Strategic Chemical Process Design and Optimization Training Course



30 Nov - 04 Dec 2026

Boston

7500 € (Per Person)

Ref: #ACE2628_197627

Course Introduction / Overview:

This intensive training course provides a comprehensive exploration of modern chemical process design and optimization, blending fundamental principles with advanced techniques. In an era where efficiency, safety, and sustainability are paramount, mastering these skills is crucial for professional chemical engineers. This program is meticulously structured to guide participants from initial conceptualization to the implementation of highly optimized and robust processes. Drawing upon foundational concepts detailed by leading academics like Robin Smith in his seminal work, "Chemical Process Design and Integration," the course emphasizes a holistic approach. Participants will delve into process synthesis, simulation, heat integration, and reaction engineering, learning to balance competing objectives such as capital cost, operating efficiency, and environmental impact. BIG BEN Training Center has designed this curriculum to be highly practical, ensuring that theoretical knowledge is immediately applicable to real-world industrial challenges. The course moves beyond simple software proficiency, fostering a deep strategic understanding that enables engineers to innovate and lead in the competitive global chemical industry.

Target Audience / This training course is suitable for:

- Chemical Engineers.
- Process Design Engineers.
- Research and Development Scientists.
- Plant and Operations Managers.
- Project Engineers and Managers.
- Technical Service Engineers.
- Process Safety Engineers.
- Junior and Senior Engineering Professionals.

Target Sectors and Industries:

- Oil and Gas.
- Petrochemicals and Refining.
- Pharmaceuticals and Biotechnology.
- Specialty and Fine Chemicals.
- Food and Beverage Processing.
- Water and Wastewater Treatment.
- Plastics and Polymers Manufacturing.
- Governmental Bodies and Environmental Agencies.

Target Organizations Departments:

- Process Engineering and Design.
- Research and Development (R&D).
- Plant Operations and Production.
- Project Management and Engineering.
- Health, Safety, and Environment (HSE).
- Technical and Process Support.
- Capital Projects and Investment Planning.

Course Offerings:

By the end of this course, the participants will have able to:

- Develop and interpret Process Flow Diagrams (PFDs) and Piping and Instrumentation Diagrams (P&IDs).
- Apply principles of mass and energy balance to complex chemical systems.
- Design and analyze various types of chemical reactors and separation units.
- Utilize pinch analysis and heat integration techniques for energy optimization.
- Employ process simulation tools for steady-state and dynamic process modeling.
- Implement advanced optimization strategies to improve process performance and profitability.
- Conduct comprehensive process safety analyses, including HAZOP studies.
- Evaluate the economic feasibility and sustainability of process designs.
- Integrate green chemistry and engineering principles into new and existing processes.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to foster a dynamic and engaging learning environment that bridges theory and practice. This course utilizes a blended approach, combining expert-led presentations with interactive workshops, group discussions, and detailed case study analyses from various industries. Participants will engage in hands-on exercises that simulate real-world process design and optimization challenges, allowing them to apply concepts in a practical context. Collaborative problem-solving sessions are a core component, encouraging the exchange of ideas and experiences among peers. The instructor will facilitate these sessions, providing personalized feedback and guiding participants toward innovative solutions. Emphasis is placed on critical thinking and strategic decision-making rather than rote memorization. This immersive and participant-centered approach ensures that attendees not only grasp the technical material but also develop the confidence and skills to implement these advanced techniques effectively within their own organizations upon completion of the course.

Course Agenda (Course Units):

Unit One Fundamentals of Chemical Process Design

- Introduction to process design principles and hierarchy.
- Developing and interpreting Process Flow Diagrams (PFDs).
- Understanding Piping and Instrumentation Diagrams (P&IDs).
- Fundamentals of mass and energy balances in process systems.
- Thermodynamic principles and phase equilibria for process calculations.
- Material selection and corrosion considerations in design.
- Introduction to process equipment specification sheets.

Unit Two Reactor and Separation Process Design

- Principles of chemical reaction engineering and kinetics.
- Design and analysis of ideal and non-ideal reactors.
- Selection criteria for different reactor types (CSTR, PFR, Batch).
- Fundamentals of equilibrium-stage separation processes.
- Design principles for distillation, absorption, and stripping columns.
- Advanced separation techniques including membrane separation and adsorption.
- Process synthesis for reaction and separation systems.

Unit Three Process Integration and Energy Optimization

- Introduction to process integration and energy efficiency.
- Fundamentals of heat exchanger design and network synthesis.
- Pinch analysis for setting energy targets and optimizing utility systems.
- Heat integration strategies for grassroots and retrofit projects.
- Design of utility systems including steam, cooling water, and refrigeration.
- Waste heat recovery technologies and applications.
- Mass integration and water network optimization.

Unit Four Process Simulation and Advanced Optimization

- Introduction to process modeling and simulation environments.
- Developing steady-state process simulations.
- Convergence techniques and troubleshooting simulation models.
- Introduction to dynamic simulation for process control and safety studies.
- Formulating and solving process optimization problems.
- Linear and non-linear programming techniques in process design.
- Data-driven modeling and optimization approaches.

Unit Five Process Safety, Economics, and Sustainability

- Inherent safety in process design principles.
- Hazard identification techniques (HAZID, What-if).
- Hazard and Operability (HAZOP) study methodology.
- Capital and operating cost estimation techniques.
- Economic evaluation metrics (NPV, IRR, Payback Period).
- Integrating sustainability and green engineering principles into design.
- Life Cycle Assessment (LCA) for chemical processes.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

How can the principles of circular economy be fundamentally integrated into the initial stages of chemical process design, rather than being an afterthought, to create inherently sustainable and profitable systems?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself by adopting a holistic and strategic perspective on chemical process design, moving beyond the conventional focus on software proficiency. While many programs concentrate on the mechanics of simulation tools, this training emphasizes the underlying engineering principles and critical thinking required to make sound design decisions. It uniquely integrates the crucial pillars of process safety, economic viability, and environmental sustainability into every stage of the design curriculum, reflecting modern industrial demands. Participants learn not just how to design a process, but how to design a process that is inherently safer, more profitable, and environmentally responsible from its conception. The curriculum is structured to build a deep conceptual understanding, from fundamental thermodynamics and reaction kinetics to advanced optimization and process integration. By focusing on the 'why' behind the 'how,' the course equips engineers with a versatile and future-proof skill set, enabling them to innovate and solve complex, multi-faceted problems rather than merely executing routine calculations. This strategic approach fosters leadership and a forward-thinking mindset essential for career advancement in the chemical industry.