Utkalmani Gopabandhu Institute of Engineering, Rourkela-4
Dept of Electrical Engineering

LESSON PLAN

Course Name: Power Electronics and PLC (Th 5)
Semester: 5th
Session: 2022-23
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Course Objectives:
1. To be familiar with construction, working principle & application of various power electronics devices.
2. To be familiar with different gate triggering circuits and commutation methods.
3. To be familiar with working principle of phase-controlled rectifier.
4. To be familiar with types and working principle of inverter.
5. To be familiar with working principle and voltage control of chopper.
6. To be familiar with frequency variation using Cyclo-converter.
7. To be familiar with control principle of AC & DC industrial drive.
8. To be familiar with different application of SCR / Thyristor.
9. To be familiar with concept in PLC & its Programming.

Chapter 1_Understand the Construction and Working of Power Electronic Devices

Class	Content
1	Construction, Operation, V-I characteristics & application of power diode, SCR, DIAC, TRIAC, Power MOSFET, GTO &IGBT
2	Two transistor analogy of SCR. Gate characteristics of SCR.
3	Switching characteristic of SCR during turn on and turn off. Turn on methods of SCR.
4	Turn off methods of SCR (Line commutation and Forced commutation) Load Commutation Resonant pulse commutation
5	Voltage and Current ratings of SCR. Protection of SCR Over voltage protection
6	Over current protection Gate protection
7	Firing Circuits General layout diagram of firing circuit R firing circuits R-C firing circuit
8	UJT pulse trigger circuit Synchronous triggering (Ramp Triggering)
9	Design of Snubber Circuits Summarise, recap and question

Chapter 2_Understand the Working of Converters, AC Regulators and choppers

Class	Content
1	Controlled rectifiers Techniques (Phase Angle, Extinction Angle control), Single quadrant semi converter, two quadrant full converter and dual Converter
2	Working of single-phase half wave-controlled converter with Resistive and R-L loads.
3	Understand need of freewheeling diode.
4	Working of single phase fully controlled converter with resistive and R- L loads.
5	Working of three-phase half wave-controlled converter with Resistive load
6	Working of three phase fully controlled converter with resistive load.
7	Working of single-phase AC regulator.
8	Working principle of step up & step-down chopper & Control modes of chopper Operation of chopper in all four quadrants.

Chapter 3_Understand the Inverters and cyclo-converters

Class	Content
1	Classify inverters. Explain the working of series inverter.
2	Explain the working of parallel inverter.
3	Explain the working of single-phase bridge inverter.
4	Explain the basic principle of Cyclo-converter. Explain the working of single-phase step Cyclo-converter
5	Explain the working of single-phase step down Cyclo-converter. Applications of Cyclo-converter.

Chapter 4_Understand application of power electronic circuits

Class	Content
1	List applications of power electronic circuits. List the factors affecting the speed of DC Motors.
2	Speed control for DC Shunt motor using converter. Speed control for DC Shunt motor using chopper.
3	List the factors affecting speed of the AC Motors. Speed control of Induction Motor by using AC voltage regulator
4	Speed control of induction motor by using converters and inverters (V/F control).
5	Working of UPS with block diagram
6	Battery charger circuit using SCR with the help of a diagram. Basic Switched mode power supply (SMPS) - explain its working & applications

Chapter 5_PLC and its applications

Class	Content
1	Introduction of Programmable Logic Controller (PLC). Advantages of PLC. Applications of PLC
2	Different parts of PLC by drawing the Block diagram and purpose of each part of PLC.
3	Ladder diagram Description of contacts and coils in the following states i)Normally open ii) Normally closed iii) Energized output iv) latched Output v) branching

4	Ladder diagrams for i) AND gate ii) OR gate and iii) NOT gate. 5.8 Ladder diagrams for combination circuits using NAND, NOR, AND, OR and NOT
5	Timers-i) T ON ii) T OFF and iii) Retentive timer And ladder diagrams related to timer
6	Counters-CTU, CTD Ladder diagrams using counters. PLC Instruction set
7	Ladder diagrams for following (i) DOL starter and STAR-DELTA starter (ii) Stair case lighting (iii) Traffic light Control (iv) Temperature Controller
8	Special control systems- Basics DCS & SCADA systems Computer Control–Data Acquisition, Direct Digital Control System (Basics only)

Learning Materials:

1. Lecture Notes
2. Power Electronics by Dr. P. S. Bhimbhra
3. Modern Power Electronics by B.K.Bose