

AMB13 MICROBIAL PROCESSING ENGINEERING

UNIT-1 BIO PROCESS DEVELOPMENT

An interdisciplinary challenge, major classes of products

UNIT-2 INTRODUCTION TO ENGINEERING CALCULATION, PRESENTATIONS AND ANALYSIS OF DATA

Physical variables, dimensions, units, errors in data and calculations, testing mathematical models, process flow diagram

UNIT-3 MATERIAL BALANCES

Thermodynamics Law of conservation of mass, types of material balance products, electron balances, biomass yield, theoretical oxygen demand, problems

UNIT-4 ENERGY BALANCES

Basic concepts, General Energy balance equations, Enthalpy calculations, Enthalpy changes in non-reactive processes, Types of energy balance calculations, Types of heat reactions, problems

UNIT-5 UNSTEADY STATE MATERIAL AND ENERGY BALANCES

Material balance equation for CSTR, Energy balance equations, solving differential equations, solving mass balances, solving energy balances, problems

UNIT-6 FLUID FLOW AND MIXING

Classification of fluids, Reynolds number, Momentum transfer, Non – Newtonian fluids, Two-Parameter models, rheological properties of fermentation broths, mixing, power requirements for mixing, scale-up of mixing systems, role of shear in stirred fermentors, problems

UNIT-7 HEAT TRANSFER

Equipments, mechanism of heat transfer, conduction, heat transfer between fluids, design equation for heat transfer systems, applications of design equations, problems

UNIT-8 MASS TRANSFER

Molecular diffusion, role of diffusion in bioprocessing, film theory, convective mass transfer, oxygen uptake and transfer in cell cultures, $k_L a$ determination, problems.

UNIT-9 HOMOGENEOUS REACTIONS

Basic reaction theory, calculation of reaction rates, general reaction kinetics for biological systems, yields in cell culture, cell growth kinetics, production kinetics, kinetics of cell death, problems

UNIT-10 HETEROGENEOUS REACTIONS

Concentration gradients and reaction rates in solid catalysts, internal mass transfer and reaction, the Thiele modulus and effectiveness factor, external mass transfer, problems

UNIT-1 REACTOR ENGINEERING

Bioreactor configurations, practical considerations for bioreactor construction, monitoring and control of bioreactors, ideal reactor operations, batch operation of a mixed reactor, case study of penicillin production.

Reference Books

1. Bioprocess Engineering - Basic concepts by M. L. Schuler & F. Kargi, Entice Hall 1992.
2. Bioprocess Engineering Principles by Pauline M. Doran, Academic Press 1995.
3. Fermentation & Biochemical Engineering Hand Book (1983), Principles, Process Design and Equipment. HC Vogel, Noyes.
4. Principal of Microbe & Cell Cultivation (1975), SJ Prit, Blackwell Scientific co.).
5. Bioprocess Computations in Biotechnology (Vol. 1) TK Ghose, Ellis howard Ltd.

