COURSE CONTENT

ELECTRONIC DEVICES AND CIRCUITS LAB								
II Semester: ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
2520471	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		
Prerequisites: Electronic Devices and Circuits								

Course Overview:

This laboratory course aims to provide hands-on experience and simulation-based learning of semiconductor devices and basic electronic circuits. Students will analyze the characteristics and applications of diodes, BJTs, and FETs, design rectifiers and amplifiers, and simulate modern electronic circuits using software tools. The course bridges theoretical concepts with practical implementation, developing foundational skills essential for analog electronics and circuit analysis.

Course Objectives:

The students will try to learn

- The practical behavior of PN junction and Zener diodes through I-V characteristics, rectifiers, voltage regulation, and waveform shaping applications.
- Biasing and amplification characteristics of BJTs in different configurations, along with their input-output parameters and stability aspects.
- The design, implementation, and evaluation of rectifier circuits with and without filters to understand ripple factor and DC supply performance.
- The simulation and analysis of transistor- and FET-based circuits, including CE amplifiers, JFETs, MOSFETs, and CMOS inverters, for analog and digital applications.
- utilization of modern circuit simulation tools to validate experimental results, analyze device characteristics, and design low-power, high-performance electronic circuits.

Course Outcomes:

After successful completion of the course, students shall be able to

- Analyze the I-V characteristics of semiconductor devices such as diodes, BJTs, and FETs.
- Design and evaluate basic rectifier, clipper, clamper, and voltage regulation circuits.
- De Demonstrate biasing techniques for BJTs and determine their operating point using DC load line analysis.
- Design and analyze transistor amplifier circuits in various configurations using h-parameter models.
- Simulate and interpret electronic circuits using appropriate simulation tools.

List of Experiments:

A. Hardware-Based Experiments (7):

1. Study the I-V characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.

2. Examine the reverse bias characteristics of a Zener diode and demonstrate its application as a voltage regulator under varying conditions.
3. Design and analyze half-wave and full-wave rectifiers (center-tap and bridge) with and without capacitor filters to evaluate ripple factor and output voltage.
4. Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.
5. Plot the input and output characteristics of a BJT in common emitter configuration to determine input/output resistance and current gain.
6. Design and test fixed bias and voltage divider bias circuits to establish a stable operating point for a BJT amplifier and study DC load line behavior.
7. Construct and analyze a Common Base (CB) configuration of a BJT to study input-output characteristics and determine current gain (α) and input/output resistance.

B. Software-Based Simulation Experiments (7):

1. Simulate a full-wave bridge rectifier with capacitor filter to analyze waveform smoothing and ripple reduction in DC power supply design.
2. Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages and load resistances.
3. Simulate a common emitter amplifier with and without emitter bypass capacitor to analyze the effect on voltage gain and signal amplification.
4. Simulate BJT operation as a switch and small-signal amplifier to understand its dual functionality in digital and analog applications.
5. Simulate the output and transfer characteristics of a JFET to determine parameters such as pinch-off voltage, drain resistance, and transconductance.
6. Simulate the characteristics of a MOSFET and design a CMOS inverter to study digital switching behavior and low-power logic design.
7. Simulate the transfer and output characteristics of an enhancement-mode NMOS transistor to analyze threshold voltage, drain current, and switching behavior.

Open Ended Experiments

1. Measurement of Ripple factor and Efficiency of Rectifiers and filters, leads to designing of voltage regulators.
2. Finding the bandwidth of amplifiers leads to the designing of Amplifiers.

Hardware Requirements:

1. Regulated DC Power Supply (0-30V)
2. Function Generator
3. Digital Multimeter
4. Cathode Ray Oscilloscope (CRO) or DSO
5. Breadboards and Connecting Wires
6. Resistors, Capacitors, Diodes (1N4007, Zener Diodes)
7. BJTs (e.g., BC107, 2N2222), JFETs (e.g., J201), MOSFETs (e.g., IRF540N)
8. Trainer Kits (optional but preferred for ease)

Software Requirements (Any one of the listed tools or equivalent):

1. LTSpice (Free from Analog Devices)
2. NI Multisim (Academic License or Student Version)
3. Proteus Design Suite (Simulation and PCB Design)
4. TINA-TI (Free from Texas Instruments)
5. PSPICE for TI or OrCAD Lite
6. Windows PC or Laptop with minimum 4GB RAM and i3 processor or better

REFERENCE LINK:

1. https://www.youtube.com/watch?v=rEOZRBNvdO0&list=PLxkNJa1brEVmHqs-bcBUzRhSnUIkO8yhO&index=2
2. https://www.youtube.com/watch?v=BLfNFq0CGV4&list=PLxkNJa1brEVmHqs-

bcBUzRhSnUlkO8yhO&index=3

3. https://www.youtube.com/watch?v=VeTm1xn2Tdk&list=PLxkNJa1brEVmHqs-bcBUzRhSnUlkO8yhO&index=4
4. https://www.youtube.com/watch?v=nerF4wjrv7s&list=PLxkNJa1brEVmHqs-bcBUzRhSnUlkO8yhO&index=5

MATERIALS ONLINE:

5. 1. Lab manual
6. 2. Open-ended experiments