INDUSTRIAL BIOTECHNOLOGY & MICROBIOLOGY (IBT-820) Credit Hrs 3 (3-0)

Educational Objectives:

- To provide an overview and discuss details of significant processes and products in biotechnological industries and commercial biology based activities.
- To impart the knowledge on Historical overview of Biotechnology, production of some commercially important modern Bioproducts, Industrial Enzymes, Products of plant and animal cell cultures. Production of recombinant proteins.

Course Outcomes:

After completing Industrial Biotechnology students will be equipped with a basic understanding of the following:

- Current bioreactor process technology
- Regulatory requirements
- Operational challenges
- Industrial case studies

Course Contents:

- Introduction to industrial bioprocess:
- A historical overview of industrial fermentation process – traditional and modern biotechnology. A brief survey of organisms, processes, products relating to modern biotechnology. Process flow sheeting – block diagrams, pictorial representation.
- Production of primary metabolites
- A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid, lactic acid, acetic acid etc.,); amino acids (glutamic acid, phenyalanine, aspartic acid etc.,) and alcohols (ethanol, butanol etc.,)
- Production of secondary metabolites
- Study of production processes for various classes of secondary metabolites: antibiotics: beta-lactams (penicillin, cephalosporin etc.), aminoglycosides (streptomycin etc.,) macrolides (erythromycin), vitamins and steroids.
- Production of enzymes and other bioproducts

- Production of industrial enzymes such as proteases, amylases, lipases, cellulases etc., Production of biopesticides, biofertilisers, biopreservatives (Nisin), cheese, biopolymers (xanthan gum, PHB etc.,), single cell protein.
- Production modern biotechnology products
- Production of recombinant proteins having therapeutic and diagnostic applications, production of vaccines. Production of monoclonal antibodies. Products of plant and animal cell culture Microbiology
- Microbial groups (bacteria, protozoa, microscopic algae, fungi, cyanobacteria, virus).
- Applied fields of microbiology (medical, aquatic, food, agricultural, geochemical, acromicrobilogy, industrial, exomicrobilogy).
- Cell types – structures of some prokaryotes and eukaryotes.
- Structures and functions of cell organelles.
- Differences between prokaryotes and eukaryotes.
- Cell differention, specialiazation and function.
- Taxanomic groups,
- Classification Methods e.g., for (Bacteria).
- Microbial Control, Preservation, and Maintenance
- Control & Preservation methods.
- Maintenance -Features to be considered (e.g cost, viability, purity, Genetic, etc) -Methods (subcluture, drying freeze drying, freezing , etc.
- Microbial metabolism
- Growth and growth measurement- Nutritional groups with respect to carbon and energy requirements (photoautotrophs, photoheterotrophs, chemoautotrophs,chemoheterotrophs).
- Type of microbial culture, setting up and maintaining them.
- Selection of organisms and optimization of yield of product
- Microorganism Growth in Controlled Environments
- Medium Development
- Growth of Microorganisms in an Industrial Setting
- insulin - downstream processing after E. coli fermentation
- Alcoholic beverage industry-Beer brewing and Wine-making
- History and current practices
- “Secondary” fermentations and their uses in wine making
- Genetic engineering of yeast strains to address key industry problems

- Industrial ethanol production
- Methods, sources of feed stocks used
- Current and potential microorganisms used
- Biochemical and microbiological issues in maximizing ethanol production
- Markets for ethanol and an analysis of economic and environmental issues
- Yeast production for the food industry – the transition from a beer-making by-product
- Fermented food industry -Food and beverage production (dairy products, bread making, mushroom growing, etc).
- Antibiotic production
- Microbial enzyme industry

Recommended Books:

1. Casida Jr, L.E., “Industrial Microbiology”, New Age International (P) Ltd.
2. Presscott, Dunn, “Industrial Microbiology”, Agrobios (India).
3. Wulf Cruger and Anneliese Crueger, “Biotechnology: A Textbook of Industrial Microbiology”, Panima Publishing Corporation.
4. Murrey Moo & Young, “Comprehensive Biotechnology”, Pergamon.
5. Industrial Microbiology: An Introduction by Michael J. Waites, Neil L. Morgan, John S. Rockey and Gary Higton. Blackwell Sciences. 2001
6. **Modern Industrial Microbiology and Biotechnology by NdukaOkafor 2007**
7. **Manual of Industrial Microbiology & Biotechnology by Baltz et al. 2010**