EE2301	POWER ELECTRONICS	L T P C 3 0 0 3

AIM

Learning how to apply the electronic devices for conversion, control and conditioning of electronic power.

1. POWER SEMI-CONDUCTOR DEVICES 9

Study of switching devices, - Frame, Driver and snubber circuit of SCR, TRIAC, BJT, IGBT, MOSFET, - Turn-on and turn-off characteristics, switching losses, Commutation circuits for SCR.

2. PHASE-CONTROLLED CONVERTERS 9

2-pulse, 3-pulse and 6-pulse converters – Effect of source inductance – performance parameters – Reactive power control of converters – Dual converters - Battery charger.

3. DC TO DC CONVERTER 9

Step-down and step-up chopper - Time ratio control and current limit control – Buck, boost, buck-boost converter, concept of Resonant switching - SMPS.

4. INVERTERS 9

Single phase and three phase (both 120^0 mode and 180^0 mode) inverters - PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulations - Voltage and harmonic control - Series resonant inverter - Current source inverter.

5. AC TO AC CONVERTERS 9

Single phase AC voltage controllers – Multistage sequence control - single and three phase cycloconverters –Introduction to Integral cycle control, Power factor control and Matrix converters.

TOTAL: 45 PERIODS

TEXT BOOKS

1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third edition, New Delhi 2004.
2. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

REFERENCES

1. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint,2003.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition 2003.
3. Ned Mohan, Tore.M.Undeland, William.P.Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.

SUBJECT DESCRIPTION AND OBJECTIVES

SUBJECT DESCRIPTION:

Power electronics refers to control and conversion of electrical power by power semiconductor devices where in these devices operate as switches. Advent of silicon-controlled rectifiers, abbreviated as SCRs, led to the development of a new area of application called the power electronics. Prior to the introduction of SCRs, mercury-arc rectifiers were used for controlling electrical power, but such rectifier circuits were part of industrial electronics and the scope for applications of mercury-arc rectifiers was limited. Once the SCRs were available, the application area spread to many fields such as drives, power supplies, aviation electronics, high frequency inverters and power electronics originated.

Power electronics has applications that span the whole field of electrical power systems, with the power range of these applications extending from a few VA/Watts to several MVA / MW. The main task of power electronics is to control and convert electrical power from one form to another. The four main forms of conversion are:

- AC-to-AC conversion.
- AC-to-DC conversion (Rectifiers)
- DC-to-DC conversion (Choppers)
- DC-to AC conversion (Inverters)

"Electronic power converter" is the term that is used to refer to a power electronic circuit that converts voltage and current from one form to another. These converters can be classified as:

- AC Voltage regulator and Cycloconverter & Matrix converters are converting an fixed ac voltage to variable ac voltage. Rectifier converting an ac voltage to a dc voltage.
- Rectification referring to conversion of ac voltage to dc voltage.
- Chopper or a switch-mode power supply that converts a fixed dc voltage to variable dc voltage.
- Inverter converting a dc voltage to an ac voltage.

In addition, SCRs and other power semiconductor devices are used as static switches. They are used to design the Half-bridge and Full-bridge single-phase and three-phase inverters feeding inductive loads; Applications: Power supplies, DC motor drives, AC motor drives.

OBJECTIVES:

- To get an overview of different types of power semi-conductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basic topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods.
- To study the operation of AC voltage controller and Matrix converters.
- To study simple applications.

SARDAR RAJA COLLEGE OF ENGINEERING

DEPARTMENT OF EEE

EE2301 – POWER ELECTRONICS

MICRO LESSON PLAN

Week	No of Hours	LECTURE TOPICS	TEXT / REF BOOKS
I	**UNIT I POWER SEMI – CONDUCTOR DEVICES**		
	1	Study of switching devices	R2
	2	Frame, Driver and Snubber circuit of SCR. (AV Class)	R2
	3	Frame, Driver and Snubber circuit of TRIAC, BJT.	R2
	4	Frame, Driver and Snubber circuit of IGBT.	R2
	5	Frame, Driver and Snubber circuit of MOSFET.	R2
II	6	Turn – on and Turn – off Characteristics of SCR, TRIAC, BJT.	R2
	7	Turn – on and Turn – off Characteristics of IGBT, MOSFET.	R2
	8	Switching losses of SCR, TRIAC, BJT, IGBT, and MOSFET.	R2
	9	Commutation circuits for SCR. (AV Class)	R2
III	**UNIT II PHASE – CONTROLLED CONVERTERS**		
	1	2-pulse converters. (AV Class)	R2
	2	3-pulse converters (Single Phase)	R2
	3	3-pulse converters (Three Phase)	R2
	4	6-pulse converters	R2
	5	Effect of Source Inductance in single phase converter.	R2
IV	6	Effect of Source Inductance in three phase converter.	R2
	7	Performance parameters, Reactive power control of converter.	R2
	8	Dual converters. (AV Class)	R2
	9	Battery charger.	R2
V	**UNIT III DC TO DC CONVERTER**		
	1	Step-down chopper. (AV Class)	R2
	2	Step-up chopper.	R2
	3	Time ratio control.	T1
	4	Current limit control.	R2
	5	Buck converter.	R2

VI	6	Boost converter.	R2
	7	Buck – Boost converter.	R2
	8	Concept of Resonant switching.	R3
	9	SMPS. (AV Class)	T1
	UNIT IV INVERTERS		
VII	1	Single phase inverters. (AV Class)	R2
	2	Three phase 120^0 mode inverter operation.	R2
	3	Three phase 180^0 mode inverter operation.	R2
	4	PWM techniques: Sinusoidal PWM.	R2
	5	Modified sinusoidal PWM, Multiple PWM techniques.	R2
VIII	6	Introduction to Space vector Modulation technique.	R2
	7	Voltage and Harmonic control.	T1
	8	Series resonant inverter.	R3
	9	Current source inverter. (AV Class)	R3
	UNIT V AC TO AC CONVERTERS		
IX	1	Single phase AC voltage controllers R,RL Load	R2
	2	Multistage sequence control.	R2
	3	Single phase Step down cycloconverter. (AV Class)	R2
	4	Single phase Step up cycloconverter.	R2
	5	Three phase cycloconverter.	R2
X	6	Introduction to Integral cycle control.	R2
	7	Power factor control.	R2
	8	Matrix converters. (AV Class)	T1
	9	Types of Matrix converter, DMI and IMI	T1

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