GUJARAT TECHNOLOGICAL UNIVERSITY
POWER ELECTRONICS ENGINEERING
B. E. SEMESTER: VII

Subject Name: **Power Electronics Design & Control**
Subject Code: **172406**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
4	0	2	6	70	30	30	20

Sr. No	Course Content	Total Hrs.
1.	**Introduction:** • Review of Power Electronics System (PES) – Components & Building Blocks of PES like line filter, power converters, filter • Concept of Power, Energy, Signal Processing and Power Processing, Ideal and practical switch characteristics, losses in practical switches and Safe Operating Area (SOA), Switch specifications • Review of bode plots, PM, GM	4
2.	**EMI and Input Filter:** • Concept of EMI, Conducted and radiated EMI, importance of understanding EMI • Requirement of input filter, Effect of input filter on converter TF, effect of un-damped input filter, damping the input filter • Design of damped input filter, Cascading filter sections	8
3.	**Rectifier and DC Filter:** • Review of rectifier with R load, effect of C and LC filter on rectifier input and output • Design of rectifier and DC filter (C and LC)	8

4.	**Linear Regulated Power Supply:** • Design of Series and shunt regulator using discrete components, Power transistor • Efficiency, Regulation, Protection circuits, ripple voltage • Input and output filter • Linear regulator design using IC like 78XX, 79XX, LM 317, LM 337 series	4
5.	**Controller Design for DC-DC Converter:** • Feedback, effect of feedback on network transfer functions • Construction of 1/(1+T),T/(1+T), Closed loop TF • Converter Stability, PM test, relation between PM and closed loop damping factor, transient response and damping factor • Typical Regulator design specifications, PD, PI and PID Compensator, Computation of P, I and D gain, Design of controller circuit • Measurement of loop gains, voltage injection, current injection, measurement of unstable system • Design using DC-DC converter IC like SG 3524,TL494, UC3842 etc.	10
6.	**Drive and Protection Circuits:** • Requirements of Gate drive circuit • Isolated and non-isolated Gate Drive circuits • Requirements and concept of various protections for power electronics devices and converter circuits • Various protections like over voltage, over load, short circuit, dv/dt, di/dt, thermal protection, etc. for various devices like power diodes, Power transistors, MOSFET, IGBT, SCR • Design of Gate drive and protection circuits	10
7.	**Magnetic Design:** • Concepts of magnetic, Ampere's Law, Faraday's Law, Flux, Flux density, volt-second balance, analogy between electric and magnetic circuits, Magnetic Core materials, types of magnetic devices like inductors, potential transformers, current transformers • Inductors, leakage inductors, filter inductor, AC inductor , design of inductor, multi winding inductor, Flyback inductor/ transformer • Core shapes, Area Product, Window Area, Cross Section Area, window utilization factor, polarity and dot convention, proximity effect	10

	• Potential Transformer, Equivalent Circuit, design of Potential Transformer • Current Transformer, Equivalent Circuit and design	

Text Books:

1. Fundamentals of Power Electronics 2nd ed., Robert W. Erickson, Dragan Maksimovic
2. Power Electronics Essentials and Applications, L. Umanand

Reference Books:

1. Switching Power Supplies A to Z, Sanjay Maniktala
2. Elements of Power Electronics, Philip T. Krein
3. Power Electronics Converters, Applications and design, Mohan, Undeland, Robbins
4. Power Supply Cookbook, Marty Brown
5. A monograph on Electronics Design Principles, N.C. Goyal, R.K. Khetan
6. Various Power Semiconductor Device manufacturer's Application note and data sheets.