

POWER ELECTRONICS

(Core Subject)

Course Code:	11B1WEC611	Semester:	6 th Semester, B. Tech (ECE)
Credits:	4	Contact Hours:	L-3, T-1, P-0

Course Objectives

The objectives are to study

1. To understand and acquire knowledge about various power semiconductor devices.
2. To prepare the students to analyze and design different power converter circuits.

Course Outcomes

After studying this course the students would gain enough knowledge

1. Acquire knowledge about fundamental concepts and techniques used in power electronics.
2. Ability to analyze various single phase and three phase power converter circuits and understand their applications.
3. Foster ability to identify basic requirements for power electronics based design application.
4. To develop skills to build, and troubleshoot power electronics circuits.
5. Foster ability to understand the use of power converters in commercial and industrial applications.

Course Contents

Unit	Topics	References (chapter number, page no. etc)	Lectures
1.	Introduction: Concept of Power Electronics, Applications of power electronics, Advantages and disadvantages of power-electronic converters, Power electronic systems, Power semiconductor devices, Types of power electronic converters, Power electronic modules.	Bimbhra : Chapter 1	2
2.	Power semiconductors: The p-n junction, Basic structure of power diodes, Characteristics of power diodes, Power transistors, Power MOSFETS, Insulated gate bipolar transistor, Static induction transistor, MOS controlled thyristor.	Bimbhra : Chapter 2	5
3	Thyristors: Terminal characteristics of thyristors, thyristor turn on methods, Switching characteristics of thyristors, Thyristor gate characteristics, Two-transistor model of a thyristor, Thyristor ratings, Thyristor protection, Improvement of thyristor characteristics, Series and parallel operation of thyristors, Other members of the thyristor family, Gate turn off	Bimbhra : Chapter 4	8

	thyristor, Firing circuits for thyristors, Pulse transformer in firing circuits, Triac firing circuit, Gating circuits for single phase converters, Cosine firing scheme.		
4	Thyristor Commutation: Class A commutation: Load commutation, Class B commutation: Resonant commutation, Class C commutation: Complementary commutation, Class D commutation: Impulse commutation, Class E&F commutation.	Bimbhra : Chapter 5	5
5	Phase Controlled Rectifiers: Principle of phase control, Full wave controlled converters, Single phase full wave converters, Single phase symmetrical and asymmetrical semi converters, Three phase rectifiers and thyristor converters, Performance parameters of three phase full converters, Effect of source impedance on the performance of converters.	Bimbhra : Chapter 6	6
6	Choppers: Principle of chopper operation, Control strategies, Step up choppers, Types of chopper circuits, Steady state time domain analysis of Type A choppers, Thyristor chopper circuits.	Bimbhra : Chapter 7	5
7	Inverters: Single phase voltage source inverters: Operating principle, Force commutated thyristor inverters, Voltage control in single phase inverters, Current Source inverters, Series Inverters, Parallel Inverters.	Bimbhra : Chapter 8	7
8	AC Voltage Controllers: Principle of phase control, Principle of integral cycle control, single phase ac voltage controller with R load and RL load.	Bimbhra : Chapter 9	3
9	Cycloconverters: Principle of cycloconverter operation, step up and step down cycloconverters, Three phase half wave converters, Output voltage equation for a cycloconverter, Load commutated cycloconverter.	Bimbhra : Chapter 10	3
Total Number of Lectures			44

Evaluation Scheme

1. Test 1 :15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
 - 10 Marks : Class performance, Tutorials & Assignments
 - 10 Marks : Quizzes
 - 5 marks : Attendance

Text Books

1. P S Bimbhra : Power Electronics, Khanna Publishers.

Reference Books

1. M. H. Rashid. : Power Electronics – circuits, devices & applications, Pearson Education.