GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Semester: 1

Electrical Engineering

Subject Name : Advanced Power Electronics

Sr.No	Course content
1	Semiconductor Devices: Review of Semiconductor devices like Power BJT, SCR, MOSFET, IGBT, GTO, MCT; Static and dynamic characteristics of these devices; Single quadrant, Two quadrant and bid-directional switches
2	Switching Voltage Regulators: Introduction; Linear power supply (voltage regulators); Switching voltage regulators; Review of basic dc-dc voltage regulator configurations -Buck, Boost, Buck-Boost converters and their analysis for continuous and discontinuous mode; Other converter configurations like Flyback converter, Forward converter, Half bridge, Full bridge configurations, , Push-pull converter, C'uk converter, Sepic Converter; Design criteria for SMPS; Multi-output switch mode regulator.
3	Design of Magnetic Components: Design of power transformer; high frequency transformers for flyback, forward, half-bridge–full bridge and push pull converters; Design of inductors for various converter topologies; Design of current transformers; Different types of core materials.
4	DC-AC converters/Inverters: Classification; Review of line commutated inverters; Bridge inverters with 120°,180°,and 150° modes of operation; Harmonic reduction techniques; Sine-triangular PWM; Space Vector Pulse Width Modulation; Current Source Inverters
5	Gate and Base drive circuits: Preliminary design considerations; DC coupled drive circuits with unipolar and bipolar outputs; Importance of isolation in driver circuits; Electrically isolated drive circuits; Some commonly available driver chips (based on boot-strap capacitor); Cascade connected drive circuits; Thyristor drive circuits; Protection in driver circuits; Blanking circuits for bridge inverters.
6	Three phase AC voltage controllers and Cycloconverters: Review of On-off and phase control; Three phase half-wave and full wave controllers

	and their analysis with resistive loads; three phase bi-directional delta-connected controllers; 3-phase cyclo-converter circuits; circulating current operation; non-circulating current operation; mean output voltage and harmonics in supply current waveform

Activities :

1. Design of an inductor for a given DC-DC converter configuration. The converter topology and the specifications for the inductor should be specified by the course instructor. Each student should be assigned a different design problem.
2. Design of a transformer for an insolated DC-DC converter configuration. The converter topology and the specifications for the inductor should be specified by the course instructor. Each student should be assigned a different design problem.
3. Write a code to determine the switching positions of the single phase bridge inverter so that the output voltage waveform is free from 3^{rd}, 5^{th} and 7^{th} harmonics.
4. Hardware or simulation or mathematical analysis related assignments based on other topics related to the course.

Reference

1. "Power Electronics – Converters, Applications and Design", John Willey & sons, Inc., 3rd ed., 2003- Mohan, Undeland and Robbins
2. "Power Electronics - circuits, devices and applications", Prentice Hall of India, 2nd ed., 2000- Muhammad H. Rashid
3. "Modern Power Electronics ", S. Chand and Co. Ltd., New Delhi, 2000- P.C.Sen
4. "Design of magnetic components for switched mode power converters", Wiley Eastern Ltd., New Delhi, 1992- L. Umanand and S.R. Bhat
5. "Thyristorised power controllers", New Age International Publishers, 1986 (Reprint 2008)- G.K. Dubey, S.R. Doradia, A. Joshi, and R.M.K. Sinha,
6. "Fundamentals of Power Electronics", Springer International, 2nd ed., 2001- R.W. Erickson, D. Maksimovic