



# BIOREACTOR DESIGN AND ANALYSIS

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**INTENDED AUDIENCE :** Students with a background in Biotechnology/ Bioprocess Engineering/Biochemical Engineering/ Chemical Engineering

**PREREQUISITES:** The student is expected to have a basic knowledge of mathematics Prerequisite courses can be Material and Energy Balances, Biological Rate processes, Enzyme science and Engineering

**INDUSTRIES APPLICABLE TO :** All Industrial Biotechnology related industries. SMEs/Companies dealing with production of compounds via microbial/plant/animal cell fermentations

## **COURSE OUTLINE :**

This is a core course suitable for undergraduate or postgraduate students interested in the area of bioprocess engineering or biological engineering. The course introduces the student to design principles of batch, fed-batch and continuous bioreactors. Mass and heat transfer requirements for a given fermentation system will be discussed. The student will also be able to identify suitable criterion for the scale-up of bioprocesses and characterize non-ideality in bioreactors, if present.

## **ABOUT INSTRUCTOR :**

Prof. Smita Srivastava has expertise in the application of Chemical and Biochemical Engineering principles for the development of large-scale sustainable bioprocesses for commercial production of speciality chemicals. She is an Associate Professor in the Department of Biotechnology at IIT Madras. She has more than 10 years of Teaching experience in which she has taught many theory and lab courses related to the field of Bioprocess engineering, including Bioreactor Design and Analysis, Bioprocess Modeling and Simulation, Plant Cell bioprocessing, Bioreaction Engineering Lab and Bioprocess Engineering Lab, for the B.Tech/M.Tech/M.S/PhD students of the Institute. Her research experience in bioprocess engineering has resulted in 23 peer-reviewed international journal publications as first/corresponding author, 5 book chapters, 5 Indian patent applications and 30 different international/national conference presentations in the broad area of bioprocess development and optimization.

To promote research in a specialized field like Plant Cell Bioprocess, she formulated and offered a new course in 2012 on Plant Cell Bioprocessing (as a professional elective) for the undergraduates and postgraduate students of IIT Madras. This course is also offered as an NPTEL course now. Dr. Smita is also affiliated to the Teaching and Learning Center at IIT Madras as a core faculty member, where she rendered her services as coordinator and resource person in various faculty development programmes/workshops and teaching assistant training programmes.

## **COURSE PLAN :**

**Week 1:** Introduction to the course, Design of batch bioreactors

**Week 2:** Design of batch bioreactors

**Week 3:** Design of fed- batch bioreactors Design of continuous mode of bioreactors

**Week 4:** Design of continuous mode of bioreactors

**Week 5:** : Mass transfer in bioreactors, Rheology of fermentation broths, Heterogeneous reactions in bioprocesses

**Week 6:** Heterogeneous reactions in bioprocesses (contd.), Heat transfer in bioreactors

**Week 7:** Heat transfer in bioreactors (contd.) Scale-up of bioreactors: criteria for scale-up, scale-up parameters

**Week 8:** Scale-up of bioreactors (contd.), Non-ideal reactors: design and analysis