

# GUJARAT TECHNOLOGICAL UNIVERSITY

## Power Electronics

### B. E. SEMESTER: VI

Subject Name: **Power Electronics Practice-II**

Subject Code: **162406**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Practical (I)
0	0	4	4	0	0	100

### Laboratory Work Guidelines:

(These are suggestions only. Each institute can give similar work to the students depending upon local circumstances.)

This is a laboratory oriented subject focusing on enhancing practical and laboratory skills required for Power Electronics. This is based on the topics/subjects already covered in previous semesters and subjects of current semester. The work should be divided into 3 groups.

Group-I → Laboratory experiments to be performed on real hardware. (At least 6 experiments)

Group-II → Modelling and Simulation of experiments of Group-I above. (At least 6 modelling and simulation experiments)

Group-III → A small project works to be given to students in group(3-4 students).

### (A) Experiment Group – I

Objectives of this experiment group are making the student understand

1. Power Processing circuits
2. Effects of various kinds of load on performance of power processing circuits
3. Effects of various kinds of loads (R,R-L, R-L-E etc.) on voltage and current waveforms
4. Effects of source on output of a Power processing circuit

Sr. No.	Course Contents
1.	To construct and verify performance of 1- Ø uncontrolled rectifier with different kinds of load.
2.	To construct and verify performance of 3- Ø uncontrolled rectifier with different kinds of load.

3.	To construct and verify performance of 1- $\phi$ half controlled rectifier bridge with different kinds of load.
4.	To construct and verify performance of 3- $\phi$ half controlled rectifier bridge with different kinds of load.
5.	To construct and verify performance of 1- $\phi$ full controlled rectifier bridge with different kinds of load.
6.	To construct and verify performance of 3- $\phi$ full controlled rectifier bridge with different kinds of load.
7.	To construct and verify performance of buck converter for different kinds of loads
8.	To construct and verify performance of boost converter for different kinds of loads
9.	To construct and verify performance of buck-boost converter for different kinds of loads
10.	To construct and verify performance of cuk' converter for different kinds of loads
11.	To construct and verify performance of 1- phase uncontrolled rectifier (full wave or bridge) with different kinds of load considering effects of source impedance.
12.	To construct and verify performance of any one thyristor based dc chopper.

### **(B) Experiment Group – II :**

Objectives of this experiment group are making the student understand

1. Mathematical modelling of simple power processing circuits.
2. Simulation of various Power Processing circuits.
3. Similarities among theoretical, practical and simulation results.
4. Waveforms at various points in different power circuits.

The circuits to be modelled and simulated should be the same as the circuits used for experiments performed from the group-I above.

### **(C) Experiment Group – III**

As mentioned at the starting, the students should be divided into various groups of 3 to 4 students. Each group of students can be given a small project at the starting of the semester. This work should be completed before end of the semester. A small report (around 10 to 15 pages) should be prepared by the students indicating work carried out and results obtained. The work done should be demonstrated to teachers and other students practically and through presentation slides. The project work to be included should be such that it can clear the concepts of interfacing power devices with low power signal processing circuits, interfacing microprocessor/controller with input and output devices, interfacing microprocessor/controller with real world signals.

The objectives of this work to be given to students in group are

1. Developing capacity in students to use the theory learnt to put in to practise.
2. Developing understanding of inter subject relationship among various subjects in students.
3. Developing capacity to find logical solution and implement the same practically for some commonly used processing requirements of many electronics products.
4. Developing capacity in students to find and solve common faults arising in various electronics circuits and software development.
5. Minimize mistakes commonly made by the students during laboratory work.
6. Developing technical report writing skills in students.
7. Developing technical presentation skills in students.

The suggested work is as given below.

Sr. No.	Course Contents
1.	Line synchronized firing circuit with facility to change firing angle for firing SCR or TRIAC (using circuit based on UJT, PUT, DIAC or any other active components)
2.	Signal processing circuits for generating PWM, V/F converter, F/V converter, A/D converter, D/A converter, PLL, frequency multiplier, filter, switch capacitor filters etc
3.	Generation of PWM using microcontroller and turning ON and OFF of power device through isolating devices (like pulse transformer, Opto coupler etc)
4.	Interfacing microcontroller with 7 segment LED display/ LCD displays etc
5.	Interfacing microcontroller with keyboards
6.	Interfacing microcontroller with different input-output devices (like thumb wheel switch, A/D, D/A etc.)
7.	Microcontroller based controlled rectifier operating in open loop (1-phase / 3-phase) with line synchronization
8.	Microcontroller based buck converter operating in open loop with facility to vary the % duty cycle
9.	Microcontroller based boost converter operating in open loop with facility to vary the % duty cycle
10.	Microcontroller based buck-boost converter operating in open loop with facility to vary the % duty cycle
11.	Microcontroller based measurement of voltage/ current/ frequency/ power/ pulse width etc
12.	Microcontroller based measurement of various non electrical physical quantities like speed, force, temperature, torque etc