

GENERAL INSTRUCTIONS
and
COURSE CURRICULUM
FOR

Add on Courses [AOC]

UNDER NEP 2020

FOR

Certificate Course

in

Microbiology

(Effective from Academic Session 2024-2025)



DEPARTMENT OF MICROBIOLOGY

HIMACHAL PRADESH UNIVERSITY

(NAAC Accredited "A" Grade University)

SUMMERHILL – SHIMLA – 171005 (HP) – India

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Certificate Course in Microbiology

GENERAL INSTRUCTIONS/ GUIDELINES FOR EXECUTION OF CURRICULUM

- I. The Certificate course in Microbiology will be of six months duration and Diploma course will be of one year duration.
1. **Add on Courses [AOC]:** A total of two AOC will be offered by the department. AOC of 2-credits includes the theory and practical component of 25 marks each.
- NOTE:** The practical examination will carry 25 marks as follows;
- | | |
|---|------------|
| Performance and write-up of practicals: | 15.0 marks |
| Practical record/ Notebook: | 5.0 marks |
| Viva-voce examination: | 5.0 marks |
- II. A candidate has to secure minimum pass marks individually in Theory [TH] paper and Practical [PR] examination to earn full credits in the concerned course. A candidate thus failing in any of these components shall be considered failed in that course.
- **A student will be awarded Certificate in Microbiology after securing 4 credits**
- III. The admission to this certificate course will be as per the university norms.

Course Structure for Certificate in Microbiology

Sr. No.	Course Title: Code	Credits	Lectures (Hours)	Practical (Hours)
1.	Skills in Microbiology: CMB-101	2	15	30
2.	Applied Environment Microbiology: CMB -102	2	15	30



COURSE OUTLINE

OBJECTIVES OF THE COURSE

1. **Develop Fundamental Knowledge:** Provide a strong understanding of microbiology basics, covering microbial structure, genetics, and metabolism. This objective aims to equip learners with a solid foundation in microbiology, enabling them to comprehend the intricate world of microorganisms and their significance in various fields such as healthcare, agriculture, and industry.
2. **Enhance Laboratory Skills:** This objective aims to cultivate students' proficiency in a wide range of laboratory techniques essential for the isolation, cultivation, characterization, and identification of microorganisms. By gaining practical skills, learners will be prepared for careers in research, clinical diagnostics, quality control, and other microbiology-related fields.
3. **Promote Critical Thinking and Problem-Solving Abilities:** Encourage analytical thinking and problem-solving abilities through case studies and discussions, enabling students to tackle real-world microbiological challenges effectively and contribute to advancements in the field.

COURSE OUTCOME

1. **Employment Opportunities:** Graduates will be equipped with the necessary knowledge and skills to pursue entry-level positions in microbiology-related fields such as clinical laboratories, pharmaceutical companies, food and beverage industries, environmental agencies, and research institutions.
2. **Career Advancement:** The certificate will serve as a valuable credential for individuals already working in related fields, allowing them to enhance their knowledge base and advance their careers through specialized roles or promotions.
3. **Continued Education:** Some graduates may choose to further their education by pursuing higher academic degrees in microbiology or related disciplines, such as pursuing a bachelor's or master's degree, or enrolling in specialized training programs.
4. **Contribution to Public Health and Safety:** Graduates will contribute to public health and safety by applying their knowledge and skills to identify and control microbial threats in various settings, including healthcare facilities, food production facilities, and environmental monitoring agencies.
5. **Research Opportunities:** The certificate will provide a solid foundation for individuals interested in conducting research in microbiology or related fields, enabling them to contribute to scientific advancements and innovations in areas such as drug development, disease prevention, and biotechnology.
6. **Professional Development:** Graduates will have enhanced their laboratory and critical thinking skills, as well as their ability to work effectively in multidisciplinary teams, which are essential for success in the field of microbiology and for professional development in general.



SYLLABUS

CMB-101 Skills in Microbiology

Semester – I

TOTAL HOURS: 45

CREDITS: 2

Course Outcomes:

The major outcome of the course is to

- Understand handling and working of various instruments used in microbiology laboratory
- Gain knowledge about techniques utilized for the identification of various microbes
- Understand the microbial growth as well as detailed structure and function of different cell organelles of microbes
- Gain knowledge about various techniques utilized for the control of microbes

Learning Outcomes:

By the completion of this course, the students -

- will develop a good knowledge and understanding of safety procedures and precautions used in the microbiology laboratory
- will be able to isolate, culture and different types of microbes
- will gain knowledge about different methods used for the identification of the microbes

Section –I

No. of Hours: 7

Unit 1 Microbiological Laboratory Practices

Microbiology lab safety rules, Microbiology lab equipment's and their working principle, Biosafety Levels in Microbiology

Unit 2 Microscopic Techniques

Bright Field Microscopy, Phase Contract Microscopy, Dark field Microscopy, Fluorescent microscopy, Electron Microscopy

Unit 3 Morphology and Staining

Characteristic features of bacteria, Achaea, fungi, parasites, algae, and viruses; Morphology and ultrastructure of bacteria, virus, fungi and algae; staining methods for the differentiation of different types of microbes



Section –II

No. of Hours: 8

Unit 1 Cultivation of Microorganisms

Cultivation of bacteria, cell division, culture media, growth curve, generation time, asynchronous, synchronous culture, measurement of growth. Microbial cultures: Concept of pure culture, Methods of pure culture isolation.

