JSPM's
RAJARSHI SHAHU COLLEGE OF ENGINEERING
TATHAWADE, PUNE-33
(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)
ELECTRONICS & TELECOMMUNICATION DEPARTMENT

**A.Y.2024-25** **SEM-IV**

**CLASS-S.Y.** **DIV- B**

**COURSE: -** COMMUNICATION SYSTEMS **COURSE CODE: -** EC2207T

**NAME OF THE ACTIVITY:** Simulink-based Simulation of Digital Modulation Techniques (ASK, FSK, PSK)

## CONCEPT:

This activity is designed to transition students from theoretical understanding to practical application of digital modulation. By using MATLAB Simulink, a standard industry tool, students can visually construct and analyze the waveforms of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), and Phase Shift Keying (PSK). This hands-on simulation bridges the gap between mathematical equations and the actual behavior of modulated signals, providing a dynamic and interactive learning experience.

## Objective (Goal):

- To understand the fundamental principles of ASK, FSK, and PSK digital modulation techniques.
- To build functional Simulink models capable of generating ASK, FSK, and PSK waveforms.
- To observe and analyze the output waveforms on a Simulink scope, correlating them with the binary input data.
- To gain practical, hands-on experience with MATLAB Simulink, a key tool in communication system design and analysis.
- To visually compare the distinct characteristics of each modulation scheme.

## Appropriateness (Relevance of Selected Method):

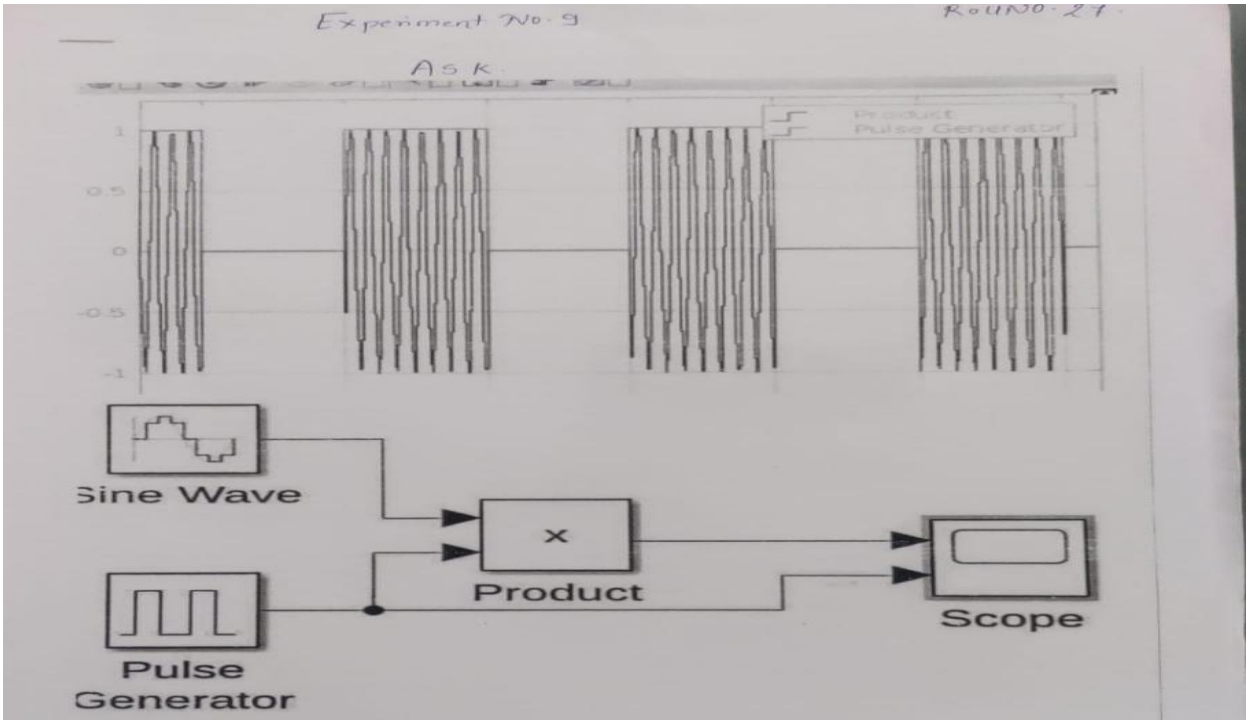
Using MATLAB Simulink is a highly appropriate method for this topic. Its graphical, block-based nature makes it an intuitive tool for visualizing complex signal processing flows without getting bogged down in extensive coding. This approach is highly relevant as it provides students with experience on a platform widely used in the industry for system modeling and simulation, enhancing both their conceptual

