CODE	COURSE	CATEGORY	L	T	P	CREDIT
EEL334	POWER ELECTRONICS LAB	PCC	0	0	3	2

Preamble : Impart practical knowledge for the design and setup of different power electronic converters and its application for motor control.

Prerequisite : Power Electronics (EET306)

Course Outcomes : After the completion of the course the student will be able to

CO 1	Determine the characteristics of SCR and design triggering circuits for SCR based circuits.
CO 2	Design, set up and analyse single phase AC voltage controllers.
CO 3	Design, set up and test suitable gate drives for MOSFET/IGBT.
CO 4	Design, set up and test basic inverter topologies.
CO 5	Design and set up dc-dc converters.
CO 6	Develop simulation models of dc-dc converters, rectifiers and inverters using modern simulation tools.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	2	2	-	-	-	3	2	-	3
CO 2	3	3	2	2	2	-	-	-	3	2	-	3
CO 3	3	3	2	2	2	-	-	-	3	2	-	3
CO 4	3	3	2	2	2	-	-	-	3	2	-	3
CO 5	3	3	2	2	2	-	-	-	3	2	-	3
CO 6	3	3	2	2	3	-	-	-	3	2	-	3

ASSESSMENT PATTERN:

Mark distribution:

Total Marks	CIE marks	ESE marks	ESE Duration
150	75	75	3 hours

Continuous Internal Evaluation (CIE) Pattern:

Attendance	Regular Lab work	Internal Test	Course Project	Total
15	30	25	5	**75**

Internal Test Evaluation (Immediately before the second series test

End Semester Examination (ESE) Pattern:

The following guidelines should be followed regarding award of marks:

a) Preliminary Work : 15Marks
b) Implementing the work/Conducting the experiment : 10Marks
c) Performance, result and inference (usage of equipments and troubleshooting) : 25Marks
d) Viva voce : 20marks
e) Record : 5Marks

General instructions **:** Practical examination is to be conducted immediately after the second series test after conducting 12 experiments from the list of experiments given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

LIST OF EXPERIMENTS:
(12 experiments are mandatory)

HARDWARE EXPERIMENTS: (A minimum of 8 experiments are mandatory)

1. Static characteristics of SCR

Aim: To determine the minimum gate current & gate voltage required to trigger the SCR also to measure the latching current, holding current and to plot the static characteristics of SCR

2. R and RC firing scheme for SCR control

Aim: To design and set up a half wave controlled rectifier with R and RC firing circuits and plot voltage waveform across the load and thyristor for different firing angles.Also determine the minimum and maximum firing angles of this circuit.

3. Line Synchronised Triggering Circuits of SCR

Aim: To design and set-up line synchronized Ramp Trigger and Digital Trigger circuits of SCR and observe the waveforms

4. AC Voltage Controller

Aim: To study the single phase AC voltage controller using TRIAC/SCRs. Set-up a single phase AC voltage controller & observe waveforms across load resistance for different firing angles.

5. Gate Driver Circuits for MOSFET/IGBT

Aim: To design and test a gate driver circuit for triggering half bridge inverter using MOSFET / IGBT using industry-standard MOSFET drive ICs/Circuits. To test the driving of floating and ground-referenced configurations.

6. Single Phase fully Controlled SCR bridge rectifier

Aim: To design and set up a single phase full converter with RL/RLE loads and observethe waveforms with and without freewheeling diode.

7. Design of Inductor/Transformer

Aim: To design and fabricate an inductor/transformer to be used in power electronic circuits.

8. Design and set-up buck/ boost / buck-boost converters

Aim: To design and set up the buck/boost/buck-boost converter and analyse the characteristics of the same.

9. Switching characteristics of MOSFET

Aim: To study and understand the switching characteristics of a power MOSFET.

10. Single-phase half bridge/full bridge inverter using power MOSFET/IGBT

Aim: To design and set up a single phase half-bridge/full-bridge inverter and observe the waveforms across load and firing pulses.

11. Single-phase sine PWM inverter with LC filter

Aim: To design and set up a single phase sine PWM inverter with LC filter using microcontroller

12. Three phase sine PWM Inverter using IGBT

Aim: To set up a 3-phase PWM Inverter with RL load and observe the waveforms

13. Speed control of DC motor using chopper

Aim: To Control the speed of a DC motor using a step-down chopper

14. Speed control of 3-phase induction motor

Aim: To Control the speed of a 3-phase induction motor using V/f control method.

SIMULATION EXPERIMENTS: (A minimum of 4 experiments are mandatory)

15. Simulation of 1-phase fully-controlled and half-controlled rectifier fed separately excited DC motor

Aim: To simulate 1-phase fully-controlled and half-controlled rectifier fed Separately Excited DC motor and observe the speed, torque, armature current, armature voltage, source current waveforms and find the THD in source current and input power factor.

16. Simulation of Dual Converter – 4 quadrant operation of separately excited DC motor

Aim: To simulate a dual converter for a separately excited DC motor and to understand the four quadrant operation

17. Simulation of buck/boost/buck-boost converters

Aim: To simulate a buck, boost and buck boost converter using MATLAB/equivalent or any other simulation platform and analyse the performance under various duty ratio/ switching frequency.

18. Simulation of single phase & three phase sine PWM inverters.

Aim: To simulate a single phase and three phase sine PWM inverter using MATLAB/equivalent

19. Simulation of 3-phase fully-controlled converter with R, RL, RLE loads

Aim: To simulate a 3-phase fully controlled converter with R,RL and RLE loads and observe the waveform in MATLAB simulink/equivalent.

20. Comparative study of PWM and Square wave inverters.

Aim:-To analyse THD, fundamental component of output voltage in PWM and Square wave inverters (single phase) using MATLAB/equivalent.

Mandatory Group Project Work **:** Students have to do a mandatory micro project (group size not more than 5 students) preferably a simulation work. A report also is to be submitted. Performance can be evaluated along with the internal test and a maximum of 5 marks shall be awarded.

Reference Books:

1. L. Umanand: Power Electronics – Essentials & Applications, Wiley-India
2. Mohan, Undeland, Robbins: Power Electronics, Converters, Applications & Design, Wiley-India
3. Muhammad H. Rashid: Power Electronics Circuits, Devices and Applications, Pearson Education
4. Ned Mohan A: "First course on power electronics and drives", MNPERE, 2003 Edn.