

BTE 463 FUNDAMENTAL BIOTECHNOLOGY (OPEN ELECTIVE) Hours: 39

UNIT I (13hrs)

Origin of life. Microbial diversity – bacteria, viruses, fungi; Beneficial and harmful microbes. Normal microflora associated with humans and animals. Microbes in human and animal nutrition (e.g. ruminants and non-ruminants) and health. Interactions between microbes, plants and animals. Microbial biotechnology: Fermentation (e.g. ethanol, enzymes, hormones, biogas, biofuels, vitamins), Antibiotics and probiotics.

UNIT II (13hrs)

Plant biotechnology: Genetic manipulation (GM) of plants, GM plants (e.g. BT cotton, BT brinjal, Golden rice, Flvr-savr tomato), GM foods, Farmers Rights, Seed terminator technology. Litigations related to life (e.g. neem, Basmati rice, turmeric). Nutraceuticals. Plant tissue culture, synthetic seeds. Plant health and diseases. Edible vaccines. Plant-microbe associations, interactions (e.g. symbiosis, mutualism) and benefits. Plant cells to generate biochemicals and medicines. Micropropagation. Environmental Biotechnology: Revegetation and energy plantations (e.g. Neem, *Jatropha*, *Pongamia*). Bioremediation (plant and microbial). Microbes in mining. Waste processing and utilization.

UNIT III (13 HRS)

Animal biotechnology: Transgenic animals (e.g. mice, sheep, fish). *In vitro* fertilization and (IVF) and embryo transfer (ET), test-tube babies. Ethical issues (e.g. human and animal rights, surrogate mother). Animal cloning -Somatic and therapeutic cloning. Animal cell culture and organ culture. Animal cells as source of biochemicals (e.g. vaccines, hormones). Animals as bioreactors (e.g. mice).

References

1. Biology of microorganisms. Brock, T.B. & Madigan, M.T., Prentice Hall, 1996
2. Basic Biotechnology. Ratledge, C. & Kristiansen, B., Cambridge Univ. Press, 2006
3. Microbial Ecology. Atlas, R.M. & Bartha, R. Benjamin Cummings, 1997
4. Microbial Biotechnology. Glazer, A.G., WH Freeman & Co., 1994
5. Biotechnology of Higher Plants. Russell, G.E. Intercept Pub., 1988
6. Plant Biotechnology. Mantell, S.H. & Smith, H. Cambridge University Press, 1983
7. Animal Transgenesis and Cloning. Houdebine, L.-M. John Wiley & Sons, 2003
8. Gene VII. Lewin, B., Oxford University Press, 2000
9. Environmental Biotechnology. Jogdand, S.N., Himalaya Publishing House, 2012

UNIT I (13hrs)

Food chemistry – Carbohydrates, amino acids, proteins, lipids, vitamins - water soluble and fat soluble, macro- and micro-nutrients. Digestion, absorption and metabolism. Nutraceuticals, probiotics, antioxidants, vitamins, organic acids, single cell proteins. rDNA technology: cell culture, recombinant proteins, large scale production and applications. Genetically modified foods, transgenic plants, genetic engineering of animals for trait improvement. Food microbiology - Food spoilage – Source of contamination – microorganisms – bacteria, yeast, mould affecting various food items (milk, bread, canned food, vegetables and fruits, meats, egg, fish, poultry). Enzymes used in food industry – microbial production of enzymes (proteases, amylases, invertases, pectinase, xylanase), immobilization, applications, production of organic acids using microbial production of novel sweeteners.

UNIT II (13hrs)

Food preservation – Functional and fermented foods - Bakery and cereal products, preservation of fruits and vegetables – dehydration, pickling. Low temperature processing and storage – chilling, cold storage. High temperature processing – drying, heat sterilization. Irradiation – types and source of irradiation, impact of radiation on foods, irradiation of packing material, health consequences of irradiated food. Chemical preservation – organic, inorganic preservatives, Sulphur dioxide, Benzoic acid, Sorbic acid, antioxidants, cleaning, sanitizing, fungicidal agents. High concentration – sugar and salt concentrates. Biopreservatives, ohmic heating, microwave, hurdle technology

UNIT III (13hrs)

Food processing - Definition of shelf life, perishable foods, semi perishable foods, shelf stable foods. Fermentation of beer and wine – bottom, top fermentation systems, continuous fermentation, treatment. cheese production. Milk – pasteurization, fermented and non-fermented milk products. Canning and bottling of fruits and vegetables – process, containers, lacquering, spoilage. Layout of food processing unit and components – grinders, mixers, sterilizers, dryers, cold storage. Packaging materials – origin, types, characteristics. Packaging techniques. Quality standards – Food Safety Act, FSSAI, ISO series, national laws and regulations: PFA, FPO, BIS and Agmark and international laws and regulations. FAO and CODEX Alimentarius

References

1. Basic Food Microbiology- Banawart GJ. AVI Publ., 1979
2. Food chemistry - Fennema (Owen R) ed. Marcel Dekker Inc., 1996
3. Food microbiology - Frazier WC and Westhoff DC. Tata Mcgraw Hill., 1978
4. Food Biotechnology - Knorr D. Marcel Dekker Inc., 1993
5. Modern Food Microbiology - Jay J. M, Loessner MJ & Golden DA., Springer Publ., 2005
6. Handbook of food analysis- Mollet (Leo M.L.) ed. 3rd Ed., CRC press, 2015