Syllabus for B.Sc. (Biotechnology)
CBCS -2018
Group II Elective Courses
SEMESTER - I

BSCBTCE 133: FOOD TECHNOLOGY 24 hours

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Understand the composition of food and biotechnological applications in food industry
CO 2. Differentiate between processes and mechanisms of food spoilage, food contamination and food poisoning
CO 3. Describe food preservation by various physical and chemical methods and food packaging
CO 4. Apply the knowledge gained in the use of food additives, flavouring and colouring agents and applications of nutraceuticals

Unit I (12 hours)

Introduction

Fermented foods: Vegetables – sauerkraut; meat- sausages; soy sauce, tempeh; pickles. Composition of milk, contamination, preservation of milk, microbiological and biochemical tests. Dairy products: Fermented dairy products- cheese, yoghurt, buttermilk, kefir, koumiss. Acidophilus milk and their value. Mushroom as food. Single cell protein – bacteria, algae and fungi. Food spoilage - Contamination and food spoilage- perishable, semiperishable and nonperishable foods. Food poisoning – Exotoxins and endotoxins. Bacterial toxins- botulin, shell fish toxins, diphtheria toxins. Mycotoxins – Aflatoxins, ochratoxins, tentoxins, fuminosin

Unit II (12 hours)

Preservation: Physical- temperature low and high; high osmotic pressure- pickling, salting, curing; dehydration, canning and bolting, vacuum packing. Chemical: Natural- vinegar, alcohol, diatomaceous earth; synthetic – benzoates, calcium propionates, sodium nitrate, sodium nitrite, sulfite; microbial – colchicines, bacteriocin. Food additives. Permitted colors and odors, stabilizer, emulsifiers, antioxidants. Flavouring agents- glutamic acid and glycine salts, carotenoids. Coloring agents- turmeric, caramel coloring, cochimeal, saffron, betanin, brilliant blue, indigotine, tartrazine. Nutraceuticals

References:

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- Swaminathan M. 1991. *Essentials of Food and Nutrition* Vol I & II, Ganesh and Co., Madras.
- Winnaker. 2000. *From genes to clones* Panima Educational Book Agency.

SEMESTER - II

BSCBTCE 183: BIOPROCESS TECHNOLOGY 24 hours

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Understand the basic principles of bioprocess technology and bioreactors
CO 2. Describe the types of fermentation processes, factors affecting and regulation
CO 3. Apply the knowledge gained in strain improvement, up- and down-streaming processes and scale up in industrial fermentation
CO 4. Apply the knowledge gained in the techniques used for separation of cells, cell disruption, separation techniques, recovery of products and safety considerations

Unit I (12 hours)

Introduction to Bioprocesses Engineering. Kinetic of microbial growth and death, Bioreactors: Principle, Kinetics, types, design, analysis and application. Types of fermentation processes: analysis of batch, Fed-batch and continuous Bioreactions, stability of microbial reactions. Aeration and Agitation systems for bioreactor. Flow behaviour of fermentation fluids Gas-Liquid mass transfer, Solid and Liquid-phase mass transfer and Heat transfer. Measurement and control of bioprocess parameters.

Unit II (12 hours)

Media for industrial fermentation. Air and media sterilization, safety in fermentation laboratory. Strain improvement of industrially important microorganism, Classification of product formation, Product synthesis kinetics, Mass balance in bioprocesses system, Energy balance in Bioprocess system. Biochemistry of Fermentation Downstream processing: Introduction, removal of microbial cells and solid matter. Foam reparation, precipitation, centrifugation, cell disruption, chromatography. Product recovery processes and Unit operations. Safety consideration in down stream processing.

References

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- Trevor. Enzyme biochemistry, Biotechnology and Clinical Chemistry. Harwood Publishers.

SEMESTER - III

BSCBTCE 233: ADVANCED BIOTECHNIQUES 24 hours

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Apply the principle, instrumentation of advanced biotechniques such as electrophoresis for the separation of proteins and DNA
CO 2. Describe the latest technological advancements in the field of electrophoresis and their applications in biological research
CO 3. Understand the principle and instrumentation in radiolabelling of biomolecules, radioactivity detection and radioisotope techniques for the quantification of biomolecules
CO 4. Demonstrate the applications of radioisotope labelling and tracing in biological research and medicine

Unit I **(12 hours)**

Electrophoresis- Introduction, Migration of ions in electric field, factors affecting electrophoretic mobility. Paper electrophoresis: - Electrophoretic run, Detection techniques, Cellulose acetate electrophoresis, High voltage electrophoresis. Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & Estimation of macromolecules. Starch-gel; polyacrylamide gel (native and SDS-PAGE (determination of molecular weight of proteins, determination of subunit stoichiometry, molecular biology applications). Agarose-gel electrophoresis, 2D electrophoresis, pulsed field gel electrophoresis, immune-electrophoresis, isoelectric focusing - Principle, Establishing pH and density gradients, Procedures & applications.

(12 hours)

Unit II

Isotopic tracer technique - Radioactive & stable isotopes, rate of radioactive decay. Units of radioactivity. Measurement of radioactivity: - Ionization chambers, proportional counters, Geiger- Muller counter, Solid and liquid scintillation counters (basic principle, instrumentation and technique), Cerenkov radiation. Measurement of Stable isotopes: Falling drop method for deuterium measurement, Mass spectrometry. Principles of tracer technique, advantages and limitations, applications of isotopes in biotechnology (distribution studies, metabolic studies, isotope dilution technique, metabolic studies, clinical applications, autoradiography).

References

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- Arora MP. 2007. *Biophysics.* Himalaya Publishing House, New Delhi.
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SEMESTER - IV

BSCBTOE 283: BIOTECHNOLOGY IN DAILY LIFE 24 hours

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Understand the role of biotechnological applications in daily life towards and in the industrial production of useful enzymes, biological compounds and fermented beverages from microbes
CO 2. Describe genetic modifications in plants towards pest control and applications of plant biotechnology in agriculture in the production of biofertilizers and biopesticides
CO 3. Discuss the contributions of biotechnology in medicine with reference to in-vitro fertilization and stem cells, dairy industry and in the pharmaceuticals and the ethical issue involved
CO 4. Apply the knowledge of environmental biotechnology towards solid and liquid waste management and biofuel production

Unit I (12 hours)

Definition and History of Biotechnology, Scope and Importance of Biotechnology. Microbial world, fermentation. Applications of Biotechnology in Industry: Production of citric acid, alcoholic beverages, Enzymes like proteases, lipases and amylases. Plant biotechnology- GM crops, gene transfer technology, bioreactors, disease control through Bt genes. Applications of Biotechnology in Agriculture: Biofertilizers, Biopesticides, Transgenic plants, Mushroom production

Unit II (12 hours)

Applications of Biotechnology in Medicine and pharmaceuticals: Insulin therapeutic molecules like tPA, factor VIII, antibiotics. Animal biotechnology – transgenic animals, test tube babies (*In-vitro* fertilization), ethical issues, animal bioreactors, stem cells, stem cell therapy, Environmental biotechnology- composting, biodegradation, biotransformation, biomining. Applications of Biotechnology in Environmental pollution control: Municipal Solid waste management, sewage and industrial effluent treatment, biofuels, Petroleum degradation

References

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