

SYLLABUS :-

Course Name: Advanced Power Electronic Converters Course No.: EE60004  
L-T-P : 3-1-0 Prerequisite:EE60019,EE60035 Module-1(8 hours): Basic Resonant Converters, Soft switching principles: ZVS, ZCS, ZVZCS Resonant Load Converters: Variable frequency series and parallel resonant converters (Resonant Switch Converters (quasi resonant): Half and full wave operations and control.Module-2(5 hours): Resonant Transition Phase Modulated Converters, Reduction of VA ratings, fixed frequency operation and advantageous usages of device and transformer non-idealities; Soft Switched Bidirectional DC-DC Converters (Dual Active Bridge): Soft-switching under buck mode and boost mode operations with or without active clamp (2 hrs) Module-3(8 hours): PWM Converters with Auxiliary Switch, ZVT /ZCT PWM Converters: Isolated and Non-isolated topologies with auxiliary switch ; Auxiliary Resonant Commutated Pole Inverters: ZVT and ZCT concepts used for Inverters; Resonant DC Link Inverters: Forced oscillation of DC Link voltage by auxiliary switch.Module-4(3 hours): High-Power Semiconductor Devices, Diodes, SCR, GTO, GCT, IGBT. Operation of series connected devices: main cause of unbalance, voltage equalizations for GCTs, IGBTs.Module-5(3 hours): Multi-pulse Diode and SCR Rectifiers, Definition of THD and PF, THD and PF of six-pulse diode rectifier, 12, 18, 24-pulse series-type and separate-type diode rectifiers, Six-pulse and 12-pulse SCR rectifier, Effect of line and leakage inductances, and Phase-Shifting Transformers, Harmonic current cancellation.Module-6(5 hours): Cascaded H-Bridge Multilevel Inverters, Introduction, Sinusoidal PWM, Space Vector PWM in two level voltage source inverters; H-bridge inverter, multilevel inverter topologies: CHB Inverter with equal dc voltages, H-bridges with unequal dc voltages, Carrier based PWM schemes: Phase shifted multi-carrier modulation, Level shifted multi-carrier modulation, overmodulation of cascaded H-bridges, Control of dc bus voltages of the H-bridges.Module-7(4 hours): Diode-Clamped Multilevel Inverters, Three level inverter: Converter configuration, switching states, Carrier based PWM: Naturally sampled PD PWM, APDM and POD PWM; Space vector modulation: Optimized space vector sequences, modulator for selecting switching states, decomposition method, hexagonal co-ordinate system, optimal space vector position within a switching period; Neutral point voltage control, over modulation of three-level inverter, High-level diode clamped inverters.Module-8(6 hours): Hybrid Multilevel Inverters (2 hours): Hybridization of Fundamental frequency switching (FFS) and PWM switching inverters: inverter topologies with isolation transformer, PWM switching strategy; Transformerless hybrid inverter: Binary H-bridge multilevel converter, Control of dc bus voltages of different modules. Multilevel Flying-Capacitor Inverters (2 hours): Inverter configuration, Modulation scheme.PWM Current Source Rectifiers and Inverters (2 hours): Trapezoidal modulation, Selective harmonic Elimination, Space vector modulation, Parallel current source inverters, Single-bridge current source rectifier, Dual-bridge current

source rectifier, Power factor control, Active Damping Control.