

B. Sc (CBCS) Industrial Microbiology – III Year
Semester–VI (Discipline Specific Elective)
DSE-1F/A: FOOD MICROBIOLOGY AND FERMENTATION
TECHNOLOGY

Theory syllabus

Credits - 4

Unit-I

1. Microorganisms of food spoilage and their sources. Intrinsic and extrinsic factors that affect microbial growth in food.
2. Food intoxication (Botulism and *Staphylococcus* poisoning), Food born diseases (Salmonellosis and Shigellosis).
3. Microbial spoilage of different foods-fruits, vegetables, meat and fish.

Unit-II

1. Principles and Methods of Food Preservation: Physical methods- Temperature (Low and High), Irradiation, Microwave processing and Aseptic packaging, Chemical methods- Salt, Sugar, Benzoates, Citric acid, Ethylene oxide, Nitrate and Nitrite.
2. Probiotics definition, examples and benefits. Fermented dairy products-Yougurt, Acidophilus Milk, Kefir, Dahi and Cheese.
3. Microorganisms as Food- Single cell protein, Edible Mushrooms (White butter, Oyster and Paddy straw).

Unit-III

1. Types of fermentation processes- Solid state, Submerged surface, Batch, Fed-Batch and Continuous.
2. Design of fermenters- Laboratory, Pilot scale and Production fermenters, Components of a typical stirred tank bioreactor.
3. Microorganisms of industrial importance- Yeasts, Moulds, Bacteria and Actinomycetes. Outline of strain improvement.

Unit-IV

1. Ingredients used in fermentation medium- Molasses, Corn steep liquor, Whey and Yeast extract. Fermentation processes: Downstream processing- Filtration, Centrifugation Cell disruption, Solvent extraction.
2. Factors affecting fermentation process: Control of Agitation, Aeration, pH, Temperature and Dissolved oxygen (DO).
3. Microbial production of industrial products- Citric acid, Ethanol, Beverages (Beer), Penicillin, Glutamic acid.



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Practical syllabus

Credits – 1

1. Measurement and production of citric acid by *A. niger*.
2. Measurement and production of ethanol by *Saccharomyces*.
3. Measurement of in vitro production of IAA by soil fungi.
4. Demonstration for the production of amino acids by soil fungi.
5. Demonstration for the cultivation of mushroom.
6. Estimation of streptomycin.
7. Isolation and identification of microorganisms of spoiled food.
8. In vitro production of aflatoxin by *A. flavus*
9. Determination of microbiological quality of milk sample by MBRT.

References:

1. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
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8. Okafor N. (2007). Modern Industrial Microbiology and Biotechnology. 1st edition. Bios Scientific Publishers Limited. USA.
9. Waites M.J., Morgan N.L., Rockey J.S. and Higton G. (2001). Industrial Microbiology: An Introduction. 1st edition, Wiley – Blackwell.
10. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
11. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
12. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.



**B. Sc (CBCS) Industrial Microbiology – III Year
Semester-VI –B (Discipline Specific Elective)
DSE-1F/B: ENVIRONMENTAL MICROBIOLOGY**

Theory syllabus

Credits – 4

UNIT – I

1. Structure and function of ecosystems. Terrestrial Environment: Soil profile and soil microflora. Aquatic Environment: Microflora of fresh water and marine habitats.
2. Atmosphere: Aeromicroflora and dispersal of microbes.
3. Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels. Microbial succession in decomposition of plant organic matter.

UNIT - II

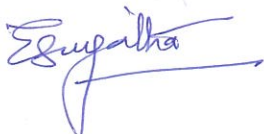
1. Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin.
2. Nitrogen cycle: ammonification, nitrification, denitrification and nitrate reduction.
3. Phosphorus cycle: Phosphate immobilization and solubilisation, Sulphur cycle: Microbes involved in sulphur cycle. Other elemental cycles: Iron and manganese.

UNIT – III

1. Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill).
2. Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment.
3. Bioremediation or Biodegradation: Microbial tolerance to heavy metals (Pb, Hg), Mechanisms of resistance, remediation of soil by microbes. Microbial plastics & biodegradation of petroleum. Brief idea about bio-magnification.

UNIT – IV

1. Eutrophication - food chain, potability of water - microbial assessment of water quality - water purification.
2. Brief account of water borne diseases and preventive measures
3. Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests.



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Practical syllabus

Credits – 1

1. Isolation of microorganisms from air
2. Isolation of microorganisms from water/sewage
3. Isolation of microorganisms from soil
4. Estimation of organic matter
5. Determination of BOD of waste water sample.
6. Determination of COD of waste water sample.
7. Bacteriological examination of water using multiple tube fermentation test: presumptive test, confirmed test and completed test
8. Study the presence of microbial activity by detecting (qualitatively) enzymes (dehydrogenase, amylase, urease) in soil.
9. Estimation of phosphates, sulphates and nitrates in polluted and unpolluted water bodies.
10. Isolation of phosphorous solubilizing bacteria/fungus from soil sample.
11. Demonstration of ammonification, nitrification and denitrification.

References:

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2. Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition. Pearson/ Benjamin Cummings.
3. Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg.
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6. Stolp H. (1988). Microbial Ecology: Organisms Habitats Activities. Cambridge University Press, Cambridge, England.
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