

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC Electrical Engineering

Semester: IV

Subject Name: **Power Electronics-I**

Sr. No.	Course content
1.	<p>Power Semiconductor Devices:</p> <p>Construction and Characteristics of Power diodes, Power Transistors, Uni Junction transistors (UJT), Programmable UJT, Power MOSFET, Insulated Gate Bipolar transistors (IGBTs), Static Induction Transistors.</p> <p>Thyristors and family :</p> <p>SCR, DIACs, TRIACs, Light Activated SCRs (LASCRs), Reverse Conducting Thyristor (RCT), Asymmetrical SCR (ASCR), Gate turn-off Thyristors (GTOs), Integrated Gate-Commutated Thyristors (IGCTs), MOS controlled Thyristors (MCTs), Power Integrated circuits (PICs), Intelligent Modules, etc.</p>
2.	<p>Thyristor Fundamentals:</p> <p>Construction, working, two transistor analogy, Static & dynamic characteristics, Gate characteristics, Turn on & turn off methods (Commutation methods), Ratings, Series & Parallel operations.</p> <p>Thyristor Protections:</p> <p>Cooling and Heat sinks, Thermal Modelling, di/dt and dv/dt protection, Design of Snubber Circuit, Over Voltage and Over Current protections, Gate protections, Electro Magnetic Interference(EMI) and Shielding.</p> <p>Thyristor firing (gate drive) circuits:</p> <p>Gate circuit requirements, Isolation of gate and base drives using Pulse transformer and Opto-couplers, Gate drive circuits like: Resistance trigger, R-C trigger, DIAC trigger, UJT based trigger, Programmable UJT trigger, IC based advance trigger, Microprocessor based trigger circuits.</p>
3.	<p>Phase Controlled (AC to DC) Converters:</p> <p>Principle of phase controlled converter operation- Single phase full wave converter, Single phase dual converters, Three phase half wave converters, Three phase full converters, Three phase dual converters, power factor improvement techniques, Single phase and three phase semi converters, Effect of source and load inductances, Operation of all above converters with R, RL, RLE load.</p>

4.	DC to DC Converters: The chopper, Basic principle of DC chopper, Classification of DC choppers, Control strategies, Chopper configurations, Thyristor chopper circuits, Jones chopper, Morgans chopper, Multiphase chopper, Flyback converters/Switching regulators like step down (buck), Step up (boost) and step down/step up (buck/boost) converters and Cuk converter etc.
5.	DC Drives with phase controlled converters: Basic characteristics of DC motors, Principles of DC motor speed control, Operating modes, Single phase and three phase Half, Semi, Full, Dual converter based dc drives, Phase locked loop control of DC drives, Microcomputer control of DC drives.
6.	DC drives with dc-dc converters: Principle of power control, Principle of Regenerative, rheostatic and combined regenerative and rheostatic brake control, Two and four quadrant DC-DC converter drives. Principle of Motoring operation of separately excited and series motor with DC-DC Converter, Steady-state analysis for time ratio control and current limit control.

Reference Books:

1. Power electronics By M D Singh and K B Khanchandani by TMH publication 2nd edition.
2. "Power Electronics - circuits, devices and applications", Prentice Hall of India, 2nd ed., 2000- Muhammad H. Rashid.
3. Power Electronics – Devices, Converters and Applications", by Vedam Subramanyam Revised 2nd edition, New Age Publications.
4. Power Electronics By P. S. Bimbhra, Khanna Publications.
5. Power Electronics, Converters, Applications and Design- Ned Mohan, Undeland and Robbins, Second Edition, John Wiley Publications.
6. Power Electronics- M. S. Jamil Asghar, PHI Learning Pvt. Ltd.
7. Power Electronics by V.R.Moorthi, Oxford University press.
8. Thyristorised controller by Dubey Joshi & Doralda, New age Publication.