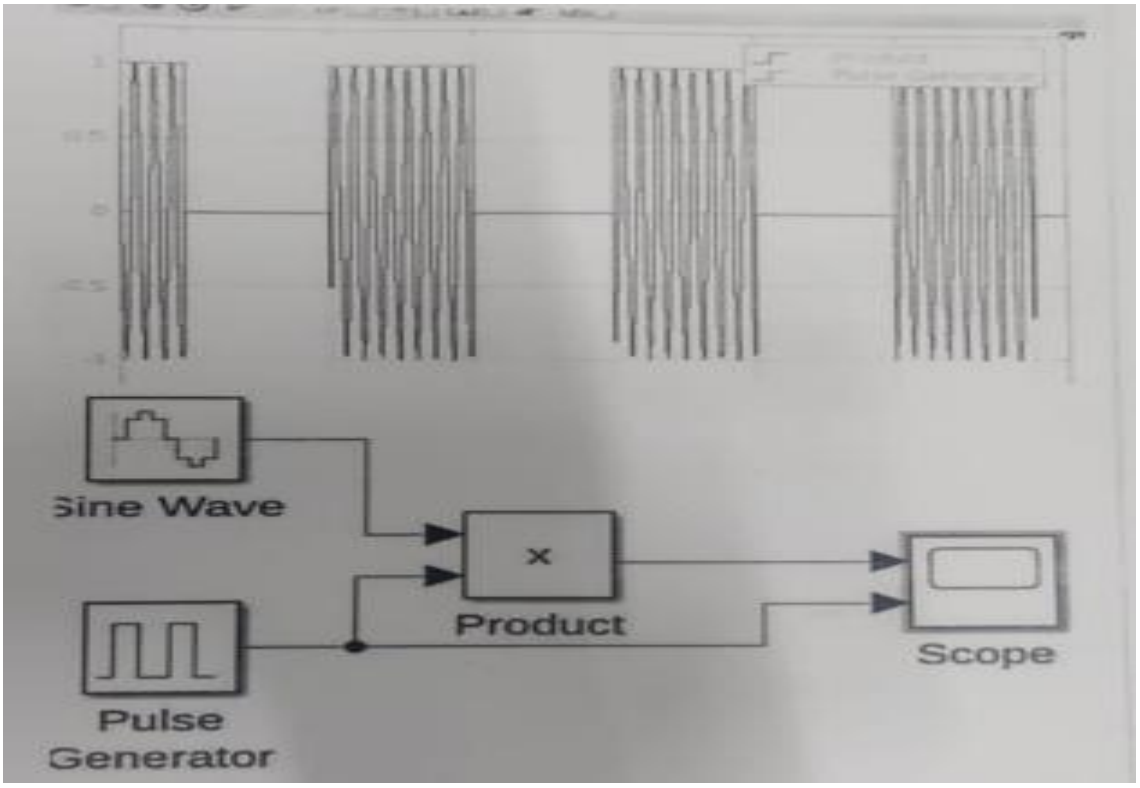
understanding and their practical skills in a cost-effective and safe virtual environment.

## Effective Presentation (Implementation Details):

The activity was conducted as a hands-on lab session.

1. **Introduction:** A brief theoretical overview of ASK, FSK, and PSK was presented, focusing on how a carrier wave's properties (amplitude, frequency, phase) are altered to represent binary data.
2. **Guided Simulation:** Students were guided step-by-step to build a Simulink model for ASK. Key blocks included the Bernoulli Binary Generator (for the message signal), a Sine Wave block (for the carrier), a Product block, and a Scope to view the output.
3. **Independent Task:** Students were then tasked to independently modify their base model or build new models to generate FSK and PSK waveforms. This required them to apply their theoretical knowledge to select and configure appropriate blocks (e.g., using a Switch block for FSK to alternate between two frequencies, or a phase shift block for PSK).
4. **Analysis:** Students captured screenshots of their input data and the corresponding ASK, FSK, and PSK waveforms, noting the changes in the carrier signal for each case.

