


**ONLINE COURSE**

On-demand

**COURSE FEE**

350 € per session

**COURSE ORGANIZATION**

Course divided in 7 sessions

Sessions can be taken individually

Sessions scheduling: suggested one per week

Effort: 4 - 8 h per session

**COURSE DESCRIPTION**

This advanced course in fermentation engineering focuses on the digital scale-up and optimization of microbial processes, through an in-depth case study of glutamic acid production. Participants will learn and apply methodologies in kinetic analysis, process modeling and simulation, scale-up strategies, and optimal operational design. The course integrates upstream and downstream operations, aiming to maximize annual glutamate output or minimize production costs

**INSTRUCTOR**

Jean-Marc Engasser, BioProcess Digital

**DIGITAL LEARNING**

- Learning platform with course resources
- Live or recorded slideshow videos
- Fermentation project on spreadsheets templates with self-corrections and guides
- Online collective or one-to-one tutoring

**COURSE PROGRAM**
**PART 1: KINETIC ANALYSIS AND SIMULATION MODEL DEVELOPMENT**
**Session 1: Kinetic analysis of the fermentation**

At the laboratory, evaluation of the rates of bacteria growth, sugar consumption, and metabolites production

**Session 2: Kinetic analysis of oxygen consumption and transfer**

At the laboratory, determination of the oxygen consumption rate, of the oxygen solubility and air to medium transfer rate

**Session 3: Fermentation modeling-simulation**

Modeling-simulation of the bacteria growth and metabolism in the laboratory batch fermentor

**PART 2: DIGITAL SCALE-UP AND OPTIMIZATION**
**Session 4: Batch fermentation scale-up and production optimization**

Scale-up of the fermentation simulation model. Optimization of the batch fermentation operation for highest production

**Session 5: Batch fermentation cost optimization**

Cost evaluation of the fermentation process. Optimization of the batch fermentation operation for lowest production cost

**Session 6: Fed-batch fermentation optimization**

Optimal operation of the fed-batch fermentations for reduced co-metabolites excretion and lowest cost

**Session 7: Fermentation intensification by oxygen-enriched air**

Optimization of the fed-batch fermentor, aerated with oxygen-enriched air, for increased production