Code	Subject Title	Cr. Hrs	Semester
BOT-409	**Microbes, Man and the Environment**	**3**	**VIII**
Year	Discipline		
4	**BOTANY**		

Syllabus Outline: Types of Microbes and their Evolution; Distribution of Microbes in the Environment and Strategies for Success, Positive and negative Interactions of microbes with men.

Course Outline:

Microbial Evolution and Nutrition: The Origin of Life, Phylogeny, Evolution of Microbes, Bacteria, Archaea and Fungi, Evolution of Microbes into Diversifying Ecosystems, Diversity of Energy Generating Systems of Microbes.

Microbial Structure, Replication and Motility: Bacterial Replication, Adhesion, Motility and Growth, Fungal Replication, Yeasts, Molds and Spores, Diversity of Viruses and Viral Replication.

Microbes in the Environment: Microbes and Nutrients. Carbon Cycling in the Ecosystem. Brown rots and White Rots, Microbes and Nutrients, Nitrogen Cycling in the Ecosystem., Ammonification, Nitrification, De-Nitrification.

Microbial Partnership: Microbial Associations with Plant Roots, Legumes, Rhizobia and Nitrogen Fixation, Mycorrhizal Associations with Plant Roots, from Trees to Orchids, Animal Fermenters, Ruminants and Hind Gut Fermenters, Cellulose Digestion, Methanogens and Chytrids, Microbes and Insects.

Microbes as Pathogens: Bacterial Pathogens of Plants, Colonization and Invasion Strategies, Fungal Pathogens of Plants, Colonization and Invasion Strategies, Using Microbes to Fight Pests and Disease, Biological Control, Bacterial Diseases of Man, Colonization and Invasion of Tissues, Models of Toxin Action, Fungal Diseases of man, Dermatophytes, *Candida* and Aspergillosis, Viral diseases of Man, Antimicrobials and Targets, Antibiotics and Antiviral Agent, Targets and Modes of Action, Emergence and Mechanism of Antibiotic Resistance.

Exploitation of Microbes in Industry: Microbes as Cell Factories, Primary and Secondary Metabolites, Fermentation Systems, Enzymes and Industry, Microbes and Food, Use of Microbes in Food and Beverage Production, Food Spoilage and Toxins, Exploitation of Natural Microbial Communities in the Treatment of Sewage.

Module Aims: To highlight the Role of Microbes in the Environment and Ecosystem and to show their Beneficial and Detrimental Roles in the Environment and on men.

Learning Strategies:

1. Lectures
2. Group Discussion
3. Laboratory Work
4. Seminar/ Workshop

Learning Outcome: To enhance the understanding of Microbes to students, their Importance and Positive/Negative Interactions with Man.

Assessment Strategies:

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Class Discussion
4. Quiz
5. Tests

Books Recommended:

1. **Edwards, C. (2008).** *Microbiology of Extreme Environments; Environmental Biotechnology.* McGraw Hill Publishers.

2. **Mitchell, R. (2006).** *Environment Microbiology*. John Wiley and Sons, Inc. New York.

3. **Black, J.G. (2005).** *Microbiology*: *Principles & Explorations.* (6th Ed.). McGraw Hill, Publishers.

4. **Holt, J.G., Krieg, N.R., Speath, P.H.A., Steley, J.T. and Williams, S.T. (2005).** *Bergey's Manual of Determinative Bacteriology.* (10th Ed.), William and Wilkins Publishers.

5. **Cappuccino, J.G. and Sherman, N. (2002).** *Microbiology, A laboratory Manual,* (4th Ed.), The Benjamin Cummings Publishing Company Inc.

6. **Sayler, G.S. and Fox, R. and Blackburn, J.W. (2001).** *Environmental Biotechnology for Waste Treatment.* Plenum Publishing Corparation.

7. **Alexander, M. (2001).** *Biodegradation and Bioremediation.* Academic Press, Inc.

8. **Mitchell, R. (1992).** *New Concepts in Environmental Microbiology.* Alan R. Liss.

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