

MICROB-GE-2

MICROBES IN HEALTH AND HYGIENE

**Marks: 100 (Theory = 50 marks
Practicals = 50 marks)**

**Duration: Theory = 30 hours (2 credits)
Practicals = 60 hours (2 credits)**

Course objectives:

The main objective of this course is to introduce the students to the role of microorganisms in human health. Students will be exposed to the importance of microbe-human interactions when learning about the human microbiome. They will become aware of common diseases caused by microorganisms and will develop an understanding of probiotics and their importance in human health. They will be introduced to bacteriophages and their application in treatment/control of bacterial infections.

Pre-requisite: Student should have studied Biology/ Biotechnology/ Biochemistry in 12th standard.

Course Learning Outcomes:

Upon successful completion of the course, the student:

CO1: Will be acquainted with the importance of the human microbiome including the benefits as well as possible harmful effects. They will have a fair knowledge of various types of microorganisms surviving on/in the human body.

CO2: Will have gained knowledge about the spectrum of diseases caused by bacteria, viruses, protozoa and fungi. They will be familiar with the methods of transmission and control of various diseases.

CO3: Will understand the role of probiotics in human health. They will have learnt about the characteristics of probiotic microorganisms and have a fair idea of prebiotics and synbiotics. They will also have an overview of bacteriophages and their role in therapy.

CO4: Will have hands-on training on isolation of microorganisms from skin and staining of microorganisms collected from oral cavity, and will be able to check the efficacy of the sanitizer and antimicrobial action of heavy metals.

CO5: Will become aware of various probiotic products available in the market and the organisms included in these products. They will receive hands-on training for evaluation of various probiotic products and microbial strains.

CO6: Will have a fair understanding of bacteriophage typing and will also have hands on training in the isolation of bacteriophages from sewage samples.

Contents:

Theory:

30 hours

Unit 1: Role of microbiome in human health: Importance of human microbiome in health. Factors affecting the survival and colonization of microorganisms on various organs including skin, throat and upper respiratory tract, gastrointestinal tract and genitourinary tract. Understanding the human microbiome using animal model systems: *C. elegans*, mice, zebrafish. Strengths and weaknesses of using these systems for human microbiome studies. Technologies for assaying the human microbiome: direct observation methods, molecular

profiling techniques, sequencing methods, strengths and weaknesses of the technologies. **8**

Unit 2: Microorganisms in human diseases: A concise overview of aetiology, symptoms, transmission and control of some common diseases: bacterial (tuberculosis, cholera, typhoid, diphtheria), viral (rabies, hepatitis, zika, COVID , polio, AIDS), protozoan (malaria, kala azar) and fungal diseases (dermatophytoses, candidiasis, aspergillosis). **12**

Unit 3: Microbes for maintaining human health: Brief description and distinction between prebiotics, probiotics and synbiotics. Probiotics for maintaining human health: prerequisite characteristics of probiotic strains, common probiotic bacterial strains, modes of action of probiotics, probiotic supplementation for disease management. Bacteriophage therapy: concept and challenges. A brief account of bacteriophage therapy for various diseases. **10**

Practicals:

60 hours

Unit 4. Study of human microflora: Isolation of microorganisms from skin by swab method using specific media: nutrient agar, mannitol salt agar, potato dextrose agar. Gram staining of bacterial isolates and lactophenol staining for fungal isolates. Gram staining of dental scrapings/plaques. Checking the efficacy of sanitizer on skin. study of the oligodynamic effect of metals on bacterial cultures. **Student group project:** multiple methods for sampling microbial biomass specimens for oral, skin, gut and respiratory microbiomes. **25**

Unit 5. Study of probiotics: Student group project: Conduction of a market survey to identify different probiotic products available in the market. Isolation and basic characterization of bacteria from probiotic products. Bacterial cell surface hydrophobicity (CSH) test to estimate bacterial adherence. Performance of acid and bile resistance test on bacterial strains. **25**

Unit 6. Bacteriophage isolation and typing: Principle, process and limitations of bacteriophage typing. Isolation of bacteriophages from sewage sample using double layer technique. **Student group project:** Phage therapy in India. **10**

