BTPC3001 BIOPROCESS ENGINEERING -I (UPSTREAM PROCESSING) [3-0-0]

Module I: (08 Hours)
Recapitulation of the principles of Kinetics for chemical and Bio-chemical Reactions. Fundamentals of homogeneous reactions for batch / semi-batch, plug low reactor (PFR), continuous stirred rank reactors (CSTR), fluidized bed reactor bubble column, air lift fermenter etc,.

Module II: (10 Hours)
Unconventional bioreactors: Hollow fiber reactor, membrane reactor, perfusion reactor for animal and plant cell culture. Analysis of ideal bioreactors: Fed-Batch reactors, Enzyme catalyzed reactions in CSTRs, CSTR reactors with Recycle and wall growth, Ideal Plug-Flow Tubular reactor.

Module III: (08 Hours)
Industrial application of enzymes: Enzymes used in detergents, leather,wool industries. and food processing. Production of glucose syrup from starch using starch hydrolyzing enzymes, production of syrup containing maltose, enzymes in sucrose industry, glucose from cellulose, lactase in dairy industry. (8 Hours)

Module IV: (08 Hours)
Methods of enzyme immobilization: Adsorption, entrapment, Direct covalent linking, cross-linking, Kinetics of immobilized enzyme Enzyme electro-catalysis (Biosensors): General approach to immobilization of enzymes into electrodes. Measurement of enzyme activity, Regeneration of cofactors. Abzymes and its application.

Module V: (06 Hours)
Food technology: Elementary idea of canning and packing. Sterilization and pasteurization of food products. Food preservation, Single cell proteins (Spirulina, Yeast). Micro-algal technology (Dunaliella, Haematococcous).

Books:

1. Principles of fermentation technology/Peter F. Stanbury, Allan Whitaker, Stephen J. Hall
2. Enzymes in industry: Production and application by W. Gerhartz, VCH Publishers, New York
3. Biochemical Engineering Fundamentals by Baily and Oilis
4. Process Engineering in Biotechnology by Jackson.
5. Microalgal biotechnology by Borowitzka

Course outcomes (Cos)
CO1: Understand Fundamentals of Upstream Processing: Explain the principles of upstream bioprocessing, including media formulation, sterilization, and microbial growth kinetics.
CO2: Analyze Microbial and Cell Culture Techniques: Apply knowledge of microbial and mammalian cell culture systems for large-scale production of bioproducts.
CO3: Design and Operate Bioreactors: Understand the design, configuration, and operation of bioreactors used in upstream processing, including batch, fed-batch, and continuous systems.
CO4: Optimize Growth Conditions and Process Parameters: Evaluate and optimize critical parameters like pH, temperature, aeration, and agitation to enhance productivity in upstream bioprocesses.
CO5: Implement Monitoring and Control Strategies: Demonstrate the ability to use sensors, control systems, and data analysis to monitor and regulate upstream bioprocesses efficiently.