

16EE206 POWER ELECTRONIC DEVICES AND CIRCUITS

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	-	30	10	40	1	8	5	5

Course Description and Objectives:

This course deals with various applications of electronic devices for conversion, control and conditioning of the electrical power. It provides an overview of different types of power semiconductor devices, their switching characteristics, operation and application in power conditioning circuits. The objective of this course is to develop expertise in switching techniques, operation and control of AC-DC, DC-DC, DC-AC and AC-AC converters.

Course Outcomes:

The student will be able to:

- understand the switching behavior of power semiconductor devices.
- understand and analyze single-phase and three-phase controlled AC-DC converters.
- understand and analyze controlled DC-DC converter topologies.
- elucidate the frequency changing operation of cyclo converter.
- explain the operation of various Inverters.

SKILLS:

- ✓ *Understand the switching characteristics of various power semi conductor devices.*
- ✓ *Design the commutation circuits for SCRs based on application.*
- ✓ *Design a SCR based controlled converter for given specifications.*
- ✓ *Design a buck converter for given specifications.*
- ✓ *Design a boost converter for given specifications.*
- ✓ *Design a PWM generator for given duty ratio.*

UNIT - 1**L-10**

POWER SEMI-CONDUCTOR DEVICES : Structure, Operation, Static and dynamic characteristics of SCR, TRIAC, Power transistor, MOSFET, IGBT and GTO; Protection schemes, Triggering and commutation of SCR.

UNIT - 2**L-8**

PHASE-CONTROLLED CONVERTERS : Operation and analysis of 2-pulse, 3-pulse, 6-pulse and dual converters; Inverter operation of fully controlled converter, Effect of source inductance, Distortion, Displacement and ripple factor of converters.

UNIT - 3**L-8**

CHOPPERS : Step-down and step-up choppers, Control strategies - Time ratio and current limit control; Voltage commutated, current commutated and load commutated choppers.

UNIT - 4**L-9**

INVERTERS : Classification of inverters – Single phase, Three phase, Series and parallel inverters; Voltage control of single and three phase inverters, Current source inverters and harmonic reduction in inverters.

UNIT - 5**L-10**

AC - AC CONVERTERS : Single phase AC voltage regulators with R and RL loads, Sequence control of AC voltage regulators; Single phase to single phase cyclo converter - Step up and step down with R and RL loads.

LABORATORY EXPERIMENTS**LIST OF EXPERIMENTS**

Total hours: 30

1. Study of characteristics of SCR, MOSFET and IGBT
2. Gate firing circuits for SCR
3. Single phase AC voltage controller with R and RL loads.
4. Single phase fully controlled bridge converter with R and RL loads.
5. Forced commutation circuits.
6. DC Jones chopper
7. Single phase parallel inverter with R and RL load.
8. Single phase cyclo-converter with R and RL load.
9. Single phase half controlled converter with R and RL load.
10. Single phase series inverter with R and RL load.
11. Single phase bridge converter with R and RL load.

TEXT BOOKS:

1. P.S.Bimbra, "Power Electronics" 5th edition, Khanna publishers, 2013.
2. M.D. Singh and K.B Khanchandani, "Power Electronics", 2nd edition, Tata Mc-Graw Hill, 2009.

REFERENCE BOOKS:

1. Vedam Subrahmanyam, "Power Electronics", 1st edition, New Age, 2001.
2. Ned Mohan, "Power Electronics", 2nd edition, Wiley, 1995.
3. C.W Lander, "Power Electronics", 3rd edition, Mc-Graw Hill, 1993.
4. M.H.Rashid, "Power Electronics: Circuits, Devices and Applications", 3rd edition, Prentice Hall of India, 2009.

ACTIVITIES:

- Study the data sheets of commercial SCR, GTO and MOSFET.
- Design of commutation circuits
- Design of gate firing circuits
- Design of DC-DC converter for speed control of DC motor
- Design of a simple focus light.
- Design of a speed regulator for ceiling fan
- Design of cyclo converter based heater.