PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

Course Code				**23ELMAP233**			
Title of the Course				**Electronic communication systems Lab**			
Offered to: (Programme/s)				B.Sc. (H)-Electronics			
L	**0**	**T**	**0**	**P**	**2**	**C**	**1**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	Major			**Course Relates to:**	Global		
Year of Revision:				**Percentage:**			
Type of the Course:				Skill development			
Crosscutting Issues of the Course :							
Pre-requisites, if any				Basic knowledge of electronic circuits, signal processing, and familiarity with using oscilloscopes and signal generators.			

Course Description:

This laboratory course is designed to complement the theoretical concepts covered in the Communication Systems curriculum. The course provides hands-on experience in the generation, modulation, and demodulation of various signals. Students will explore amplitude modulation (AM), frequency modulation (FM), and pulse modulation techniques, as well as digital communication methods such as pulse code modulation (PCM) and different types of shift keying. Through a series of carefully structured experiments, students will gain practical knowledge of the key components and systems used in modern communication technologies.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	**Understand Modulation Techniques**: Comprehend the necessity and types of modulation, focusing on amplitude and frequency modulation.
2	**Analyze AM and FM Systems**: Analyze the frequency spectrum, power relations, and generation techniques of AM and FM systems.
3	**Study Transmitters and Receivers**: Learn the block diagrams and functionality of AM and FM radio transmitters and superheterodyne receivers.
4	**Explore Communication Bands and Pulse Modulation**: Understand the electromagnetic spectrum and various pulse modulation techniques.
5	**Grasp Digital Communication Techniques**: Explore PCM, its encoders, decoders, and advantages, as well as different shift keying techniques.

Course Outcomes

At the end of the course, the student will be able to…

CO No	COURSE OUTCOME	BTL	PO	PSO
CO1	**Explain Modulation Needs and Types**: Explain why modulation is necessary and describe different modulation types.	K2	2	1
CO2	**Analyze AM and FM Waves**: Analyze and represent amplitude and frequency-modulated waves, including their generation.	K4	2	1
CO3	**Understand Transmitter and Receiver Design**: Understand and illustrate the block diagrams of AM and FM transmitters and receivers.	K5	2	1
CO4	**Apply Pulse Modulation Techniques**: Apply sampling theorem and generate and detect PAM, PWM, and PPM signals.	K5	2	1
CO5	**Implement Digital Communication Techniques**: Implement PCM and shift keying techniques, explaining their advantages and functioning.	K5	2	1

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1		2						2	
CO2		3						3	
CO3		2						2	
CO4		3						3	
CO5		2						2	

Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure

This lab course provides hands-on experience with modulation techniques, transmitters, receivers, pulse modulation, and digital communication systems. Students will construct and analyze circuits, perform measurements, and compare theoretical concepts with practical outcomes through structured experiments.

Unit I: Amplitude Modulation

Experiment 1: Amplitude Modulation and Demodulation

- **Objective:** To generate and demodulate AM signals using a transistor modulator.
- **Components Used**:
  - Transistors (e.g., 2N2222)
  - Resistors, capacitors, and inductors
  - Signal generator

- Oscilloscope
- Power supply

- **Procedure**:
  - Construct the AM modulator circuit using a transistor.
  - Connect the signal generator to the modulator input and set a carrier frequency.
  - Observe the modulated waveform on the oscilloscope.
  - Connect the demodulator circuit to the output of the modulator.
  - Compare the demodulated output with the original input signal on the oscilloscope.
- **Testing**:
  - Verify the modulation index using the oscilloscope.
  - Compare the input and output waveforms.
- **Activity**:
  - Construct the modulator circuit.
  - Observe the AM signal on the oscilloscope.
  - Demodulate the signal and compare it with the original input.

