

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

NAAC A (3.02) State University

PATAN- 384265

**Faculty of Science**

**B. Sc. Microbiology**

Syllabus/ scheme

**Sem. – 4**



Sem./CBCS/Grading pattern

*w. e. f. June-2020*

(9)

(11)

**B.Sc. Microbiology (CBCS PATTERN) - Proposed curriculum**  
**Semester-4**

SEMESTER-4  
**MB-401 : FOOD AND DAIRY MICROBIOLOGY**  
(THEORY)

**TOTAL HOURS: 60**

**CREDITS: 3**

**Unit 1**

**A. Foods as a substrate for microorganisms** No. of Hours: 10  
Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general.

**B. Microbial spoilage of various foods** No. of Hours: 10  
Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods

**Unit 2**

**A. Principles and methods of food preservation** No. of Hours: 12  
Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO<sub>2</sub>, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins

**B. Fermented foods** No. of Hours: 10  
Dairy starter cultures, fermented dairy products: yogurt, acidophilus milk, kumiss, kefir, dahi and cheese, other fermented foods: dosa, sauerkraut, soy sauce and tampeh, Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market.

**Unit 3**

**A. Food borne diseases (causative agents, foods involved, symptoms and preventive measures)** No. of Hours: 14

Food intoxications: *Staphylococcus aureus*, *Clostridium botulinum* and mycotoxins; Food infections: *Bacillus cereus*, *Vibrio parahaemolyticus*, *Escherichia coli*, Salmonellosis, Shigellosis, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni*

**B. Food sanitation and control** No. of Hours: 6  
HACCP, Indices of food sanitary quality and sanitizers

**SUGGESTED READINGS**

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.
3. Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, New York.
4. Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.
5. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
6. Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.
7. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7<sup>th</sup> edition, CBS Publishers and Distributors, Delhi, India.
8. Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
9. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9<sup>th</sup> edition. Pearson Education.

## Semester-4

### SEMESTER-4

#### MB-402 : ENVIRONMENTAL MICROBIOLOGY

#### (THEORY)

TOTAL HOURS: 60

CREDITS: 3

#### Unit 1

No. of Hours: 20

##### A. Microorganisms and their Habitats.

Structure and function of ecosystems Terrestrial Environment: Soil profile and soil microflora Aquatic Environment: Microflora of fresh water and marine habitats Atmosphere: Aeromicroflora and dispersal of microbes

##### B. Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body. 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 2

No. of Hours: 20

##### A. Microbial Interactions

Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation Microbe-Plant interaction: Symbiotic and non symbiotic interactions Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria

##### B. Biogeochemical Cycling

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

#### Unit 3 Waste Management

No. of Hours: 20

##### A. Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill) 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

##### B. Microbial Bioremediation

Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter, biosurfactants

##### C. Water Potability

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

#### SUGGESTED READINGS

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
2. Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition. Pearson/ Benjamin Cummings
3. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition. Academic Press
4. Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York
5. Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Heidelberg
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
7. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
8. Lynch JM & Hobbie JE. (1988). Microorganisms in Action: Concepts & Application in Microbial Ecology. Blackwell Scientific Publication, U.K.
9. Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
10. Stolp H. (1988). Microbial Ecology: Organisms Habitats Activities. Cambridge University Press, Cambridge, England.
11. Subba Rao NS. (1999). Soil Microbiology. 4th edition. Oxford & IBH Publishing Co. New Delhi.
12. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

B.Sc. Microbiology (CBCS PATTERN) – Proposed curriculum

## Semester-4

13

TOTAL HOURS: 60

SEMESTER –4 (PRACTICALS)

CREDITS: 4

1. Isolation of microbes (bacteria & fungi) from soil (28°C & 45°C).
2. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane.
3. Assessment of microbiological quality of water.
4. Determination of BOD of waste water sample.
5. Isolation of *Rhizobium* from root nodules.
6. MBRT of milk samples and their standard plate count.
7. Alkaline phosphatase test to check the efficiency of pasteurization of milk.
8. Isolation of any food borne bacteria from food products.
9. Isolation of spoilage microorganisms from spoiled vegetables/fruits.
10. Isolation of spoilage microorganisms from bread.
11. Preparation of Yogurt/Dahi.

B.Sc. Microbiology (CBCS PATTERN) – Proposed curriculum

## Semester-4

SUBJECT ELECTIVE

MB-SE-401 : FOOD FERMENTATION TECHNIQUES (THEORY)

CREDITS: 2

TOTAL HOURS: 30

### Unit 1

No of Hours: 4

**A. Fermented Foods**

Definition, types, advantages and health benefits

**B. Milk Based Fermented Foods**

Dahi, Yogurt, Buttermilk (Chach) and cheese: Preparation of inoculums, types of microorganisms and production process

No of Hours: 8

**C. Grain Based Fermented Foods No of Hours: 6**

Soy sauce, Bread, Idli and Dosa: Microorganisms and production process

### Unit 2

**A. Vegetable Based Fermented Foods No of Hours: 4**

Pickels, Saeurkraut: Microorganisms and production process

**B. Fermented Meat and Fish No of Hours: 4**

Types, microorganisms involved, fermentation process

**C. Probiotic Foods No of Hours: 4**

Definition, types, microorganisms and health benefits

### Suggested Readings

1. Hui YH, Meunier-Goddik L, Josephsen J, Nip WK, Stanfield PS (2004) Handbook of food and fermentation technology, CRC Press
2. Holzapfel W (2014) Advances in Fermented Foods and Beverages, Woodhead Publishing.
3. Yadav JS, Grover, S and Batish VK (1993) A comprehensive dairy microbiology, Metropolitan
4. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer