

25UEEL405	DIGITAL AND POWER ELECTRONICS LAB	Category	L	T	P	R	Credit	Year of Introduction
		PCL	0	0	3	0	2	2025

Preamble: This laboratory course provides practical exposure to the fundamental concepts of digital and power electronics through implementation and testing of basic electronic circuits.

Prerequisite: 25UEET403 - Pulse and Digital Circuits, 25UEET402 - Power Electronics

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

CO	Course Outcomes	Knowledge Level
CO1	Realize and verify combinational logic circuits using Boolean algebra, logic gates, standard ICs, and multiplexers.	K3 Apply
CO2	Design, implement and analyze sequential logic circuits using flip-flops, counters, shift registers and perform digital circuit implementation using Verilog	K3 Apply
CO3	Demonstrate and verify the operation of SCR, MOSFET, and IGBT, and implement basic triggering and gate driver circuits using hardware and simulation	K3 Apply
CO4	Implement and simulate controlled rectifiers, AC voltage controllers, and DC–DC converters and observe the effect of firing angle and duty cycle on output waveforms.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	2	2	1	3	2
CO2	3	3	3	2	2	-	-	-	2	2	1	3	3
CO3	3	2	-	2	-	-	-	-	2	2	1	3	1
CO4	2	2	3	2	-	-	-	-	2	2	2	3	2
Avg	2.5	2.25	2.67	2	2				2	2	1.25	3	2

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*	*	-	*	-
CO2	*	*	*	*	*	*	-	*	-
CO3	*	*	*	*	-	-	-	*	-
CO4	*	*	*	*	*	-	-	*	-

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*	*	-	*	-

Assessment Pattern

Continuous Assessment (25 Marks)

Continuous assessment evaluates the student's performance during the regular laboratory sessions, emphasizing practical skills, documentation, and conceptual understanding.

1. Conduct of Experiments (10 Marks)

Evaluation is based on the student's ability to perform experiments systematically and efficiently.

- Procedure and Execution:
Adherence to correct experimental procedures, systematic execution of experiments, and compliance with laboratory safety guidelines.
- Skill Proficiency:
Ability to handle laboratory instruments and components accurately, precision in observations, and effectiveness in troubleshooting during experimentation.
- Teamwork and Participation:
Active involvement, collaboration, and contribution during group laboratory activities.

2. Lab Reports and Record Keeping (5 Marks)

Evaluation is based on the quality and maintenance of laboratory documentation.

- Quality of Reports:
Clarity, completeness, and accuracy of experimental reports, including proper recording of observations, calculations, analysis, and conclusions.
- Timely Submission and Organization:
Submission of rough and fair records within the stipulated time and maintenance of a neat, well-structured laboratory record.

3. Viva Voce (10 Marks)

Evaluation of conceptual understanding and communication skills related to laboratory experiments.

- Ability to explain experimental procedure, working principle, and results.
- Understanding of theoretical concepts associated with the experiment.
- Ability to answer questions related to practical and analytical aspects of the experiment.

Evaluation Pattern for End Semester Examination (50 Marks)

End Semester Examination (50 Marks)

The end semester evaluation assesses the student's ability to independently perform experiments, interpret results, and demonstrate theoretical understanding.

1. Procedure / Preliminary Work / Design (10 Marks)

Evaluation is based on planning and conceptual clarity before performing the experiment.

- Procedure Understanding and Description:
Ability to clearly explain the experimental procedure and understand each step involved.
- Preliminary Work and Planning:
Preparation and organization of required components, instruments, and experimental setup.
- Design Logic:
Logical approach in experimental design, circuit development, or algorithm formulation related to the experiment.

2. Conduct of Experiment / Execution of Work (15 Marks)

Evaluation is based on practical performance during the examination.

- Proper circuit setup and connection.
- Accurate execution of experimental procedure.
- Efficient handling of laboratory instruments and equipment.