Unit 2 Preservation and Control of Microorganisms

Methods and principle for preservation and maintenance of microbial cultures; Control of microorganism by various physical and chemical methods.

Unit 3 Nutrition and Biochemical characterization of Microorganisms

Nutritional Categories of microorganisms based on carbon, energy and electron sources, various types of transport system in microorganisms, Principle for biochemical characterization of microbes using various tests

LIST OF PRACTICALS

(No. of Hours: 30)

1. Microscopy, Microscope and its operations, components, Microscope adjustments, Light sources, microscopic measurements, calibration: Types of microscope available, theory of various types of microbes under phase contrast, dark field and fluorescence.
2. Preparation of glassware, washing, sterilization techniques, wet heat, dry heat, filter types, laminar flow chamber types, CDC, safety levels.
3. Preparation of culture media, nutritional needs of microbes, dehydrated, selective, differential, autotrophic, heterotrophic.
4. Culture techniques, adjustment of pH, buffers, pure culture techniques, preparation of slants, Sub-culturing.
5. Isolation of bacteria and fungi using pour plate and spread plate method.
6. Microbial growth measurements, cell count, turbidity measurements, percentage transmission, Optical density, serial dilution, standard plate count.
7. Morphological characterization of microbes using various staining staining: types of dyes, preparation, staining techniques including simple staining, Gram staining, capsule staining, negative staining, spore staining, lactophenol cotton blue staining
8. Identification of bacteria using various biochemical tests
9. Drug susceptibility testing by various methods



SUGGESTED READING (Latest Edition)

1. General Microbiology. Macmillan Education Ltd.
2. Fundamental Principles of Bacteriology: Stainer RY, Ingharam JL, Wheelis ML, Painter PR
3. Biology of Microorganisms. Prentice Hall Int. Inc.: Brock TD, Madigan MT.
4. Microbiology. Mc Graw Hill: Pelczar MJ, Chan ECS, Kreig NR.
5. Topley and Wilson's principles of Bacteriology, Virology, and Immunity. Wilson GS, Miles AA.
6. A Textbook of Microbiology, S. Chand & Com., Ram Nagar, New Delhi.
7. Practical Microbiology, S. Chand & Com., Ram Nagar, New Delhi.
8. Prescott's Microbiology. Willey JM, Sherwood LM, Woolverton CJ.



CMB -102 Applied Environment Microbiology

SEMESTER – I

TOTAL HOURS: 45

CREDITS: 2

Course Outcomes:

The major outcome of the course is to

- understand the various applications of Microbiology in improving the environmental quality,
- monitoring various aspects of the environment features and bioremediation of contaminated environments.
- Enhance the skills of the students to identify and implement solutions to the problems and mitigation of human impact on the environment.

Learning Outcomes:

By the completion of this course, the students -

- will develop a fairly good knowledge and understanding of different types of environments and habitats where microorganisms grow.
- would be able to know the important role of microorganisms in maintaining healthy environment by degradation of solid or liquid wastes.
- will understand the application and use of microbes as biofertilizers.
- gain knowledge on environmental pollution, bioremediation and role of microbes in soil microbiology.
- will develop the practical skills for conducting experiments to assess the BOD/COD of wastewaters and their interpretation; practically assess the potability of drinking water by the use of standard microbiological tests.

Section –I

(No. of Hours: 8)

Unit 1

Air Microbiology-Air borne diseases caused by bacteria, fungi and viruses, Methods for air microflora studies

Unit 2

Soil Microbiology- physical and chemical characteristics, microflora of soil, a brief account of microbial interactions: symbiosis – mutualism – commensalisms – competition – amensalism – synergism – parasitism – predation

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Unit 3

Water borne diseases, Environmental contamination factors governing microflora and their distribution in natural water.

Section –II

(No. of Hours: 7)

Unit 4

Waste water treatment by aerobic and anaerobic process, Detection of potability of water samples by MPN test, concepts of BOD and COD.

Unit 5

Bioremediation, biomining and bioremediation of contaminated lands

Unit 6

Biofertilizer: Mass cultivation of microbial inoculants, Plant growth promoting rhizobacteria (PGPR), significance of mycorrhizae

List of Practicals

(No. of Hours: 30)

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. Estimation of total solids in sewage samples.
5. Estimation of volatile matter and fixed residues in sewage samples.
6. Rapid detection of bacteriological quality of water with special reference to fecal coliform.
7. Determination of dissolved oxygen in waste-water samples.
8. Determination of BOD of waste-water samples.
9. Determination of COD of waste-water samples.
10. Determination of rate of decomposition of organic matter.
11. Determination of moisture content of soil sample.
12. Determination of microbial biodiversity in soil.
13. Determination of hardness of given water sample.
14. Transformation of waste into valuable products.



Suggested Readings (Latest Edition)

1. Microbial ecology. Alexander M. John Wiley and Sons.: Inc., New York.
2. Pollution - Ecology and biotreatment: Longman Scientific Technical.
3. Advances in Microbial Ecology: S Mc Eldowney, DJ Hardman, S Waite S and KC Marshall.
4. Soil Microbiology. Subba Rao NS. Oxford & IBH Publishing Co. New Delhi.
5. Prescott's Microbiology. Willey JM, Sherwood LM, Woolverton CJ.



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