

3EC41: POWER ELECTRONICS
CREDITS - 4 (LTP: 3,0,2)

Course Objective:

This course provides strong foundation for understanding and designing of domestic and industrial power electronics devices and circuits.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Course Content:

Unit No.	Topics	Teaching Hours
1	Introduction of Power Semiconductor Devices and Controlled Circuits : Construction and Characteristics of Power diodes, Power Transistors, SCR, DIAC, TRIAC, UJT, Power MOSFET, Insulated Gate Bipolar transistors (IGBTs), Gate turn-off Thyristors (GTOs), Integrated Gate-Commutated Thyristors (IGCTs), MOS controlled Thyristors (MCTs), two transistor model of SCR, static and dynamic characteristics, gate characteristic, turn-on methods of a thyristor, turn-off methods of a thyristor , Isolation of gate and base drive using pulse transformer and Opto-couplers, gate triggering circuits, series & parallel connection of thyristors, di/dt & dv/dt protection, Power Integrated circuits (PICs), Intelligent Power Modules, Solid State Relay(SSR), Power Contactor	13
2.	AC to DC Converter : Review of half-wave and full-wave diode rectifier ; Single phase, half wave, Full wave, half controlled bridge and Full controlled bridge converter with resistive and inductive loads. Effect of freewheeling diodes. Three phase controlled converter.	06
3.	DC to DC Converter : The chopper, Principle of chopper operation, classification of choppers, Step-Up, Step-down and Step-Up/Down chopper, control strategies, Chopper configuration, Voltage and current commutated chopper, Load Commutated Chopper, multiphase chopper.	06
4.	DC to AC Converter : Thyristor, inverter classification, Single phase half and full bridge voltage source inverters, performance parameters of inverters, Internal control of inverter, Pulse Width Modulated inverters, current source inverters	06
5.	AC to AC Converter : Cycloconverter : Basic principle of operation. Single phase to single phase, Three phase to single phase Cycloconverter. AC regulators: Single phase half wave A.C. voltage regulators, Single phase full wave (bidirectional) A.C. voltage regulators with resistive load and resistive-inductive load.	06

Unit No.	Topics	Teaching Hours
6.	Power Electronics Applications : AC Drives, DC Drives, SMPS, Online and Off line UPS, Battery charger, Constant Voltage Transformer, Solar Inverter, Simulate power electronic converters and their control scheme using MATLAB.	08
Total		45

List of References:

1. M D Singh And K B Khanchandani, “*Power Electronics*” ,2nd Edition, TMH, 2008.
2. Muhammad Rashid, “*Power Electronics Circuits Devices and Application* “, 3rd Edition, Pearson Education, 2003
3. Elbs R. Ramshaw ,“*Power Electronics Semiconductor Switches*”, 2nd edition, Springer, 1993.
4. Ramamourthy, “*An Introduction To Thyristor And Their Applications*”, 2nd edition, East West Books Pvt Ltd ,1991.

Course Outcomes (COs):

At the end of this course students will be able to

1. Understand the construction and characteristics of power semiconductor devices.
2. Design and analyse various SCR firing and commutation methods.
3. Analyze, operate and design of various industrial based power electronics converters.
4. Apply the knowledge of power electronic converter for speed control of DC motors, AC motors and industrial applications.
5. Understand the SMPS, UPS, Battery charger, and simulation of power electronics converter.