

## II SEMESTER

### BTH 501 MICROBIAL BIOTECHNOLOGY

Hours: 52

#### Course outcomes:

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

CO 1. Understand basic principles of primary and secondary metabolite production by the microorganisms,

CO 2. Understand regulation of fermentation processes and upstreaming and downstreaming

CO 3. Acquire knowledge of production of secondary metabolites like penicillin, streptomycin, and tetracycline, amino acids, vitamins, hormones, organic acids, microbial beverages like beer, and wine

CO 4. Know use of microorganisms as probiotics and the role of nutraceuticals in human health, waste utilization to generate biofuels and biogas.

#### UNIT I (13 hrs)

Microbial products: Microbial Biomass, Primary metabolites, secondary metabolites microbial enzymes, transformed products. Gene cloning in microorganisms other than *E. coli* (*Salmonella*, *Rhizobium*, *Agrobacterium*, *Bacillus subtilis*, *Streptomyces*, *Aspergillus niger*). Microbial primary and secondary metabolites: Aminoacids (Glutamic acid, L-lysine), Vitamins and hormones (vitamin B12, vitamin A, riboflavin, gibberellins). Organic acids and other industrial chemicals (Lactic acid, citric acid, alcohol, acetic acid, glycerol, acetone). Antibiotics (Penicillin, streptomycin, tetracycline), peptide antibiotics (lantibiotics)

#### UNIT II (13 hrs)

Microbial Enzymes: Microbial production of enzymes (Protease, amylase, invertase, pectinase, xylanase) substrate, production, purification of enzymes, immobilization, their application in food and other industries. Microbial exopolysaccharides (EPS), classification and applications (health, industrial, pharmaceutical and food): Alginate, Cellulose, Hyaluronic acid, Xanthan, Dextran, Gellan, Pullulan, Curdlan, polysaccharides of lactic acid bacteria; Chitin, chitosan and chitin derivatives.

#### UNIT III (13hrs)

Microbial beverages and food: Production of wine, beer, and vinegar. Microbial food: Oriental foods, Baker's yeast, cheese, SCP, SCO (PUFA), mushroom cultivation, sauerkraut, silage, probiotics. Nutraceuticals. Bioconversion, biofuels, biogas. Waste utilization to generate biofuels.

#### UNIT IV (13 hrs)

Biofertilizers: *Rhizobium*, *Azotobacter*, *Azospirillum*, *Cyanobacteria*, *Mycorrhiza*, phosphate solubilizers, *Frankia*. Biopesticides: *Bacillus thuringiensis*, *Bacillus popilliae*, *Trichoderma*, *Baculoviruses*. Plant growth promoting Rhizobacteria (PGPR)

#### References

1. Comprehensive Biotechnology. Vol. 1, 2, 3 & 4. Moo-Young, M., Pergamon Press, 2011
2. Fundamentals of Biotechnology. Prave, P. et al., Wiley-Blackwell Pub., 1987
3. Industrial Microbiology. Cassida, L.E., John Wiley & Sons, 1968
4. Industrial Biotechnology. Crueger, W. & Crueger, A., Sinauer Associates Inc., 1990
5. Industrial Biotechnology. Demain, A.L., American Society for Microbiology, 1986
6. Microbial Biotechnology. Glazer, A.G., WH Freeman and Company, 1994
7. Microbial Technology. Peppler, H.J., Vol. 1 & 2. Academic Press, 1979