Catalytic Reactor Design in Chemical Engineering Training Course

Professional Development Training Course Outline

Category	General Training	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Catalytic Reactor Design in Chemical Engineering Training Course equips engineers, researchers, and industry professionals with advanced insights into heterogeneous and homogeneous catalysis, reaction kinetics, and reactor modeling. Participants will gain hands-on expertise in designing, optimizing, and scaling catalytic reactors, bridging theoretical foundations with practical industry applications. The program emphasizes cutting-edge tools, process simulation, and data-driven methodologies to enhance reactor performance, minimize energy consumption, and reduce environmental impact.

Through a blend of lectures, interactive workshops, and real-world case studies, this course empowers professionals to tackle complex catalytic systems with confidence. Participants will explore emerging trends such as microreactors, process intensification, green catalysis, and AI-assisted reactor optimization. By the end of the program, attendees will possess the skills to improve process efficiency, implement innovative solutions, and drive sustainable chemical manufacturing practices. This course is essential for chemical engineers aiming to stay at the forefront of reactor design and process innovation.

Programme Curriculum

Catalytic Reactor Design in Chemical Engineering Training Course

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Course Objectives

1. Understand fundamental principles of catalysis and reactor design.
2. Apply reaction kinetics and thermodynamics to industrial processes.
3. Master heterogeneous and homogeneous catalytic systems.
4. Design and optimize batch, CSTR, and plug flow reactors.
5. Implement process simulation and modeling tools
6. Enhance reactor performance through scale-up techniques.
7. Apply safety and environmental regulations in reactor design.
8. Explore process intensification and microreactor technologies.
9. Integrate AI and machine learning for predictive reactor optimization.
10. Analyze reaction mechanisms and catalyst deactivation phenomena.
11. Evaluate energy efficiency and sustainability metrics in chemical processes.
12. Solve real-world challenges using industrial case studies.
13. Foster innovative thinking and problem-solving in catalytic engineering.

Target Audience

1. Chemical engineers and process engineers.
2. R&D scientists in catalysis and chemical industries.
3. Plant managers and operations engineers.
4. Graduate and postgraduate chemical engineering students.
5. Environmental and sustainability engineers.
6. Industrial consultants in process optimization.
7. Professionals in petrochemical, pharmaceutical, and polymer industries.
8. AI and simulation specialists in chemical process industries.

Course Modules

Module 1: Fundamentals of Catalysis

- Introduction to catalytic mechanisms and kinetics.
- Types of catalysts: heterogeneous vs homogeneous.
- Catalyst characterization and activity evaluation.
- Case Study: Industrial ammonia synthesis via Haber-Bosch process.
- Emerging trends in green catalysis and nanocatalysts.

Module 2: Reaction Kinetics & Thermodynamics

- Reaction rate laws and order determination.
- Temperature and pressure effects on reaction rate.

- Thermodynamic constraints in reactor design.
- Case Study: Exothermic reaction control in oxidation reactors.
- Application of Arrhenius and Van’t Hoff equations in design.

Module 3: Reactor Types & Design Principles

- Batch, CSTR, PFR, and packed bed reactors.
- Residence time distribution and conversion analysis.
- Design equations for ideal reactors.
- Case Study: Continuous biodiesel production in CSTR.
- Selection criteria for industrial reactors.

Module 4: Process Simulation & Modeling

- Introduction to Aspen Plus, COMSOL, and MATLAB.
- Simulation of catalytic reactor performance.
- Optimization of operating conditions.
- Case Study: Simulation-based optimization of methanol synthesis.
- Sensitivity analysis and uncertainty quantification.

Module 5: Catalyst Deactivation & Regeneration

- Causes and types of catalyst deactivation.
- Modeling deactivation kinetics.
- Regeneration strategies for long-term operation.
- Case Study: Fluid catalytic cracking in refineries.
- Economic implications of catalyst lifetime.

Module 6: Scale-up & Process Intensification

- Challenges in scaling laboratory reactors to industrial scale.
- Process intensification techniques and microreactors.
- Heat and mass transfer considerations.
- Case Study: Microreactor for pharmaceutical synthesis.
- Optimization of throughput and safety.

Module 7: Sustainability & Energy Efficiency

- Green chemistry principles in reactor design.
- Energy integration and waste minimization strategies.
- Lifecycle assessment and environmental impact.
- Case Study: Sustainable ethylene oxide production.
- Implementation of renewable feedstocks.

Module 8: AI & Advanced Optimization Techniques

- Machine learning for predictive reactor design.
- Real-time monitoring and control of catalytic reactors.
- Digital twins and process automation.
- Case Study: AI-assisted catalyst selection in petrochemical plants.
- Future trends in smart chemical manufacturing.

Training Methodology

This course employs a participatory and hands-on approach to ensure practical learning, including:

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	27 Nov 2026	Online	$1,000
23 Nov 2026	27 Nov 2026	Physical	$1,500
23 Nov 2026	27 Nov 2026	Physical	$3,000

Start Date	End Date	Location	Price
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$4,500
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

Ready to enroll or request a customized program? Book online or contact us:

Register Online Now

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