3. Result with Valid Inference / Quality of Output (10 Marks)

Evaluation is based on correctness and interpretation of results.

- Accuracy of Results:
Precision and correctness of experimental observations and output.
- Analysis and Interpretation:
Ability to analyse results and draw valid technical conclusions.

4. Viva Voce (10 Marks)

Evaluation of student's understanding of experimental concepts.

- Ability to explain procedure, working principle, and results.
- Ability to answer theoretical and practical questions related to the experiment.

5. Record (5 Marks)

Evaluation is based on laboratory documentation submitted during the examination.

- Completeness and accuracy of recorded experiments.
- Clarity, neatness, and systematic presentation of laboratory records.

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	50	50	3 Hours

Continuous Internal Evaluation Pattern:

Attendance	: 5 marks
Continuous Assessment Test	: 20 marks
Continuous Assessment Assignment	: 25 marks

SYLLABUS

EXPERIMENT LIST

PART A – DIGITAL ELECTRONICS

(Any 8 experiments - mandatory)

Pre-lab assignment: Familiarization of Logic Gates, Identification of typical logic ICs, Interpreting IC datasheets.

1. Half adder & Full adder using gates.
2. Half subtractor & Full subtractor using gates.
3. 4-bit adder/subtractor & BCD adder using IC 7483.
4. BCD to decimal decoder and BCD to 7-segment decoder & display
5. Study of multiplexer IC and realization of combinational circuits using multiplexers.
6. Realization of RS, T, D & JK flip flops using gates.
7. Design of synchronous up, down & modulo-N counters.
8. Realization of 4-bit serial IN serial OUT registers using flip flops.
9. Design of ring counter and Johnson's counter using IC 7495
10. VHDL implementation of : - a) half adder & full adder
b) half subtractor & full subtractor

Textbooks:

1. Mano, M. M., & Ciletti, M. D. (2013). *Digital design* (5th ed.). Pearson Education.
2. Leach, D. P., Malvino, A. P., & Saha, G. (2015). *Digital principles and applications* (8th ed.). McGraw-Hill Education.
3. Floyd, T. L. (2015). *Digital fundamentals* (11th ed.). Pearson Education.

Reference Books:

1. Roth, C. H., Jr., & Kinney, L. L. (2014). *Fundamentals of logic design* (7th ed.). Cengage Learning.
2. Tocci, R. J., Widmer, N. S., & Moss, G. L. (2011). *Digital systems: Principles and applications* (11th ed.). Pearson Education.
3. Palnitkar, S. (2003). *Verilog HDL: A guide to digital design and synthesis* (2nd ed.). Pearson Education.

PART B

POWER ELECTRONICS HARDWARE EXPERIMENTS

1. Static characteristics of SCR
2. R and RC firing scheme for SCR control
3. Line Synchronised Triggering Circuits of SCR
4. AC Voltage Controller.
5. Gate Driver Circuits for MOSFET/IGBT

SIMULATION EXPERIMENTS:

1. Simulation of Single Phase Half-Wave Controlled Rectifier (R Load)
2. Simulation of Single Phase Fully Controlled Bridge Rectifier
3. Simulation of Single Phase AC Voltage Controller (TRIAC / Anti-parallel SCR)
4. Simulation of buck/boost/buck-boost converters
5. Simulation of RC Triggering Circuit for SCR

Textbooks

1. Rashid, M. H. (2014). *Power electronics: Circuits, devices, and applications*. Pearson Education.
2. Hart, D. W. (2010). *Power electronics*. Tata McGraw-Hill Education.
3. Bimbhra, P. S. (2022). *Power electronics*. Khanna Publishers.

References

1. Mohan, N., Undeland, T. M., & Robbins, W. P. (2007). *Power electronics: Converters, applications, and design*. Wiley India.
2. Erickson, R. W., & Maksimović, D. (2012). *Fundamentals of power electronics*. Springer.
3. Krein, P. T. (1998). *Elements of power electronics*. Oxford University Press.