Suggested Reading:

1. Brock Biology of Microorganisms by M.T. Madigan, J. Aiyer, D. Buckley, W. Sattley and D. Stahl. 16th edition. Pearson, USA. 2021.
2. Prescott's Microbiology by J. M. Willey, K. Sandman and D. Wood. 11th edition. McGrawHill Higher Education, USA. 2019.
3. Textbook of Microbiology by R. Ananthanarayan and C.K.J. Paniker. 10th edition. Universities Press, India. 2017.
4. Jawetz, Melnick and Adelberg's Medical Microbiology by K.C. Carroll, S.A. Morse, T.A. Mietzner and S. Miller. 27th edition. McGraw Hill Education. 2016.
5. Microbiology: An Introduction by G.J. Tortora, B.R. Funke and C.L. Case. 9th edition. Pearson Education, USA. 2007.
6. Cappucino, J. and Sherman, N. (2014). Microbiology: A Laboratory Manual. 10th edition. Pearson Education, India.

7. Collee, J.G., Fraser, A.G., Marmion, B.P. and Simmons, A. (2007). Mackie and McCartney Practical Medical Microbiology. Elsevier 14th edition 1996.
8. Randhawa, V.S., Mehta, G. and Sharma, K.B. (2009). Practicals and Viva in Medical Microbiology. 2nd edition. Elsevier, India.
9. Fuller, R. (2012). Probiotics: The Scientific Basis. Springer Netherlands.
10. Dhanasekaran, D. and Sankarnarayanan, A (2021). Advances in Probiotics, Microorganisms in Food and Health. Academic Press.

Facilitating the achievement of Course Learning Outcomes

Unit no.	Course Learning Outcomes	Teaching and learning Activity	Assessment Tasks
1.	Will be acquainted with the importance of the human microbiome including the benefits as well as possible harmful effects. They will have a fair knowledge of various types of microorganisms surviving on/in the human body	Class room lectures on human microbiome. Pictorial representation of various organ systems with the corresponding microflora.	Test and quiz on human microbiome.
2.	Will have gained knowledge about the spectrum of diseases caused by bacteria, viruses, protozoa and fungi. They will be familiar with the methods of transmission and control of various diseases.	Class room lectures on the aetiology, symptoms, transmission and control of various diseases. Pictorial representation of various signs and symptoms of diseases.	Test and quiz on symptoms, transmission and control of various diseases. Match the following type quiz on disease and causative agent. Identification of disease based on photographs of specific disease presentation.
3.	Will understand the role of probiotics in human health. They will have learnt about the characteristics of probiotic microorganisms and have a fair idea of prebiotics and synbiotics. They will also have an overview of	Class room lectures and videos on probiotics and bacteriophages.	Test and quiz on role of probiotics, prebiotics, synbiotics and bacteriophages.

	bacteriophages and their role in therapy.		
4.	Will have hands-on training on isolation of microorganisms from skin and staining of microorganisms collected from oral cavity, and will be able to check the efficacy of the sanitizer and antimicrobial action of heavy metals.	Class room lecture and hands-on practical of isolation of bacteria from skin surface and staining of bacteria from oral cavity. Determination of sanitizer efficacy on skin.	Demonstration of practicals. Quiz on various aspects of practicals including principle, observations, result and precautions.
5.	Will become aware of various probiotic products available in the market and the organisms included in these products. They will receive hands-on training for evaluation of various probiotic products and microbial strains.	Online and offline survey of probiotic products and types of probiotic organisms. Practical demonstration of isolation of probiotics and study of various properties.	Demonstration of practicals. Quiz on various aspects of practicals including principle, observations, result and precautions.
6.	Will have a fair understanding of bacteriophage typing and will also have hands on training in the isolation of bacteriophages from sewage samples.	Classroom lecture on bacteriophage typing. Practical performance of isolation of bacteriophages from sewage.	Quiz on various aspects of practicals including principle, observations, result and precautions.

* Assessment tasks are indicative and may vary.