Kinetics and Reactor Modeling 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

In today's rapidly evolving process industries, advanced Reaction Engineering, Process Intensification, Digital Twin Technology, Computational Modeling, and Sustainable Manufacturing have become critical drivers of operational excellence. Kinetics and Reactor Modeling Training Course is designed to equip professionals with the knowledge and practical skills required to analyze reaction mechanisms, develop kinetic models, optimize reactor performance, and implement data-driven decision-making strategies. Participants will gain comprehensive exposure to Chemical Reaction Kinetics, Catalytic Processes, Machine Learning for Process Optimization, Process Simulation, and Advanced Reactor Design techniques used across chemical, petrochemical, pharmaceutical, energy, and specialty chemical industries.

The program combines theoretical foundations with real-world industrial applications, enabling participants to solve complex reaction engineering challenges through modern modeling tools and simulation platforms. Emphasis is placed on Process Digitalization, Artificial Intelligence in Chemical Engineering, Predictive Analytics, Sustainability Optimization, Carbon Reduction Technologies, and Industry 4.0 Integration. Through practical case studies, simulation exercises, and industrial examples, learners will develop competencies in reactor scale-up, parameter estimation, model validation, process safety assessment, and performance optimization, ensuring improved productivity, efficiency, and profitability in modern manufacturing environments.

Programme Curriculum

Kinetics and Reactor Modeling Training Course

Introduction

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Course Duration

5 days

Course Objectives

Upon completion of this training, participants will be able to:

1. Understand advanced Chemical Reaction Kinetics principles and applications.
2. Develop accurate Kinetic Models for industrial reaction systems.
3. Apply Data Analytics and Machine Learning techniques in kinetic parameter estimation.
4. Design and optimize Batch, CSTR, and Plug Flow Reactors.
5. Utilize Digital Twin Technology for reactor performance monitoring.
6. Perform Process Simulation and Modeling using industry-standard software.
7. Evaluate Catalytic Reaction Systems and catalyst performance.
8. Conduct Reactor Scale-Up and Scale-Down Studies effectively.
9. Implement Predictive Maintenance strategies through process modeling.
10. Assess Process Safety and Risk Management in reaction systems.
11. Optimize reactor operations for Energy Efficiency and Sustainability.
12. Integrate Industry 4.0 technologies into reaction engineering workflows.
13. Develop solutions for Net-Zero Emissions and Green Manufacturing initiatives.

Target Audience

1. Chemical Engineers
2. Process Engineers
3. Production Engineers
4. Research & Development Scientists
5. Process Simulation Specialists
6. Plant Operations Managers
7. Petrochemical and Refinery Professionals
8. Pharmaceutical and Specialty Chemical Industry Professionals

Course Modules

Module 1: Fundamentals of Chemical Reaction Kinetics

- Reaction rate theories and mechanisms

- Elementary and complex reactions
- Rate law development and interpretation
- Temperature dependence and Arrhenius equation
- Kinetic parameter estimation techniques
- **Case Study:** Kinetic analysis and optimization of ammonia synthesis reactions.

Module 2: Advanced Reaction Mechanisms and Catalysis

- Homogeneous and heterogeneous catalysis
- Catalyst characterization techniques
- Surface reaction kinetics
- Catalyst deactivation and regeneration
- Selectivity and yield optimization
- **Case Study:** Catalytic cracking optimization in petroleum refining.

Module 3: Reactor Design Fundamentals

- Batch reactor design principles
- Continuous Stirred Tank Reactor (CSTR) modeling
- Plug Flow Reactor (PFR) analysis
- Reactor sizing and residence time calculations
- Conversion and performance evaluation
- **Case Study:** Reactor selection for pharmaceutical API production.

Module 4: Computational Reactor Modeling

- Mathematical model development
- Mass and energy balance formulation
- Numerical solution techniques
- Model calibration and validation
- Sensitivity and uncertainty analysis
- **Case Study:** Simulation of exothermic polymerization reactors.

Module 5: Process Simulation and Digital Twins

- Process simulation workflows
- Digital twin architecture
- Real-time process monitoring
- Predictive analytics integration
- Performance optimization strategies
- **Case Study:** Digital twin deployment for petrochemical reactor monitoring.

Module 6: Machine Learning and AI in Reaction Engineering

- AI-driven process optimization
- Machine learning for kinetic modeling
- Data-driven reactor performance prediction
- Advanced process control applications
- Industrial AI implementation frameworks
- **Case Study:** AI-based optimization of catalytic reactor operations.

Module 7: Reactor Scale-Up, Safety and Sustainability

- Scale-up methodologies
- Process safety assessment
- Hazard identification and mitigation
- Sustainable reactor design concepts
- Carbon footprint reduction strategies
- **Case Study:** Safe scale-up of hydrogen production reactors.

Module 8: Industrial Applications and Emerging Technologies

- Industry 4.0 applications in chemical processing
- Smart manufacturing technologies
- Advanced reactor configurations
- Green chemistry and circular economy
- Future trends in reaction engineering
- **Case Study:** Small Modular Reactor (SMR)-inspired process intensification concepts for energy-efficient 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
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

Email: info@fineskilltrainingcenter.com | Website: www.fineskilltrainingcenter.com