Diodes, Thyristors, BJTs, JFETs, MOSFETs, GTOs IGBTs, Comparison of these as switching devices, Drive and Protection circuit for these devices – New Semiconductor materials for Power devices.

POWER DIODE AND POWER BJT : Basic structure and I-V & Switching characteristics of Power diode, Structure and Switching characteristics of Power BJT, Breakdown voltage considerations , operating limits and Safe operating area, Drive circuits for BJT, Snubber design for Power diode.

THYRISTORS AND GTOs : Basic structures - I-V characteristics, Physics of device operation, Switching characteristics of Thyristors and GTOs, Drive circuits, Snubber circuits for Thyristors and GTOs - Over current protection of GTO.

IGBT, POWER JFET & MOSFETS: :Basic structures, I-V characteristics, physics of device operation, Switching characteristics , Safe operating area of IGBT and Power JFET & MOSFET - Drive circuits and Protection. Loss in switching devices

GATE AND DRIVE CIRCUITS: Design Consideration, De-coupled drive circuits, electrically isolated driver circuits, Cascade connected drive circuits, Power device protections scheme in drive circuits, Circuit layout considerations.

Filters and Heat sink Design. Line frequency inductor (AC choke & DC choke) design, High frequency inductor and transformer design for power converters.

RECENT TRENDS IN SEMICONDUCTOR DEVICES: Basic structures and I-V characteristics of recent thyristor (IGCT, SGCT) and transistor (MV IGBT, IEGT) family switching devices. SiC devices - IGBT & MOSFET. Drive circuits and protections. Comparative analysis of recent switching devices and applications.

APPLICATIONS : Single phase rectifiers and Three phase rectifiers using Diodes and Thyristors, Choppers, Inverters using GTOs-IGBTs and power JFETs & MOSFETs.

Course Outcomes: After the completion of the course the student may be able

- To analyse the device structure
- To design and develop firing circuit and snubber circuit
- To design high frequency inductor and transformers

Recommended Books :

1. Mohan. N et al., "Power Electronics: Converters, Applications and Design", John Wiley and Sons, Newyork, Third Edition, 2002.
2. Kassakian, J.G .et.al., "Principles of Power Electronics", Pearson Education India., 2010.
3. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, Third edition, New Delhi 2004.
4. M.D. Singh and K.B. Khanchandani , "Power Electronics", Tata McGraw Hill, New Delhi, Second Edition, 2008.
5. Donald A. Neamen, "Semiconductor Physics and Devices", Tata McGraw Hill, New Delhi, Fourth Edition, 2011

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes etc.)	25