

Course contents for Biochemical Engineering

1. **Faculty:** FLSB
2. **Course code:**
3. **Course title:** Biochemical Engineering
4. **Number of credits:** Two
5. **Course Objectives:**

This course can educate the students about chemical engineering strategies which are commonly employed in process industries, and how to implement them into biological systems to produce valuable metabolites in biotech-industries. Subsequently, the fundamental biochemical engineering concepts including cell-growth kinetics, bioreaction engineering, bioprocess design and transport operation will be taught in this course.

6. **Minimum prerequisites for taking this course, if any:**

Only those students who have already cleared the course Fermentation Technology are eligible.

7. **Course structure with units, if applicable:**

- a. **Introduction to biochemical engineering:** chemical engineering in biological process, features of biochemical systems and industrial biochemical processes.
- b. **Enzyme catalysis and applications:** enzymes used in industry, medicine and food, enzyme immobilization techniques, enzyme reactors with typical examples.
- c. **Cell cultivation and kinetics:** factors affecting microbial growth, stoichiometry of microbial reactions, monod model and other structured and unstructured models for cell cultivation.
- d. **Transport phenomena in bioprocess systems:** introduction of dimensionless numbers, Newtonian and nonNewtonian behaviour of fermentation broth, agitation and mixing, power consumption, gas/liquid transport in cells, transfer resistances, mass transfer coefficients and their role in scale-up of equipment, enhancement of oxygen transfer, heat transport in microbial system and heat transfer correlations.
- e. **Bioprocess economics:** process economics, bioproduct regulations and typical examples
- f. **Mixed microbial populations in applications and natural systems:** interrelationships of microorganisms in soil and other natural ecosystems, and biological waste water treatment.

8. **Suggested Readings:**

- a. Biochemical Engineering Fundamentals, JE Bailey and DF Ollis, McGraw-Hill (2010)
- b. Biochemical Engineering: A Textbook for Engineers, Chemists and Biologists, S Katoh & J Horiuchi, Wiley-VCH (2015)
- c. Biochemical Engineering, JM Lee, Prentice Hall (2009)
- d. Bioprocess Engineering Basic Concepts, by M Shuler and F. Kargi, Prentice Hall (2002)

9. **Evaluation:**

Theory:	Mid-semester Written Examination	: 40% Marks
	End-semester Written Examination	: 40% Marks
	Quiz / Assignment/Presentation (oral / poster)/other	: 20% Marks