



**SILVER OAK
UNIVERSITY**

EDUCATION TO INNOVATION

(Established under Gujarat Private Universities Act, 2009)

SEMESTER – V

Air and Water Microbiology

Food and Dairy Microbiology

Introduction to Bacterial Genetics 1

Introduction to Bacterial Genetics 2



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Subject: - Air and Water Microbiology								
Program: B.Sc.				Subject Code:			Semester: IV	
Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
04	-	4	6	24/60	20/50	16/40	-	150

THEORY

Unit:1 Air microbiology

- a. Air flora
 - (i) Transient nature of air flora
 - (ii) Droplet, droplet nuclei, and aerosols
- b. Air pollution: Chemical pollutants, their sources in air and effects on human health
- c. Methods of Air sampling and types of air samplers
 - (i) Impact on solids
 - (ii) Impingement in liquid
 - (iii) Sedimentation
 - (iv) Centrifugation
 - (v) Precipitation
 - (vi) Thermal Precipitation
- d. Air sanitation: Physical and chemical methods
- e. Air borne infections

Unit:2 Water microbiology-i

- a. Types of water: surface, ground, stored, distilled, mineral and de-mineralized water
- b. Bacteriological standards of potable water, Bureau of Indian standards (BIS) World health Organization (WHO)
- c. Water borne diseases
- d. Indicators of faecal pollution; *Coliforms*, *Streptococcus faecal*, *Clostridium perfringens*



Unit: 3 Water microbiology-ii

- a. Bacteriological analysis of Drinking Water
 - i. Presumptive coliform count
 - ii. Confirmed test
 - iii. Completed test
 - iv. Eijkman test
 - v. Membrane filter technique
- b. Quantitative analysis of Drinking water: MPN, SPC

Unit:4 Waste water microbiology

- a. Sewage and Waste Water
 - i. Physicochemical parameters: pH, temperature, total solids, Suspended solids, Chemical Oxygen Demand (C.O.D.)
 - ii. Biological parameters: B.O.D., Toxicity
 - iii. Industrial water pollutants, their ecological effects and health hazards
- b. Characteristics of waste water
 - i. Physico chemical parameters: pH, temperature, total solids, Suspended solids, Chemical Oxygen Demand (C.O.D.)
 - ii. Biological parameters: B.O.D, Toxicity
 - iii. Industrial water pollutants, their ecological effects and health hazards
- c. Methods of waste water treatment
 - i. Primary treatment and secondary treatment: Principles and role of microorganisms in: Septic tank, Imhoff tank, trickling filters, activated sludge process and oxidation ponds
 - ii. Advanced treatment and final treatment
 - iii. Solid waste processing: Anaerobic sludge digestion and composting



PRACTICAL

1. . Microbiological analysis of drinking water
 - A. Standard plate count
 - B. Detection of fecal pollution of water by performing presumptive, confirmed and completed test
 - C. Determination of MPN of coliforms in water
2. Study of skin flora
3. Study of Air flora by settling plate technique

REFERENCE BOOKS:

- Daniel Lim., Microbiology, 2nd Edition; McGraw-Hill Publication Ingraham J.L. and Ingraham C.A. (2004) Introduction to Microbiology. 3rd Edition. Thomson Brooks / Cole.
- Madigan M.T, Martinko J.M. (2006) Brock's Biology of Microorganisms. 11th Edition. Pearson Education Inc.
- Salle A.J. (1971) Fundamental Principles of Bacteriology. 7th Edition. Tata MacGraw Publishing Co.
- Tortora G.J., Funke B.R., Case C.L. (2006) Microbiology: An Introduction. 8th Edition.
- Stanier R.Y. (1985) General Microbiology. 4th and 5th Edn Macmillan Pub. Co. NY
- Pelzar M. J., Chan E. C. S., Krieg N. R.(1986) Microbiology. 5th Edition, McGraw-Hill Publication
- Prescott, Lancing M., John, P. Harley and Donald, A. Klein (2006) Microbiology, 6th Edition, McGraw Hill Higher Education
- Hans G. Schlegel (1993) General Microbiology, 8th Edition, Cambridge University Press
- Martin Frobisher (1937) Fundamentals of Microbiology, 8th Edition, Saunders, Michigan University press
- Standard Methods for the Examination of Water and Wastewater (2005) 21st edition, Publication of the American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF); edited by Andrew D. Eaton, Mary Ann H. Franson.



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THEORY

Unit: 1 Introduction to food microbiology

- a. Food as a substrate for microorganisms
- b. Principles of food preservation:
 - (i) Asepsis
 - (ii) Removal of microorganisms
 - (iii) Heat treatments employed in processing foods
 - (iv) Temperatures employed in low-temperature storage
 - (v) Methods of drying
 - (vi) Added preservatives
 - (vii) Developed preservatives
 - (viii) Preservation by radiation

Unit: 2 FOOD SPOILAGE

- a. Contamination and Spoilage of food
- b. Bread
- c. Vegetables and fruits
- d. Heated canned foods Food borne diseases
- e. Detection of food-borne pathogens
- f. The HACCP System and Food safety: Outline

Unit: 3 DAIRY MICROBIOLOGY



- a. Definition Indian standards
- b. Composition and nutritive value of milk
- c. Contamination and Spoilage of milk and milk products
- d. Preservation of milk and milk products
- e. Fermented milks
- f. Cheese production
- g. Probiotics

