



# INDUSTRIAL BIOTECHNOLOGY

## PROF. DEBABRATA DAS

Department of Biotechnology  
IIT Kharagpur

**INTENDED AUDIENCE :** Biotechnology, Chemical Engineering, Biochemical Engineering, Food Technology, Environmental Engineering, Applied Microbiology, Pharmacy.

**PRE-REQUISITES :** Knowledge in microbiology, Biochemistry and mathematics in 10+2 level

**INDUSTRIES APPLICABLE TO :** DuPont India, IFB Agra Industry, IOC; ONGC, Dr. Reddy's Laboratories, Biocon United beverages.

## COURSE OUTLINE :

The course aims to provide fundamental insights to exploit enzymes and microbes for the manufacturing of products which have a huge industrial significance. It uniquely blends the science and engineering with various biochemical processes to obtain products of diverse fields such as chemicals, food, bioenergy etc. The course introduces bioreactors, its types, operation methods and provides an experimental demonstration of the same. Strategies to obtain higher yields, design of the reactors and production of biofuels from microbes are thoroughly explained. Students of various disciplines such as biotechnology, chemical engineering, food engineering, and pharmaceutical industries can be benefitted from the course as it discusses the existing bioprocess applications such as wine and cheese making, antibiotics and vaccines etc. The course majorly focusses on the applications and allows students to gain practical knowledge rather than mere theory. Major bottlenecks for the operation of biochemical industries will be discussed.

## ABOUT INSTRUCTOR :

Prof. Debabrata Das pursued his doctoral studies from Indian Institute of Technology (IIT) Delhi. He is a Senior Professor at IIT Kharagpur. He was also associated as MNRE Renewable Energy Chair Professor. He has pioneered the promising R&D of Bioenergy production processes by applying fermentation technology. Prof. Das is involved in three different area of research: Gaseous energy recovery from organic wastes; algal biorefinery and CO<sub>2</sub> sequestration; and microbial fuel cell. He is presently involved in teaching both undergraduate and post-graduate courses on Biochemical Reaction Engineering; Aspects of Biochemical Engineering; Bioprocess Plant and Equipment Design; and Bioprocess Technology for the students of Department of Biotechnology; Department of Chemical Engineering; Department of Chemistry and School Energy Science and Engineering. He has been teaching for the last 29 years. He was associated as a Biochemical Engineer in M/s. Citurgia Biochemicals Ltd., Surat and involved in citric acid production through fermentation process. Presently, he has the Google h-index of 43 for his research work. He has about 137 research publications in the peer reviewed journals and contributed more than 30 chapters in the books published by International publishers. He is the author of the books: Biohydrogen Production: Fundamentals and Technology Advances published by M/s. CRC Press, New York and Biohythane: Fuel for the future published by Pan Stanford Publishing, Singapore. He is the Editor of the book entitled Algal Biorefinery: An Integrated Approach published separately by Springer, Switzerland and Capital Publishing Company, India. Another book entitled A bioelectrochemical system that convert wastes to Watts is with the publisher.

## COURSE PLAN :

**Week 1:** Introduction, Microbes and enzymes of industrial importance

**Week 2:** Different types of bioreactors and bioreactor design

**Week 3:** Microbial growth, substrate degradation and product formation kinetics, Tutorial 1

**Week 4:** Instrumentation, Sterilization of air, media and reactor

**Week 5:** Upstream and Downstream processing

**Week 6:** Production of Oxy Chemicals I: Tax and non-tax alcohol, Brewing industry, Tutorial 2

**Week 7:** Production of Oxy Chemicals II: Wine making, Vinegar and citric acid production, Tutorial 3

**Week 8:** Production of Oxy Chemicals III: Antibiotics: Penicillin; Streptomycin

**Week 9:** High fructose corn syrup, Cheese making, and Single cell production

**Week 10:** Vaccines production and Metal leaching

**Week 11:** Bioenergy- Gaseous fuels: Biohydrogen, Biomethane and Microbial fuel cell;  
Liquid fuels: Bioethanol, Biodiesel and Biobutanol

**Week 12:** Aerobic and Anaerobic wastewater treatment processes, Tutorial 4