Research Methods for Chemical Engineers 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

Research Methods for Chemical Engineers Training Course is designed to equip participants with advanced skills in experimental design, data-driven research, process optimization, and AI-enhanced chemical engineering analysis. In today's rapidly evolving industrial landscape, chemical engineers must integrate statistical modeling, machine learning, computational simulation, and sustainable process design to solve complex engineering problems. This course bridges the gap between theory and industrial application by emphasizing Design of Experiments (DOE), process analytics, simulation tools, and research innovation frameworks that are aligned with modern chemical engineering challenges.

The training also emphasizes digital transformation in chemical engineering research, enabling participants to leverage tools such as Python, MATLAB, multivariate data analysis, and predictive modeling techniques. With a strong focus on industrial case studies, real-world problem solving, and research publication strategies, learners will gain the ability to design robust experiments, analyze chemical processes efficiently, and contribute to innovation in areas like sustainability, green chemistry, process intensification, and smart manufacturing systems.

Programme Curriculum

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Course Objectives

1. Master advanced chemical engineering research methodologies
2. Apply Design of Experiments (DOE) and statistical modeling techniques
3. Develop skills in process simulation and computational modeling
4. Utilize Python and MATLAB for data-driven chemical analysis
5. Implement machine learning in chemical process optimization
6. Understand multivariate data analysis and regression modeling
7. Design and interpret industrial-scale experimental research
8. Improve process efficiency using AI-driven optimization techniques
9. Conduct literature review and scientific research structuring
10. Apply sustainability and green chemistry research principles
11. Develop skills in research publication and technical reporting
12. Use predictive analytics for chemical process improvement
13. Integrate digital transformation tools in chemical engineering research

Target Audience

1. Chemical Engineers in manufacturing industries
2. Process Engineers and Plant Operators
3. Research & Development (R&D) Scientists
4. Graduate and Postgraduate Chemical Engineering Students
5. Industrial Quality Control Engineers
6. Data Analysts in chemical/process industries
7. Academicians and Lecturers in engineering fields
8. Energy, petrochemical, and pharmaceutical professionals

Course Modules

Module 1: Fundamentals of Research Methods in Chemical Engineering

- Scientific research frameworks and methodology types
- Hypothesis formulation and validation techniques
- Literature review and gap identification strategies
- Research ethics and data integrity principles
- Experimental vs computational research approaches
- **Case Study:** Development of research framework for optimizing refinery output efficiency

Module 2: Design of Experiments (DOE) and Statistical Analysis

- Full factorial and fractional factorial designs
- ANOVA and regression analysis techniques
- Response Surface Methodology (RSM) applications
- Optimization of experimental variables
- Statistical validation of experimental results
- **Case Study:** Optimization of catalytic reaction yield using DOE

Module 3: Computational Modeling & Simulation

- Process simulation fundamentals
- Introduction to Aspen Plus/MATLAB modeling concepts
- Numerical methods for chemical engineering problems
- Model validation and sensitivity analysis
- Scaling simulation results to industrial systems
- **Case Study:** Simulation of distillation column performance in petrochemical plant

Module 4: Data Analytics and Machine Learning in Chemical Engineering

- Data preprocessing and feature engineering
- Supervised and unsupervised learning methods
- Predictive modeling for process optimization
- Neural networks in chemical process systems
- AI-driven decision-making in operations
- **Case Study:** Predicting polymer quality using machine learning models

Module 5: Process Optimization Techniques

- Linear and nonlinear optimization methods
- Constraint-based process optimization
- Energy efficiency improvement techniques
- Multi-objective optimization strategies
- Industrial application of optimization algorithms
- **Case Study:** Optimization of heat exchanger network for energy savings

Module 6: Sustainable & Green Chemical Engineering Research

- Principles of green chemistry
- Life Cycle Assessment (LCA) methodologies
- Waste minimization and valorization techniques
- Carbon footprint analysis in processes
- Renewable feedstock research methods
- **Case Study:** Sustainable biodiesel production optimization from waste oils

Module 7: Research Writing, Publication & Technical Reporting

- Structure of scientific papers and journals
- Data visualization and interpretation techniques
- Referencing and citation management tools
- Grant writing and proposal development
- Peer review and publication strategies

- **Case Study:** Preparing a publishable paper on reactor efficiency improvement

Module 8: Industrial Research & Innovation in Chemical Engineering

- Translational research from lab to industry
- Pilot plant design and scale-up methodologies
- Innovation management in chemical industries
- Industry 4.0 integration in chemical research
- Technology readiness level (TRL) assessment
- **Case Study:** Scale-up of nanocatalyst production for industrial use

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:

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