# Advanced Reaction Engineering and Reactor Design Training Course



Ref: #ACE6689

## Course Introduction / Overview:

This training course gives a comprehensive look into the core principles of advanced reaction engineering and reactor design. Chemical reactors are the heart of any chemical plant, where raw materials are turned into valuable products. Optimizing these reactors is crucial for improving yield, efficiency, and safety. This course gives participants a solid foundation in the fundamental concepts of chemical kinetics and reactor types, including batch, continuous stirred tank (CSTR), and plug flow reactors (PFR). We explore how to model complex reactions, account for non-ideal flow patterns, and design reactors for multiphase systems. The curriculum is informed by leading academic and industry resources, such as the book Chemical Reaction Engineering by Octave Levenspiel, which serves as a foundational reference. BIG BEN Training Center is committed to giving a forward-thinking curriculum that equips professionals with the skills needed to design, analyze, and optimize reactors for a wide range of industrial applications.

## Target Audience / This training course is suitable for:

- Chemical and process engineers.
- R&D scientists.
- Plant managers and operations leaders.
- Process design and project engineers.
- Academics and students in chemical engineering.
- Technical and engineering consultants.
- Professionals in catalyst development.

## Target Sectors and Industries:

- Chemical manufacturing.
- Petrochemicals.
- Oil and gas.
- Pharmaceuticals.
- Polymers and plastics.
- Government agencies and research institutes.
- Energy and power generation.

## Target Organizations Departments:

- Process design and engineering.
- Research and development.
- Operations and production.
- Capital projects.
- Process control and automation.
- Quality assurance.
- Technical services.

## Course Offerings:

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

- Describe the fundamentals of chemical kinetics.
- Design and size ideal batch and continuous reactors.
- Model non-ideal flow using residence time distribution (RTD).
- Analyze and design reactors for multiple reactions.
- Understand the principles of catalytic and multiphase reactors.
- Perform heat and mass balances on reactor systems.
- Discuss safety and control aspects of reactor design.
- Use simulation software for reactor modeling.

## Course Methodology:

This training course uses a blend of theoretical instruction, guided exercises, and hands-on projects to give a dynamic learning experience. The curriculum combines theoretical lectures with real-world case studies to bridge the gap between academic concepts and practical application. Participants will use hands-on activities, including group workshops and scenario-based exercises, to reinforce their understanding of key topics. We use discussions and Q&A sessions to encourage a collaborative learning environment, where participants can share experiences and insights. The course also includes an in-depth analysis of successful and unsuccessful projects from various industries to highlight best practices and common pitfalls. This approach gives participants the confidence to apply their new knowledge directly to their professional roles. At BIG BEN Training Center, we believe that an engaging and interactive format is key to mastering new skills, so he focuses on giving immediate feedback and continuous support throughout the training. The methods are designed to ensure every participant leaf with a clear, practical skill set.

## Course Agenda (Course Units):

### Unit One: Fundamentals of Reaction Kinetics.

- Rate laws and reaction order.
- Temperature dependency and activation energy.
- Homogeneous and heterogeneous catalysis.
- Reaction mechanisms.
- Analysis of kinetic data.

## Unit Two: Design of Ideal Reactors.

- Batch reactors.
- Continuous stirred-tank reactors (CSTRs).
- Plug flow reactors (PFRs).
- Reactor sizing and performance equations.
- Comparing reactor types for different reactions.

## Unit Three: Non-Ideal Reactor Behavior.

- Residence time distribution (RTD).
- Modeling non-ideal reactors.
- Dispersion and tanks-in-series models.
- Fluidized bed reactors.
- Optimizing reactor networks.

## Unit Four: Multiphase and Catalytic Reactors.

- Fundamentals of heterogeneous catalysis.
- Gas-solid and gas-liquid reactors.
- Fixed bed and fluidized bed reactors.
- Trickle bed reactors.
- Heat and mass transfer effects.

## Unit Five: Reactor Design and Optimization.

- Reactor safety and runaway reactions.
- Heat integration in reactor systems.
- Reactor design for selectivity and yield.
- Case studies in industrial reactor design.
- Future trends in reaction engineering.

# 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 advancements in computational fluid dynamics (CFD) and AI-driven modeling fundamentally change the way we design and optimize complex, multiphase chemical reactors?

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

This training course is unique because it combines a strong theoretical foundation in reaction engineering with a practical, hands-on approach to reactor design. While many courses discuss the basic principles, our curriculum goes deeper, giving participants the tools and methods needed to solve complex, real-world problems. We don't just teach you about PFRs and CSTRs; we help you find out how to model non-ideal behavior, account for heat transfer limitations, and select the right reactor for a specific industrial application. The curriculum is heavily focused on real-world case studies from major industries, enabling participants to apply what they learn to solve complex industrial challenges. It’s an advanced program that gives professionals the skills needed to innovate and optimize the core of any chemical plant.