Power Electronics (EN-427)

Pre-Requisite(S)

- EN-213 Electronic Circuit Design, EN-214 Circuit Analysis-II

Recommended Book(s)

- Power Electronics Circuits, Devices and Applications by Muhammad H. Rashid, 3rd Edition

Reference Book(s)

- Fundamentals of Power Electronics by Robert W. Erickson

Course Objectives

Teach the semiconductor devices and circuits for the conversion of electrical power of a given form into a desired form. Introduce the applications of power electronics including rectifiers, inverters, UPS.

Course Learning Outcomes (CLO)

CLO-1:	To be able to understand the characteristics of Power Devices and to learn the operation, and performance parameters of Power Electronic Circuits	C3
CLO-2:	To be able to analyze the Power Electronic Circuits: Rectifiers, AC Voltage Controllers, Choppers and Inverters	C4
CLO-3:	To be able to design Rectifiers, AC Voltage Controllers, Choppers and Inverters of given Rating/Parameters	C5

Course Contents

- Introduction to Power Electronics, Types of Power Semiconductor Devices and Power Electronic Circuits
- Power Diode Characteristics, Reverse Recovery Characteristics, Types of Diodes, Series and Parallel Connected Diodes,
- Analysis of Power Diode circuits with RC, RL, LC and RLC loads
- Uncontrolled Rectifier (Diode Rectifiers): Single-Phase Half-Wave Rectifiers, Single-Phase Full-Wave Rectifiers
- Effect of RL and RLC load, Three-Phase HW and FW Rectifiers, Effect of RL and RLC load
- Uncontrolled Rectifier Circuit Designing
- Power Transistors: BJTs, Power MOSFETs, COOLMOS, SITs, IGBTs, Series and Parallel Operation
- DC-DC Converters: Principle of Step-Down Operation, Principle of Step-Up Operation, Converter Classification
- Step-Down Converter with RL Load, Step-Down Converter with Resistive and RL Load, Performance Parameters
- Switched -Mode Regulators: Buk, Boost, Buck-Boost, Cu'k Regulators
- Chopper Circuit Design
- PWM Inverters: Principle of Operation, Performance Parameters, Single-Phase and Three-Phase Inverters, Voltage Control of Single-Phase Inverters
- Thyristors: Characteristics, Thyristors Turn-On, Thyristors Turn-Off, Thermistors Types, Series and Parallel Operation of Thyristors
- Multilevel Inverters: Multilevel Concept, Types of Multilevel Inverters
- Controlled Rectifiers: Single-Phase and Three-Phase Full Converter, Single-Phase and Three-Phase Dual Converter, Power Factor Improvements, Single-Phase and Three-Phase Semiconverters
- Analysis of Single-Phase and Three-Phase controlled rectifiers with RL load
- Design of Controlled Rectifier Circuits
- AC Voltage Controllers: ON-OFF and Phase Control, Single-Phase and Three-Phase Controllers, Cycloconverters
- Analysis of AC Voltage Controllers with different loads.
- Design of AC Voltage Controller Circuits
- Static Switches: Single-Phase and Three-Phase AC Switches, DC switches, Solid-State Relays
- Power Supplies: AC and DC supplies designing

Mapping of CLOs to Assessment Modules

CLOs/PLOs	CLO1	CLO2	CLO3	
PLO1: Engineering Knowledge	√			
PLO2: Problem Analysis		√		
PLO3: Design and Development of Solution			√	

PLO4: Investigation				
PLO5: Modern Tool Usage				
PLO6: The Engineer and Society				
PLO7: Environment and Sustainability				
PLO8: Ethics				
PLO9: Individual and Team Work				
PLO10: Communication				
PLO11: Project Management				
PLO12: Life Long Learning				