Experiment 2: Balanced Modulator

- **Objective:** To suppress the carrier in an AM signal using a balanced modulator.
- **Components Used**:
  - Diodes (e.g., 1N4148)
  - Operational amplifiers (e.g., 741)

    - Resistors and capacitors
    - Signal generator
    - Oscilloscope
- **Procedure**:
    - Set up the balanced modulator circuit using diodes and operational amplifiers.
    - Input the carrier and message signals from the signal generator.
    - Observe the output waveform on the oscilloscope, noting the suppression of the carrier.
    - Adjust the input signals and observe the changes in carrier suppression.
- **Testing**:
    - Measure the carrier suppression.
    - Analyze the modulated signal for carrier absence.
- **Activity**:
    - Build the balanced modulator circuit.
    - Generate an AM signal and observe the suppression of the carrier on the oscilloscope.

Unit II: Frequency Modulation

Experiment 3: Frequency Modulation and Demodulation

- **Objective**: To generate and demodulate FM signals using a reactance modulator.
- **Components Used**:
    - Varactor diode
    - Reactance modulator components
    - Resistors, capacitors, inductors
    - Signal generator

    - Oscilloscope
- **Procedure**:
    - Construct the reactance modulator circuit using a varactor diode.
    - Input the carrier signal from the signal generator and modulate it.
    - Observe the FM signal on the oscilloscope.
    - Connect the demodulator circuit and compare the demodulated output with the original input.
- **Testing**:
    - Measure the frequency deviation.
    - Compare input and output waveforms.
- **Activity**:
    - Set up the reactance modulator circuit.
    - Generate and observe FM signals on the oscilloscope.
    - Demodulate the signal and compare it to the original.

Experiment 4: Pre-emphasis and De-emphasis

- Objective: To understand the effect of pre-emphasis and de-emphasis on FM signals.
- **Components Used**:
    - Operational amplifiers
    - Resistors, capacitors
    - Signal generator
    - Oscilloscope
- **Procedure**:
    - Implement the pre-emphasis circuit using operational amplifiers.

- Pass the FM signal through the pre-emphasis circuit.
- Observe the output waveform on the oscilloscope.
- Implement the de-emphasis circuit and pass the signal through it.
- Compare the final output with the original signal.

- **Testing**:
  - Measure signal-to-noise ratio improvement.
  - Compare signals before and after de-emphasis.
- **Activity**:
  - Implement pre-emphasis and de-emphasis circuits.
  - Observe the signal on the oscilloscope before and after processing.

Unit III: Transmitters and Receivers

Experiment 5: AM Transmitter Block Diagram

- **Objective:** To construct and study the block diagram of an AM transmitter.
- **Components Used**:
  - Oscillator
  - Modulator
  - Power amplifier
  - Antenna
  - Resistors, capacitors, inductors
  - Signal generator
  - Oscilloscope
- **Procedure**:
  - Construct the oscillator, modulator, power amplifier, and antenna blocks.

- Connect these blocks as per the AM transmitter block diagram.
- Input the modulating signal and observe the transmitted signal on the oscilloscope.
- Measure the output power and frequency.

- **Testing**:
  - Measure the output power and frequency.
  - Analyze the transmitted signal.

- **Activity**:
  - Construct each block of the AM transmitter.
  - Observe the combined output on the oscilloscope.

Unit IV: Pulse Modulation

Experiment 6: Pulse Amplitude Modulation (PAM)

- **Objective:** To generate and detect PAM signals.
- **Components Used**:
  - Sample and hold circuit
  - Operational amplifiers
  - Resistors, capacitors
  - Signal generator
  - Oscilloscope
- **Procedure**:
  - Construct the sample and hold circuit for PAM generation.
  - Input the analog signal and observe the PAM signal on the oscilloscope.
  - Implement the PAM detection circuit.
  - Compare the detected output with the original analog signal.

- **Testing**:
    - Measure the amplitude of pulses.
    - Compare the modulated and demodulated signals.
- **Activity**:
    - Construct PAM generation and detection circuits.
    - Observe the PAM signal and demodulate it.

