BTS 453 BIOPROCESS TECHNOLOGY (SOFT CORE COURSE)

Hours: 40

Course outcomes:

After successful completion of the course, students will be able to:

CO 1. Understand basic principles of bioprocess technology and advantages of bioprocess over chemical process.
CO 2. Learn various aspects of up- and down-streaming processes in pilot scale study and application to larger scale in industry
CO 3. Have firm knowledge about industrial application of various fermenters and regulation of the fermentation process.
CO 4. Gain knowledge on recovery of products, techniques used for separation of cells, physical and chemical methods of cell lysis, filtration, centrifugation and large-scale separation techniques.

UNIT I (13 hrs)
Basic principles in bioprocess, advantages of bioprocess over chemical process. Isolation and improvement of industrially important strains. Design of fermentation media, inoculum development. Sterilization – Sterilization of medium, air and fermenters. Thermal death kinetics. Design of fermenter- criteria for ideal fermenter, aeration, agitation, valves, baffles, heat exchanges. Types of fermenters: tower fermenter, cylindroconical vessels, air-lift fermenter, deep-jet fermenter, the cyclone column, the packed tower, rotating disc fermenter and photobioreactors. Animal cell culture fermenter-stirred fermenter, microcarrier, encapsulation, hollow fiber chambers, packed glass bead reactors. Cell immobilization techniques.

UNIT II (13 hrs)
Types of fermentation processes: submerged fermentation, surface or solid substrate fermentation, batch fermentation, continuous fermentation, kinetics of fermentation processes. Transport phenomenon in bioprocesses- mass transfer, biological heat transfer and heat transfer coefficients. Online acquisition: Bioprocess control and monitoring of variables such as temperature, agitation, pressure, pH, PID control, use of computers in bioprocess control systems (data logging, analysis and control).

UNIT III (14hrs)
Downstream processing of biological molecules: Separation of cells, foam separation, flocculation, filtration, centrifugation (Basket and bowl centrifugation), cell lysis methods, physical and chemical methods. Large scale separation techniques like Distillation, solvent extraction, liquid-liquid extraction, chromatographic techniques, membrane filtration, ultra filtration, reverse osmosis, crystallization, spray drying, drum drying, freeze drying, whole broth processing. Application of cells in bioprocess (LAB, PAB, yeast, mixed cultures, plant and animal cells). Biosensors: construction and application, fermentation economics.

References

1. Biochemical Engineering fundamentals, Bailey J., Bailey J. & Ollis D.F., McGraw-Hill Pub.,1986
2. Chemical Engineering. J.M Coulson &J.F. Richardson, Pregamon Press, 2002
3. Comprehensive Biotechnology. Volumes 1, 2, 3 & 4. Moo-Young M., Pergamon Press, 2011
4. Fundamentals of Biotechnology. Prave P.et al., Wiley-Blackwell Pub., 1987
5. Principles of Fermentation Technology. StanburyP.F. et al Pergamon Press, 1984