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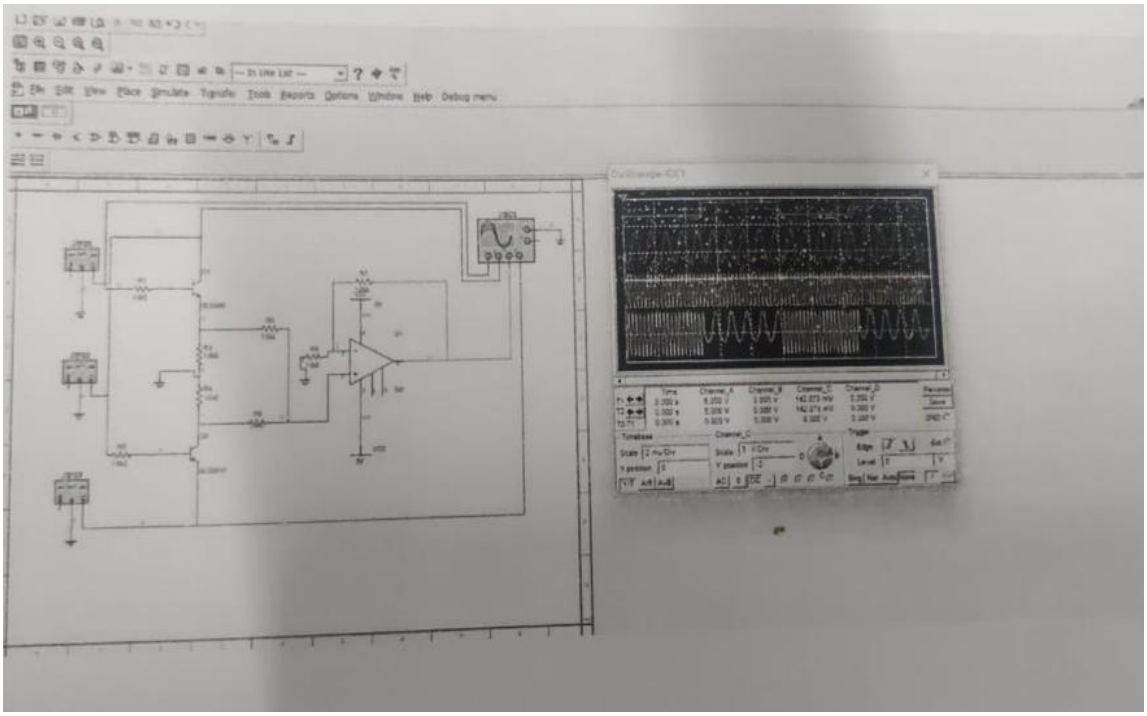

## BENEFITS/OUTCOME:

This activity led to a significant improvement in students' comprehension of digital modulation.

- **Enhanced Conceptual Clarity:** The visual and interactive nature of the simulation solidified students' understanding of how binary '1's and '0's translate into tangible signal changes.
- **Practical Skill Development:** Students acquired basic competency in using MATLAB Simulink, a valuable skill for their future careers in engineering.
- **Increased Engagement:** The hands-on, problem-solving approach was more engaging than a traditional lecture, leading to better retention of the material.
- **Immediate Feedback:** The ability to instantly see the results of their model changes allowed students to self-correct and experiment, deepening their learning.

## Reproducibility & Reusability by other Scholar for further Development

- **Reproducibility:** This activity is highly reproducible by any scholar, requiring only access to MATLAB with the Simulink add-on. The core methodology and the list of required blocks can be easily documented in a lab manual to ensure consistent implementation.
- **Reusability:** The base models created in this activity can be reused and expanded upon in more advanced courses. They can serve as the foundation for subsequent labs focusing on demodulation, the effects of channel noise (by adding an AWGN block), and performance metrics like Bit Error Rate (BER) analysis.

## Peer Review & Critique:

1. How effectively does this simulation activity help students connect the mathematical theory of modulation with the practical visualization of waveforms?
2. Is the complexity of building the Simulink models from scratch appropriate for the skill level of Second Year students, or would a template-based approach be more effective?
3. How could this activity be extended to include the demodulation process to provide students with a complete view of a communication system?
4. What methods can be used to assess individual student contributions and understanding if the activity is performed in groups?

| Category | Name of the Peer | Organization | Q1 | Q2 | Q3 | Q4 Suggestion/Improvement |
|---|---|---|---|---|---|---|
| Internal | A.A. Tabgade | JSPM'S RSCOE | 04 | 04 | 03 | 04 good |
| External | Rupali Jahagir | MIT ADT | 05 | 03 | 04 | 04 |

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