GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 4

Power Electronics

Subject Code 142402
Subject Name Fundamentals of Power Electronics

Sr.No	Course content
1.	Introduction: Power Electronics System(PES) – Overview, Components & Building Blocks of PES, Power, Energy, Control, Electronics Devices, Requirements of Signal Processing and Power Processing, Ideal switch characteristics, Semiconductor materials for Power Switches, Power Switch classification
2.	Power Electronics Components & Characteristics: Basic passive components resistors, capacitors, inductor, transformer their equivalent circuit and their behavior at different frequencies. Active components like DIAC, UJT, PUT, Optocoupler etc. and their characteristics, Basic application circuits.
3.	Power Switching Devices: Construction and Characteristics of Rectifier Diodes, Fast Recovery Diodes, Ultra Fast Recovery Diodes, PiN Diode, Diode as uncontrolled switch, Fully Controlled Power Switches like Power BJT, Power MOSFET, Power FET, IGBT etc.
4.	Thyristor: SCR, Operating principle, characteristics, Two transistor Model, Thyristor Construction (Planner Diffused & Alloy Diffused), Turn ON methods, Turn OFF Mechanism, Turn OFF methods, Converter Grade and Inverter Grade Thyristors, Thyristor Commutation, Commutation, requirements and Classes of Commutations,Thyristor driving circuits, Thyristor protection circuits.
5.	Other Power Devices : Working principle and symbol of Triac, LASCR, ASCR, SIT, SITH, MCT, MTO, ETO, Power Integrated Circuits etc.
6.	Driving and Protection requirements of various power switches: Driving Circuit, dv/dt , di/dt, over voltage, over current protection etc., Comparison of various power switching devices based on their ratings, switching speed, characteristics etc.
7.	AC-DC Converters: Classification, 1-phase and 3-phase uncontrolled Rectifier, Principle of phase controlled rectifier, rectifier with R, R-L and R-L-E load, rectifier with C,LC filter, effect of different filters and loads on line current and voltage waveforms, output voltage and current waveforms, effect of source inductance, Effect of rectifier on 3-phase 4 wire system, Inrush current at turn on, comparison of 1 and 3 phase rectifiers
8.	DC-DC Converters: Classification, principle, output control methods, Types of chopper, Step up, step down, step up-down chopper, Thyristor based choppers, voltage and current commutated choppers, Principle of SMPS

9.	DC-AC Converters: Inverters, classification, principle, VSI and CSI, operation of series, parallel, half and full bridge inverters, McMurry Inverters, 3-phase inverters, voltage control
10.	AC-AC Converters: AC voltage controllers, integral cycle control, principle of phase controlled switching, Concept of THD or HF, DPF, DF, IPF, Ripple factor, AC Choppers, 1- phase Cyclo-converters

Reference Books:

1. Power Electronics Converters, Applications and design, Wiley, Ned Mohan, Undeland, Robbins
2. Power Electronics, Circuits Devices and Applications, M.H.Rashid
3. Power Electronics Systems Theory & design, J.P.Agrawal
4. Power Electronics, TMH, M.D.Singh, Khanchandani
5. Power Electronics Devices, Circuits and Industrial Applications, Oxford, V.R. Moorthi
6. Power Electronics, M. S. Jamil Asgar
7. Power Electronics, Sachin S. Sharma, University Science Press