

PPE102POWER CONVERTERS

L	T	P	Cr
3	1	2	4.5

Course Objectives: To impart knowledge about the physics of device operation, static and dynamic characteristics, ratings, protection, operating limitations and safe operating area, to discuss the design issues of drive circuits and their usage. PWM schemes, understanding of inverters and cyclo-converters, DC-DC converters and resonant inverters and their analysis with R, RL, RLE type of loads

POWER CONVERTERS : H-bridge configuration of converter, Brief overview of power converters, Dual converter - Sequence control of converters, performance parameters: harmonics, ripple, distortion, power factor, effect of source impedance and overlap-reactive power and power balance in converter circuits. Six pulse, twelve pulse and Active Front End (AFE) conversion.

AC VOLTAGE CONTROLLERS :Introduction-Static Characteristics of TRIAC- Principle of phase control -Single phase AC voltage regulators with R, & R-L loads, Sequence control of AC regulator, Three phase AC regulator, various configurations, analysis with R and R-L loads.

CYCLOCONVERTERS: Single phase to single phase, three phase to single phase, three phase to three phase, Forced commutated cycloconverters, Output voltage of a three phase cycloconverter, Harmonics, Power factor Control

INVERTERS: 120° and 180° mode of operation of three phase inverters, Three phase Step wave inverter circuits, Three phase PWM controlled inverter circuits

DC-DC CONVERTER: Buck/ Boost Converter, Buck-Boost Converter; High-Frequency Switching, High-Frequency Isolation transformer, Push-Pull Converter, Full-Bridge Converter, Forward Converter, Fly-back Converter; Resonant DC-DC converters: Analysis and design of Resonant Converter (SRC) Circuits namely Series, Parallel, and Series-Parallel, Zero-Voltage, Zero-Current Resonant Converter, Industrial applications of DC-DC resonant converters and reduction in THD and power factor improvement

PWM INVERTER MODULATION STRATEGIES: Single and multiple PWM, Sinusoidal PWM (SPWM), Modified SPWM, Space vector modulation and hysteresis band current control PWM techniques. PWM based inverters and resonant converters

CONTROL CIRCUITS: Introduction-Gating circuits for single phase and three phase fully controlled thyristor converters: Gating pulse requirements – Schemes for generating gating pulses. Gating requirements for choppers, A gating circuit for PWM type A chopper., Control circuit for cycloconverter: Synchronizing circuit – Reference voltage signals, Logic and Triggering circuit, Converter group selection - Firing circuits for three phase AC regulators.

LABORATORY: Device characteristics of IGBT, GTO, MOSFET, Gate Drive Circuits, PWM signal Generation, DC-DC Converter, Three phase full converter, Three phase Voltage Source Inverter, Half and Full wave Cyclo-converter, Simulation of Power Converters and harmonic analysis.

Course Outcome:

- To realize drive and control circuits for power converters,
- To develop power converters used for the control of DC and AC
- To conceptualise and analyse the issues related to recent converter operation

Recommended Books

1. Mohan, N., Undeland, T.M. and Robbins, W. P., *Power Electronics: Converter Applications and Design*, John Wiley and Sons (2007).

2. *Rashid, M.H., Power Electronics Circuits, Devices and Applications, Prentice-Hall of India Private Limited (2006).*
3. *Sen, P.C., Power Electronics, Tata McGraw-Hill Publishing Company (1996).*
4. *Philip T. Krein, Elements of Power Electronics, Oxford university Press (2008)*
5. *Bose B.K., Power Electronics & AC Drives, Prentice Hall Englewood cliffs, NJ, (1986)*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes etc.)	40