23EE501:PowerElectronics

B.Tech. III Year ISem.

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Pre requisite: Analog Electronics, Digital Electronics

Course Objectives:

- To Design /develop suitable power converter for efficient control or conversion of power in drive applications
- To Design / develop suitable power converter for efficient transmission and utilization of power in power system applications.

Course Out comes: At the end of this course students will demonstrate the ability to

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers. Analyze the operation of voltage source inverters

UNIT-I

Power Switching Devices: Concept of power electronics, scope and applications, types of power converters; Power semiconductor switches and their V-I characteristics - Power Diodes, Power BJT, SCR, Power MOSFET, Power IGBT; Thyristor ratings and protection, Series and parallel connections of SCRs, Two transistor analogy of SCR, methods of SCR commutation, UJT as a trigger source, gate drive circuits for BJT and MOSFETs.

UNIT-II

AC-DC Converters(Phase Controlled Rectifiers): Principles of single-phase fully-controlled converter with R, RL, and RLE load, Principles of single- phase half-controlled converter with RL and RLE load, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, General idea of gating circuits ,Single phase and Three phase dual converters.

UNIT-III

DC-DC Converters (Chopper/SMPS): Introduction, elementary chopper with an active switch and diode, concepts of duty ratio, average inductor voltage, average capacitor current. Buck converter -Power circuit, analysis and waveform at steady state, duty ratio control of output voltage. Boost converter - Power circuit, analysis and waveforms at steady state, relationbetweendutyratioandaverageoutputvoltage.Buck-Boostconverter-Powercircuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

UNIT-IV

AC-DC Inverters: Introduction, principle of operation, performance parameters, single phase bridge inverterswithR,RLloads,3-phasebridgeinverters-120-and180-degreesmode of Operation, Voltage control of single-phaseinverters–single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation.

UNIT-V

AC-AC Converters: Phase Controller (AC Voltage Regulator) - Introduction, modes of operation of Triac, principle of operation of single-phase voltage controllers for R, R-L loads and its applications. Cyclo-converter -Principle of operation of single phase cyclo-converters, relevant waveforms, irculating current mode of operation, Advantages and disadvantages.

TEXTBOOKS:

1. M.H.Rashid, “Powerelectronics:circuits,devices,and applications”,Pearson Education India, 2009.
2. N.MohanandT.M.Undeland,“PowerElectronics:Converters, Applications and Design”, John Wiley & Sons, 2007.

REFERENCEBOOKS:

1. R.W.EricksonandD.Maksimovic,“FundamentalsofPower Electronics”,Springer Science &Business Media, 2007.
2. L.Umanand,“PowerElectronics:EssentialsandApplications”,WileyIndia,2009.