A Seminar on

AI in Chemical Process Technology

Activity Report

Academic Year	2024-25
Program Driven by	Self
Quarter	II
Program / Activity Name	A Seminar on AI in Chemical Process Technology
Program Type	
Program Theme	Innovation and startups
Start Date	08-02-2025
End Date	08-02-2025
Duration of the Activity (in Mins)	60
Number of Student Participant	50
Number of Faculty Participant	70
Number of external Participant	--
Expenditure Amount in Rs.	
Any Remark	--
Mode of Session Delivery	Offline
Objective	
Benefit in terms of Learning / Skills / Knowledge obtained	
Feedback	
Video url (mp4)	
Photograph 1 (jpg)	Attached
Photograph 2 (jpg)	Attached
Overall report of the Activity (pdf)	As given below

Dr. P. H. Zope

Convener IIC

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Village
बाभरी
Decimal
DMS
Latitude
21.014066
21°0'50" N
Longitude
75.502681
75°30'9" E

Report on AI in Chemical Process Technology
Date: 08 February 2025
Presented by: Dr. Vijay Ramkrishna Diware
Associate Professor, Chemical Engineering

Objectives

The primary objectives of this report are:

1. To explore the role and impact of Artificial Intelligence in chemical process technology.
2. To identify key AI techniques and their industrial applications in chemical engineering.
3. To examine the benefits, outcomes, and challenges associated with AI integration.
4. To highlight recent advancements and future directions for AI-driven chemical processes.
5. To promote awareness of AI's potential in fostering sustainable, safe, and efficient operations.

Introduction

Artificial Intelligence (AI) is revolutionizing chemical process technology by significantly improving efficiency, precision, and sustainability at all stages of chemical production. The adoption of AI—including machine learning, neural networks, and optimization algorithms—has transformed how chemical processes are designed, controlled, and optimized.

Integration of AI in Chemical Processes

AI technologies are now central to the development of intelligent chemical systems. These tools analyze vast amounts of historical and real-time process data to automate decision-making and streamline operations.

Key Applications

1. **Predictive Maintenance**
   AI systems can predict equipment failure in advance, helping prevent costly downtimes and improve asset longevity.
2. **Real-time Monitoring and Fault Detection**
   AI enhances process safety and performance by enabling continuous monitoring and rapid detection of irregularities.
3. **Process Simulation and Optimization**
   With AI, chemical processes can be simulated and optimized more efficiently, reducing energy consumption and waste.
4. **Materials and Catalyst Discovery**
   Machine learning models accelerate the search for new materials and catalysts using data-driven high-throughput screening.

Benefits

- **Increased Efficiency**: Faster and more accurate decision-making.
- **Cost Reduction**: Minimized downtime, optimized resource usage, and lower maintenance costs.
- **Enhanced Safety**: Early detection of faults and process deviations.
- **Sustainability**: Reduced emissions and waste through optimized operations.
- **Accelerated Innovation**: Faster discovery and development of new materials and chemicals.

Outcomes

- **Improved Operational Reliability**: Plants experience fewer unexpected shutdowns and higher consistency in product quality.
- **Shorter Development Cycles**: R&D timelines are significantly reduced due to AI-driven simulations and predictions.
- **Higher Profitability**: Efficient resource utilization leads to cost savings and increased margins.

- **Environmental Compliance**: AI helps in achieving and maintaining compliance with environmental regulations.
- **Informed Decision-Making**: Data-backed insights support smarter strategic and operational decisions.

Challenges

- Data quality and availability
- Lack of model interpretability (black-box nature)
- Integration with traditional legacy systems
- Requirement for domain-specific AI training

Conclusion and Future Directions

AI is poised to transform chemical process technology into a data-driven, adaptive, and sustainable discipline. As the field evolves, continued research and industry collaboration will be vital to address existing challenges. The future lies in the development of interpretable AI, hybrid models that combine domain knowledge with data, and accessible tools tailored for chemical engineers and plant operators.