AMCH25 BIOCHEMICAL ENGINEERING

UNIT-1 INTRODUCTION TO BIOCHEMICAL ENGINEERING

1.1 Difference between a Chemical & Biological Reaction process
1.2 Steps in a Typical Biochemical process
1.3 Role of a Chemical Engineer in designing a Biochemical process

UNIT-2 INTROCUTION TO MICROBIOLOGY AND BIOCHEMISTY

2.1 The protist kingdom and classification
2.2 Structure of cell- functions of cell components
2.3 Comparison between prokaryotic, Eukaryotic, gram +ve & gram –ve
2.4 Hierarchy of cellular organization
2.5 Lipids & Polysaccharides- their role in cell architecture
2.6 Types of Nucleotides- RNA & DNA- genetic doers
2.7 Amino acids- General structure, peptide bond, hydrogen bonding & pK 1 & pK2 values 8. Proteins- Structure of proteins, classification based on functions, Process of gene expression- Transcription & Translation Control of Protein synthesis in cells,(Introduction & Repression)

UNIT-3 CELL GROWTH. METABOLISM AND ENERGETICS

3.1 Mitotic Multiplication
3.2 Factors affecting cell growth, requirements for cell growth & Medium formulation
3.3 ATP, NAD & FAD energy storing mechanism
3.4 Respiration- aerobic (TCA) & anaerobic mechanism
3.5 Carbon metabolism- EMP & shunt pathways.
3.6 Transport across cell membrance- Active, Passive & Facilitated
3.7 Stoichiometry of cell growth & product formation, Yield coefficient, elemental balance, degree of reduction, heat generation, Introduction to metabolic flux analysis

UNIT-4 CELL GROWTH KINETICS

4.1 Growth Cycle- Phases for Batch Culture
4.2 Microbial growth kinetics: Monod's Equation, Estimation of kinetic parameters using batch culture and continuous culture experiments
4.3 Modifications to account for endogenous & maintenance kinetics
4.4 Other forms of growth models- Tessier, Moser & Contois Malthu's Law, Logistic curve, Structured models- Compartmental models equations, Equations of metabolic models

UNIT-5 ENZVME ENGINEERING

5.1 Types of enzymes: intracellular & extra cellular, Hydrolytic, Protolytic & Esterases, Enzyme cofactors & their importance
5.2 Difference between a enzymatic & whole cell process
5.3 Enzyme immobilization- Chemical & Physical methods, advantages & limitation
5.4 Kinetics of enzyme catalyzed reactions
a. Michaelis Menten Kinetics

b. Methods for determining rate parameters, Lineweaver Burk Plot. Eadie Hofstee, Hanes plot
c. Reversible reactions, multiple substrates
d. Cofactor activation
e. Substrate activation & inhibition
f. Types of Enzyme inhibition reversible & irreversible, Competitive, Noncompetitive, uncompetitive and mixed
g. Effect of pH, Temperature and other environmental factors
h. Types of deactivation and deactivation kinetics. (Numerical examples and derivation of kinetic expressions based on mechanism)

5.5 Kinetics of immobilized enzyme
a. Effect of external mass transfer limitation
b. Effect of internal diffusion limitation
c. Both external & intraparticle controlling

UNIT-6 BIOREACTOR ENGINEERING

6.1 Fed Batch Reactor Analysis
6.2 CSTR'S for enzyme catalyzed reaction
6.3 CSTR'S for cell culture (steady state), CSTR with recycle
6.4 Description of typical aspects of aerobic fermenter, Description of bioreactor configurations
6.5 Description of alternate bioreactor configurations
6.6 Sterilization Reactors- Batch & continuous sterilization, Numerical Examples

UNIT-7 SPECIAL PRODUCT RECOVERY OPERATIONS

7.1 Chromatography, Membrane Separation – Microfiltration, Reverse Osmosis,
7.2 Electrophoresis, Aqueous two phase separation

CHAPTER 8: GENETIC ENGINEERING & RECOMBINANT DNA TECHNOLOGY AND TISSUE CULTURE TECHNIQUES

Reference Books:

1. Biochemical engineering fundamentals Book by Jay Bailey
2. Bioprocess Engineering Principles Book by Pauline M Doran