Advanced Crude Oil Distillation Unit (CDU) Operations

Course general description:

Crude Oil Distillation Units (CDUs) are the heart of any refinery, serving as the primary separation process for converting crude oil into valuable products such as naphtha, diesel, kerosene, and fuel oils. This course delves into the advanced principles, operational techniques, troubleshooting strategies, and engineering concepts that govern CDU operations. Participants will gain a deep understanding of the complexities of CDUs, including optimization, energy efficiency, safety, and sustainability practices. Through lectures, case studies, simulations, and discussions, participants will be equipped to address operational challenges and leverage advancements in CDU technology.

Audience:

This course is designed for:

1. Process engineers and operators working in refineries.
2. Refinery managers and supervisors seeking advanced operational insights.
3. Maintenance and reliability engineers involved in CDU systems.
4. Graduates in chemical, petroleum, or process engineering disciplines.

Course objectives:

By end of the course participants will gain:

1. Understand the principles and functions of crude oil distillation.
2. Master advanced methods and techniques for optimizing CDU operations.
3. Develop skills in troubleshooting common operational problems.
4. Explore engineering concepts for improving energy efficiency and reducing emissions.
5. Learn about advancements in CDU technology, including digitalization and sustainability.
6. Apply knowledge through real-world case studies and practical exercises

Course duration:

5 days

Course location:

Cairo-Dubai-Istanbul

Course contents:

Day 1: Fundamentals of Crude Oil Distillation

- Overview of CDUs – Introduction to Crude Distillation Units (CDUs) in refining, types of crude oil, and key components like preheat trains, desalters, and distillation columns.
- Principles of Distillation – Explanation of vapor-liquid equilibrium, fractionation theory, and the role of reflux, reboilers, and side strippers in distillation.
- Pretest and Group Discussion – Pretest to assess baseline knowledge and discussion on challenges in crude oil variability and feedstock quality.
- Case Study – Analyze the performance of a basic CDU setup.
- Interactive Learning – Group discussion and practical case study to reinforce distillation concepts.

Day 2: Advanced Operational Techniques

- Feed Preparation & Desalting – Importance of desalting, operating parameters, and the impact of poor desalting on downstream units.
- Atmospheric & Vacuum Distillation – Design and operation of atmospheric distillation columns and vacuum distillation for processing heavy residues.
- Optimization of Cut Points – Techniques for maximizing product yields by optimizing cut points.

- Practical Exercises – Simulate an atmospheric distillation column operation and calculate cut points for diesel yield.
- Quiz – Evaluate understanding of distillation principles with a quiz.

Day 3: Energy Efficiency and Heat Integration

- Heat Integration & Energy Recovery – Design of preheat trains, fouling mitigation, heat exchangers, and waste heat recovery systems.
- Energy Optimization – Introduction to pinch analysis for optimizing energy use.
- Fouling & Corrosion – Discussion on causes, effects, and preventive measures for fouling and corrosion in CDUs.
- Case Study – Optimize a preheat train to reduce energy consumption, followed by group discussions on balancing energy efficiency with operational constraints.
- Quiz – Assess understanding of energy integration and fouling mitigation strategies**.**

Day 4: Troubleshooting and Problem Solving

- Common Operational Problems – Discuss flooding, weeping, entrainment, pressure drops, temperature excursions, and product contamination in distillation columns.
- Troubleshooting Tools – Use of process simulation software, real-time monitoring, and predictive maintenance tools.
- Hands-On Simulation – Simulate and troubleshoot a flooding issue using process simulation software.
- Group Activity – Develop a troubleshooting plan for a hypothetical CDU problem.
- Practical Learning – Apply learned troubleshooting techniques in hands-on and group activities.

Day 5: Advancements and Final Assessment

- Innovations in CDU Technology – Overview of advanced control systems, automation, carbon capture, renewable feedstocks, and emerging trends in refining technologies.
- Career Pathways & Industry Outlook – Future opportunities in CDU operations, professional development, and global trends in the energy transition.
- Final Assessment – Comprehensive written test covering all course content.
- Post-Test Comparison – Compare results with the pretest to measure knowledge progress.
- Feedback Session – Discuss key takeaways and address any remaining participant questions**.**

Methodology:

- 50% lectures & concepts
- 10% Videos
- 15% Case studies
- 15% Exercises
- 10% Discussions

Course code: (TPRS002)