

Department of Chemical Engineering

List of Major Courses

Specialization B : Bioengineering and Biotechnology

S.N.	Sem	Name of Course	NPTEL Sem (Even/Odd) tentative	Instructor's Name	Duration (weeks)	Credits
1	V	Industrial Biotechnology	Odd	Prof. Debabrata Das IIT Kharagpur	12	4
2	VI	Thermodynamics for Biological Systems : Classical and Statistical aspects	Even	Prof. G. K. Surreshkumar and Prof. Senapati, IIT, Madras	12	4
3	VI	Material and Energy Balances	Even	Prof. Vignesh Muthuvijayan, Dept of Biotechnology, IIT Madras	12	4
4	VII	Transport Phenomena in Biological Systems	odd	Prof. G.K. Suraish Kumar IIT Madras	12	4
5	VII	Principles of Downstream techniques in Bioprocesses	odd	Prof. Mukesh Doble Department of Biotechnology IIT Madras	12	4

Note to Students : The sequence of subjects, choice of semester is suggestive, tentative and depends upon availability of NPTEL course at that time.

Syllabus for Major Courses

Specialization B : Bioengineering and Biotechnology

1. Industrial Biotechnology

Syllabus

Unit 1 :

Introduction, microbes and enzymes of industrial importance, different types of bioreactors and bioreactor design

Unit 2 :

Microbial growth, substrate degradation and product formation kinetics, instrumentation, sterilization of air, media and reactor, upstream and downstream processing

Unit 3 :

Production of oxychemicals

Unit 4 :

High fructose corn syrup, Cheese making, single cell production, vaccine production, metal leaching

Unit 5 :

Bioenergy : gaseous fuels, biohydrogen, biomethane, microbial fuel cell, bioethanol, biobutanol and biodiesel, aerobic and anaerobic waste water treatment processes

2.Thermodynamics for Biological Systems : Classical and Statistical aspects

Syllabus :

Unit 1 :

Review of concepts, Useful thermodynamic functions

Unit 2 :

Thermodynamic properties of pure fluids

Unit 3 :

Thermodynamics of solutions, phase equilibria

Unit 4 :

Reaction Equilibria, Statistical Thermodynamics : definition and application

Unit 5 :

Macrostate, microstate, partition function and thermodynamic properties, ensemble and time average, review

3. Material and Energy Balances

Syllabus

Unit 1 :

Introduction, Units and dimensions, fundamentals of material balances, material balances for single and multiple units without reactions,

Unit 2 :

Material balances for reactive processes, combustion reactions, material balances for systems with recycle, bypass and purge

Unit 3:

Energy balances : objectives and procedures, mechanical energy balances

Unit 4 :

Energy balances for nonreactive processes with and without phase change

Unit 5 :

Mixing and solutions, energy balances on reactive processes, material and energy balances for unsteady state processes

4. Transport Phenomena in Biological Systems

Syllabus

Unit 1 :

Introduction, mass conservation principles, mass flux

Unit 2 and 3 :

Momentum flux for biological systems

Unit 4 :

Energy flux, Charge flux

Unit 5 :

Fluxes under simultaneous , multiple driving forces

5. Principles of Downstream techniques in Bioprocesses

Syllabus:

Unit 1 :

Heat and mass balances, flow sheets

Unit 2:

Solid liquid separation and its problems adsorption

Unit 3 :

Liquid liquid extraction

Unit 4:

Membrane separations, chromatographic separations

Unit 5 :

Chromatographic separations(contd), crystallization, drying, future trends

