Bioprocess Engineering Fundamentals Training Course

Professional Development Training Course Outline

Category	General Training	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Bioprocess Engineering Fundamentals is a critical discipline that integrates biotechnology, biochemical engineering, process optimization, biomanufacturing, sustainable production, industrial microbiology, fermentation technology, bioreactor design, process analytics, and quality-by-design (QbD) principles to develop efficient biological production systems. As industries increasingly adopt Industry 4.0, digital bioprocessing, artificial intelligence (AI), process analytical technology (PAT), advanced biomanufacturing, and sustainability-driven production, professionals require a strong understanding of bioprocess engineering concepts to enhance productivity, product quality, regulatory compliance, and operational excellence.

Bioprocess Engineering Fundamentals Training Course provides participants with comprehensive knowledge of upstream processing, downstream processing, cell culture technology, fermentation science, process scale-up, bioprocess control, contamination management, validation strategies, and regulatory frameworks. Through practical case studies and industry-focused learning, participants will gain the skills necessary to design, operate, troubleshoot, optimize, and validate modern bioprocess systems used in pharmaceutical, biotechnology, food, agricultural, and environmental industries.

Programme Curriculum

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Course Objectives

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

1. Understand modern Bioprocess Engineering Principles and industrial applications.
2. Apply Advanced Fermentation Technologies for enhanced productivity.
3. Design and optimize Bioreactor Systems for biological production.
4. Implement Process Analytical Technology (PAT) strategies.
5. Utilize Digital Biomanufacturing and Industry 4.0 concepts.
6. Optimize Upstream Processing Operations.
7. Improve Downstream Processing Efficiency.
8. Apply Quality-by-Design (QbD) methodologies.
9. Develop effective Contamination Control Programs.
10. Perform Bioprocess Scale-Up and Technology Transfer.
11. Analyze critical process parameters using Data Analytics.
12. Ensure compliance with GMP and Regulatory Requirements.
13. Drive Sustainable and Cost-Effective Bioprocessing Solutions.

Target Audience

1. Bioprocess Engineers
2. Biotechnology Professionals
3. Process Engineers
4. Production Supervisors
5. Quality Assurance Personnel
6. Research Scientists
7. Pharmaceutical Manufacturing Specialists
8. Technical Managers and Plant Leaders

Course Modules

Module 1: Introduction to Bioprocess Engineering

- Fundamentals of bioprocess engineering
- Role of biotechnology in industry
- Bioprocess industry trends
- Biological production systems overview

- Economic considerations
- **Case Study:** Development of a commercial recombinant protein production facility.

Module 2: Microbiology for Bioprocesses

- Microbial cell structure
- Industrial microorganisms
- Growth kinetics
- Metabolic pathways
- Strain selection criteria
- **Case Study:** Selection of microbial strains for enzyme production.

Module 3: Biochemistry and Cell Metabolism

- Cellular energy generation
- Metabolic engineering concepts
- Enzyme kinetics
- Product formation pathways
- Metabolic flux analysis
- **Case Study:** Optimization of metabolic pathways for bioproduct yield improvement.

Module 4: Upstream Processing Fundamentals

- Media development
- Inoculum preparation
- Sterilization techniques
- Process preparation
- Culture maintenance
- **Case Study:** Media optimization for high-cell-density cultivation.

Module 5: Fermentation Technology

- Batch fermentation
- Fed-batch fermentation
- Continuous fermentation
- Fermentation monitoring
- Process troubleshooting
- **Case Study:** Improving fermentation productivity in a vaccine manufacturing process.

Module 6: Bioreactor Design and Operation

- Bioreactor classifications
- Mixing and aeration systems
- Oxygen transfer mechanisms
- Heat transfer requirements
- Bioreactor performance evaluation
- **Case Study:** Design optimization of a large-scale stirred-tank bioreactor.

Module 7: Cell Culture Engineering

- Mammalian cell culture
- Stem cell cultivation

- Suspension cultures
- Adherent cell systems
- Cell culture scale-up
- **Case Study:** Commercial monoclonal antibody production process.

Module 8: Process Monitoring and Control

- Process sensors
- PAT implementation
- Automation systems
- Real-time monitoring
- Control loop optimization
- **Case Study:** Deployment of PAT tools in biopharmaceutical production.

Module 9: Downstream Processing Fundamentals

- Product recovery methods
- Cell separation technologies
- Filtration systems
- Centrifugation operations
- Clarification techniques
- **Case Study:** Improving protein recovery efficiency.

Module 10: Purification Technologies

- Chromatography principles
- Membrane separation
- Ultrafiltration systems
- Diafiltration techniques
- Product polishing
- **Case Study:** Purification process design for therapeutic proteins.

Module 11: Scale-Up and Technology Transfer

- Scale-up principles
- Engineering challenges
- Process characterization
- Technology transfer planning
- Risk management
- **Case Study:** Transition from pilot plant to commercial production.

Module 12: Quality Assurance and Validation

- GMP requirements
- Process validation
- Cleaning validation
- Documentation practices
- Deviation management
- **Case Study:** Validation strategy for a biologics manufacturing facility.

Module 13: Contamination Control and Biosafety

- Sources of contamination
- Cleanroom considerations
- Biosafety requirements
- Environmental monitoring
- Corrective actions
- **Case Study:** Investigation of microbial contamination events.

Module 14: Sustainability and Bioprocess Optimization

- Resource efficiency
- Energy optimization
- Waste minimization
- Green bioprocessing
- Circular bioeconomy concepts
- **Case Study:** Sustainable biomanufacturing implementation project.

Module 15: Emerging Technologies in Bioprocess Engineering

- AI-driven bioprocess optimization
- Digital twins
- Continuous biomanufacturing
- Single-use technologies
- Smart factories
- **Case Study:** Industry 4.0 implementation in a modern bioprocess facility.

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	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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

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