COURSE TITLE	**FUNDAMENTALS OF MICROBIOLOGY**
COURSE CODE	**01CB1401**
COURSE CREDITS	**4**

Objective:

1 This course will cover elementary concepts of microbiology to help students understand the structure, function, and classification of microorganisms.

2 This course will analyze the role of microorganisms in the environment, emphasizing their applications in industry, agriculture, food, and health sectors.

Course Outcomes: After completion of this course, student will be able to:

1 Apply the concepts of microbial classification, structure, and growth to explain microbial roles in health, industry, and the environment.

2 Evaluate microbial interactions with hosts, ecosystems, and other organisms to determine their significance.

3 Appy laboratory techniques for microbial isolation, identification, and control.

4 Analyze the impact of microbial threats and antimicrobial resistance.

5 Design fermentation processes for industrial production.

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Fundamentals of microbiology** Whittaker's five kingdom classification of living organisms , Classification and identification of microorganisms , Morphological features and cell structure of bacteria, cyanobacteria, virus, fungi, algae and protozoa, Importance of microorganisms	8

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Contents : Unit	Topics	Contact Hours
2	**Growth and control of microorganisms** Modes of microbial reproduction, growth curve of microbes, binary fission, enumeration techniques, effect of environmental conditions on growth, extremophiles, nutrition, bacterial metabolism, • Theory and practice of sterilization (disinfectant, antiseptic, sanitizer, germicide, bactericide and bacteriostasis, tyndallization, pasteurization), physical control (high temperature, low temperature, desiccation, osmotic pressure, physical- dry heat, moist heat, radiation, UV light, ionizing radiation, X- rays, gamma rays, cathode rays, surface tension and interfacial tension, filtration, HEPA filter), chemical control (phenol and phenolic compounds, halogen aliphatic alcohol, formaldehyde, ethylene oxide, heavy metals, anionic and cationic detergents, dyes, quaternary ammonium compounds, aldehydes, gaseous sterilization) methods in practice	7
3	**Methods in microbiology** Pure culture techniques, principles of microbial nutrition, culture media and types (simple, complex, enriched, enrichment, selective & differential), replica plating techniques, preservation techniques , Principles and applications of microscopes (dark field, brightfield, resolving power, numerical aperture, chromatic aberration, phase contrast microscopy, fluorescent microscopy, electron microscopy, TEM and SEM), Principles of staining, simple staining, negative staining, differential staining, gram and acid-fast staining, flagella staining, capsule and endospore staining	8
4	**Industrial and medical microbiology** Fermentation processes- batch and continuous, outline of the production for ethanol, vinegar, citric acid, amylase, vitamin B, antibiotics (penicillin and streptomycin), Application of microorganisms in dairy and food industries, Fermented dairy products: starter culture, cheese: types, curdling, processing, ripening, Other fermented dairy products: yogurt, cultured buttermilk, acidophilus milk, kefir and cultured sour milk, Introduction to probiotics, prebiotics and symbiotics, functional foods, Indian fermented food products: pickles, idli, khaman and bread. Microbes as food: mushrooms, spirulina and yeasts, Normal microflora of the human body: importance of normal microflora,normal microflora of skin, throat, gastrointestinal tract, urogenital tract, Bacterial, viral and fungal diseases , Mechanism of action and resistance of antibiotic agents (antibacterial, antifungal and antiviral)	10
5	**Environmental microbiology** Soil microbiology: role of microorganisms in the essential nutrient cycles like carbon, nitrogen and phosphorus, soil structure, and plant-microbe interactions , Aquatic microbiology: microbiology of water, wastewater treatment, waterborne diseases, Air Microbiology: microorganisms in the air and their impact on human health and the environment, Bioremediation	9
Total Hours		**42**

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment 1** To acquire the skill of aseptic technique in the field of microbiology.	2
2	**Experiment 2** To understand principles and use of various laboratory instruments.	2
3	**Experiment 3** To study and prepare different types of growth media.	2
4	**Experiment 4** To isolate bacteria from given sample by spread plate and streak plate techniques.	2
5	**Experiment 5** To observe various morphology forms of bacteria by differential staining techniques.	2
6	**Experiment 6** To study the bacterial growth curve.	2
7	**Experiment 7** To isolate lactose fermenting and non-fermenting bacteria.	2
8	**Experiment 8** To isolate and identify amylase producing bacteria.	2
9	**Experiment 9** To study the alcohol fermentation.	2
10	**Experiment 10** To study antibiotic sensitivity by disc diffusion method.	2
11	**Experiment 11** To find the antibiotic sensitivity by Cup plate/borer method.	2
12	**Experiment 12** To perform Standard Plate Count (SPC) of soil sample by serial dilution technique.	2
13	**Experiment 13** To determine the amount of DO and BOD in given water sample.	2
14	**Experiment 14** To detect presence of coliforms in given water sample by performing MPN test.	2
Total Hours		**28**

Textbook :

1 A Textbook of Basic and Applied Microbiology, K.R. Aneja, Pranay Jain, Raman Aneja, New Age International Private Limited, 2021

2 Microbiology, E.C.S. Chan, Michael J. Pelczar, Jr., Noel R. Krieg, Tata McGraw- Hill Education Pvt. Ltd, 2025

References:

1 Prescott's Microbiology, Prescott's Microbiology, Joanne Willey, Linda Sherwood, Christopher J. Woolverton, McGraw Hill, 2017

2 Essentials of Microbiology, Essentials of Microbiology, Essentials of Microbiology, Essentials of Microbiology, Amita Jain, Parul Jain, Elsevier India, 2019

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
0.00	0.00	35.00	35.00	30.00	0.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, quiz, brainstorming, MOOCs etc.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Supplementary Resources:

1 http://samples.jblearning.com/9781284211757/9781284240535_FMxx_Pommerville12e.pdf

2 https://agrimoon.com/wp-content/uploads/Fundamentals-of-Microbiology.pdf

3 https://www.basu.org.in/wp-content/uploads/2020/03/Fundamentals-of-Microbiology-1.pdf?utm_source=chatgpt.com

4 https://archive.org/details/fundamentalsofmi00alca

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