Experiment 7: Pulse Width Modulation (PWM)

- **Objective:** To generate and detect PWM signals.
- **Components Used**:
    - Comparator
    - Operational amplifiers
    - Resistors, capacitors
    - Signal generator
    - Oscilloscope
- **Procedure**:
    - Set up the comparator circuit for PWM generation.
    - Input the analog signal and observe the PWM signal on the oscilloscope.
    - Implement the PWM detection circuit.
    - Compare the detected output with the original analog signal.
- **Testing**:
    - Measure the pulse width variation.
    - Compare input and output signals.
- **Activity**:

- Build PWM generation and detection circuits.
- Observe the PWM signal and demodulate it.

Unit V: Digital Communication Techniques

Experiment 8: Amplitude Shift Keying (ASK)

- Objective: To generate and detect ASK signals.
- **Components Used**:
  - Oscillator
  - Modulator
  - Demodulator
  - Resistors, capacitors
  - Signal generator
  - Oscilloscope
- **Procedure**:
  - Set up the ASK modulator circuit.
  - Input the digital signal and carrier signal, and observe the ASK signal on the oscilloscope.
  - Implement the ASK demodulator circuit.
  - Compare the demodulated output with the original digital signal.
- **Testing**:
  - Measure the amplitude of the ASK signal.
  - Compare input and demodulated output.
- **Activity**:
  - Construct ASK generation and detection circuits.

- Observe the ASK signal on the oscilloscope.

Experiment 9: Frequency Shift Keying (FSK)

- Objective: To generate and detect FSK signals.
- **Components Used**:
  - Oscillator
  - Modulator
  - Demodulator
  - Resistors, capacitors
  - Signal generator
  - Oscilloscope
- **Procedure**:
  - Construct the FSK modulator circuit.
  - Input the digital signal and carrier signals, and observe the FSK signal on the oscilloscope.
  - Implement the FSK demodulator circuit.
  - Compare the demodulated output with the original digital signal.
- **Testing**:
  - Measure the frequency shifts in the FSK signal.
  - Compare input and demodulated output.
- **Activity**:
  - Build FSK generation and detection circuits.
  - Observe the FSK signal on the oscilloscope.

Experiment 10: Phase Shift Keying (PSK)

- Objective: To generate and detect PSK signals.
- **Components Used**:
    - Oscillator
    - Modulator
    - Demodulator
    - Resistors, capacitors
    - Signal generator
    - Oscilloscope
- **Procedure**:
    - Set up the PSK modulator circuit.
    - Input the digital signal and carrier signal, and observe the PSK signal on the oscilloscope.
    - Implement the PSK demodulator circuit.
- Compare the demodulated output with the original digital signal.

  Testing:
    - Measure the phase shifts in the PSK signal.
    - Compare input and demodulated output.
- **Activity**:
    - Construct PSK generation and detection circuits.
    - Observe the PSK signal on the oscilloscope.

Lab Manual:

Supplied by the Department

References:

1. [Reference 1 - Author(s), Year of Publication, Title, Edition, Publisher]
2. [Reference 2 - Author(s), Year of Publication, Title, Edition, Publisher]

LAB EXAMINATION PATTERN

23ELMAP233: Electronic communication system Lab

Semester: III **MAX Marks:35M** **Time:3Hrs**

(A) SEE Evaluation Procedure

1. For Aim, Apparatus, circuit diagram, Flow chart	**5M**
2.For Observation table, formulas, Program	**5M**
3. Experiment Procedure and Execution	**10M**
4.Output of Experiment	10M
5. Practical Record	**2M**
6. Viva voce	**3M**

(B) CONTINUOUS ASSESMENT(Internal) **15 MARKS**

15 marks for the continuous assessment (Day to day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the regularity/ record/viva). Laboratory teachers are mandated to ensure that every student completes 80%-90% of the lab assessments.

TOTAL: (A)+(B) = **50 MARKS**