Unit:4 MICROORGANISMS AS FOOD AND FERMENTED FOODS

- a. Single cell protein
- b. Mushroom Culture
- c. List of fermented foods
- d. Production of alcoholic beverages
- e. Production of breads

PRACTICAL

1. Bacteriological analysis of food.
2. Bacteriological analysis of milk (MBRT, qualitative, quantitative, AFB) Sterility testing
3. Fermentative production of amylase and its estimation

Reference:

- Frazier, W. C. and Westhoff, D. C., (2006). Food Microbiology, 4Ed., Tata Mc-Graw Hill, India.
- Sukumar De. (2013). Outlines of Dairy Technology, Oxford university. (ISBN:978-0-19561194-6
- Wiley, J., & Sherwood, L. (2007). Prescott, Harley, and Klein's Microbiology, 9Ed., McGraw-Hill Science/Engineering/Math.
- Dubey, R.C. (2010). Textbook of Biotechnology, S. Chand. Multicolor 1Ed.
- James M. Jay (2000) Modern Food Microbiology.Sixth edition AN ASPEN PUBLICATION® Aspen Publishers, Inc. Gaithersburg, Maryland.
- Purohit, S. S., (2006). *Microbiology: Fundamentals and Applications*, 7Ed., Agrobios (India).



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Subject: - Introduction to Bacterial Genetics 1								
Program: B.Sc.				Subject Code:			Semester: IV	
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THEORY

Unit:1 Introduction to Bacterial Genetics

- Principles of inheritance - relevance of Mendelian laws
- Nature of genetic material: gene structure and function, arrangement and linkage, gene complementation, cistron, concept of intron and exon, one gene one polypeptide theory, structures of DNA, organization of bacterial chromosome. Microorganisms as genetic tools

Unit:1 Introduction to Bacterial Genetics

- Experiments to prove NA as inheritance material
- Semi-conservative mode of chromosome replication, work of Messelson and Stahl
- Molecular mechanism of chromosome replication, origin of replication, mode of formation of replication fork and its growth, post-replicative modification of DNA
- Models of chromosome replication- Cairn's model and Rolling circle model

Unit:1 Introduction to Bacterial Genetics

- Concept of central dogma and its exceptions
- Gene transcription as the 1st step of gene expression, molecular mechanism of transcription, role of RNA polymerase, initiation, elongation and termination of RNA synthesis, post transcriptional modifications in bacteria
- Nature of Genetic code - characteristics of genetic code - triplet, degeneracy, Wobble Hypothesis. Deciphering genetic code, work of Nirenburg, Holley and Khorana
- Type of RNAs involved in protein synthesis, structure and function of RNA

Unit:1 Introduction to Bacterial Genetics



- i. Gene translation: Ribosome- their general nature, structure and role in protein synthesis
- ii. Initiation, elongation and termination of protein synthesis, post translational processing
- iii. Protein localization- export of protein, role of signal peptides
- iv. Regulation of Gene_expression:
- v. Lac operon (positive & negative control),
- vi. Tryptophan operon (Attenuation control)

PRACTICAL

1. Isolation of pigmentation mutants of *S. marcescens* by U.V. mutagen
2. Isolation of resistant mutant by gradient plate technique
3. Isolation of DNA from *S. cerevisiae*

References:

- Microbiology, (5th Ed.) – Prescott
- Microbiology, (2nd Ed.) – R.M. Atlas
- Microbiology, (3rd Ed.) - Tortora
- Genes VIII, -Benjamin Lewin
- Molecular Genetics of Bacteria (2nd Ed.) - Snyder
- Molecular Biology of the Gene (5th Ed.) -J. D. Watson



Subject: - Introduction to Bacterial Genetics 2								
Program: B.Sc.				Subject Code:			Semester: IV	
Teaching Scheme				Examination Evaluation Scheme				
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THEORY

Unit:1

- i. Nature of mutation: spontaneous and inducible mutation
- ii. Phenotypic classes of bacterial Mutants and Genotypic classes of bacterial Mutants
- iii. Mutation rate & Mutagenesis(physical, oxidative deaminating agents, base analogues, intercalating agents, alkylating agents, Mu phage)

Unit:2

- i. Methods for the isolation of auxotrophic mutants, phenomic and phenotypic lag
- ii. Reversion of mutation- true reversion and suppression, types of suppressor mutations
- iii. DNA repair- direct and indirect repair mechanisms and recombination repair

Unit:3

- i. Introduction to genetic recombination and its biological significance: Types of recombination and their molecular mechanisms - generalized, site specific and illegitimate recombination, recombination frequency and its significance
- ii. Modes of genetic transfer in bacteria- merodiplodic nature of bacterial zygote
- iii. Plasmids and transposable elements

Unit:4

- i. Transformation: transformation principle, competence factor, mechanisms of DNA uptake, transfection
- ii. Transduction: phages involved in, types- restricted, generalized and abortive transduction
- iii. Conjugation: role of sex factor, types of crosses involved, F+ and Hfr cells. Mechanisms of chromosomal transfer interrupted mating and its applications, Zygotic induction, sexduction



PRACTICAL

1. Study of spontaneous nature of bacterial mutations using Replica plate technique

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- Microbiology, (5th Ed.) – Prescott
- Microbiology, (2nd Ed.) – R.M. Atlas
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