

## Advanced Gas Fractionation

### Course general description:

This advanced course provides comprehensive coverage of gas fractionation principles, design, and operations in oil and gas processing facilities. The program focuses on deep technical understanding of fractionation technology, thermodynamics, process optimization, and troubleshooting. Participants will gain advanced knowledge of column design, internals selection, control strategies, and operational excellence in gas fractionation units

### Audience:

This course is designed for:

1. Process Engineers
2. Operations Engineers
3. Plant Operators
4. Technical Services Personnel
5. Design Engineers
6. Maintenance Engineers
7. Production Engineers

### Course objectives:

By end of the course participants will gain:

1. Apply advanced thermodynamic principles to fractionation processes
2. Design and optimize fractionation columns and systems
3. Evaluate column internals and their performance
4. Implement advanced control strategies
5. Troubleshoot complex operational issues
6. Optimize energy efficiency in fractionation operations
7. Analyze and improve separation efficiency
8. Apply safety considerations in design and operation
9. Conduct technical and economic evaluations

### Course duration:

5 days

### Course location:

Cairo-Dubai-Istanbul

### Course contents:

#### **Day 1: Advanced Fractionation Fundamentals**

- Thermodynamics & Phase Behavior – Vapor-liquid equilibrium (VLE), thermodynamic models, and phase behavior in multicomponent systems.
- Mass Transfer & Separation Efficiency – Mass transfer principles, separation efficiency, and column hydraulics.
- Operational Analysis – Flooding/loading calculations, pressure drop analysis, and feed conditioning.
- Energy Considerations – Energy balance and efficiency improvements.
- Practical Applications – Case study on VLE calculations, problem-solving on column hydraulics, and daily quiz.

#### **Day 2: Column Design and Internals**

- Tray Design & Selection – Valve trays, sieve trays, and bubble cap trays.
- Packing Systems – Random and structured packing selection and design.
- Column Sizing & Internals – Feed introduction, liquid/vapor distributors, and collector systems.

- Material & Installation Considerations – Internals installation requirements and material selection.
- Practical Applications – Case study on internals selection, group exercise on column sizing, and daily quiz.

### **Day 3: Process Control and Optimization**

- Control Strategies – Advanced process control techniques and dynamic column behavior.
- Instrumentation & DCS Configuration – Control system design and instrumentation setup.
- Energy Optimization – Heat integration, energy-saving strategies, and efficiency improvements .
- Performance Monitoring – Key performance indicators (KPIs) and process optimization.
- Practical Applications – Case study on control strategy development, simulation exercise on dynamic response, and daily quiz.

### **Day 4: Troubleshooting and Operations**

- Operational Challenges – Common process problems and diagnostic techniques.
- Performance & Capacity Analysis – Efficiency evaluation and capacity limitations.
- Startup & Shutdown – Standard operating procedures and emergency scenarios.
- Maintenance & Safety – Preventive maintenance, safety systems, and environmental compliance.
- Practical Applications – Case study on troubleshooting, group exercise on performance analysis, and daily quiz.

### **Day 5: Special Applications and Assessment**

- Advanced Applications – Cryogenic fractionation and high-pressure operations.
- Innovations & Future Trends – Emerging technologies and process improvements.
- Final Course Review – Summary of key topics and Q&A session.
- Final Examination – Comprehensive assessment and evaluation.
- Certification – Exam results discussion and certificate distribution.

#### **Methodology:**

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

**Course code: (TPRS009)**