

Paper No- 14
SEMESTER –V
ENVIRONMENTAL MICROBIOLOGY

THEORY

MARKS: 100

Unit 1 Microorganisms and their Habitats

No. of Lectures: 10

- 1.1 Structure and function of ecosystems
- 1.2 Terrestrial Environment: Soil profile and soil microflora
- 1.3 Aquatic Environment: Microflora of fresh water and marine habitats
- 1.4 Atmosphere: Aeromicroflora and dispersal of microbes
- 1.5 Microbial succession in decomposition of plant organic matter

(Chapter 2, Fundamentals of Ecology by Odum EP and Barret GW, 5th Ed., Thomson Cole, 2005, Pages 18-37; Chapters 6 & 9, Microbial Ecology: Fundamentals and Applications by Atlas RM and Bartha R, 4th Ed., Benjamin Cummings, 2000, Pages: 177-182, 332-379)

Unit 2 Biological Interactions

No. of Lectures: 10

- 2.1 Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation
- 2.2 Microbe-Plant interaction: Symbiotic and non symbiotic interactions
- 2.3 Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria

(Chapters 3, 4 &5, Microbial Ecology: Fundamentals and Applications by Atlas RM and Bartha R, 4th Ed., Benjamin Cummings, 2000, Pages: 60-91, 99-119 and 149-161)

Unit 3 Biogeochemical Cycling

No. of Lectures: 10

- 3.1 Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin
- 3.2 Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction
- 3.3 Phosphorus cycle: Phosphate immobilization and solubilisation
- 3.4 Sulphur cycle: Microbes involved in sulphur cycle
- 3.5 Other elemental cycles: Iron and manganese

(Chapters 10 &11, Microbial Ecology: Fundamentals and Applications by Atlas RM and Bartha R, 4th Ed., Benjamin Cummings, 2000, Pages: 386-405 and 414-449)

Unit 4 Waste Management

No. of Lectures: 15

- 4.1 Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill)
- 4.2 Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment

(Chapters 12, Microbial Ecology: Fundamentals and Applications by Atlas RM and Bartha R, 4th Ed., Benjamin Cummings, 2000, Pages: 462-507)

Unit 5 Microbial Bioremediation

No. of Lectures: 3

Biodegradation: Principles and degradation of common pesticides

(Chapter 20, Environmental Microbiology by Maier RM, Pepper IL and Gerba CP, 2nd Ed. Academic Press, 2009, Pages: 387-418).

PRACTICALS

MARKS: 50

1. Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action
2. Isolation of microbes (bacteria & fungi) from soil (28°C & 45°C)
3. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane
4. Determination of BOD of waste water sample
5. Detection (qualitative) of the presence of enzymes (dehydrogenase, amylase, urease) in soil

SUGGESTED READINGS

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
2. Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganisms. 12th edition. Pearson/ Benjamin Cummings
3. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
4. Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York
5. Singh A, Kuhad, RC & Ward OP (2009). Advances in applied bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA

ONLINE READING MATERIAL

1. <http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-89-environmental-microbiology-fall-2004/lecture-notes/>
2. www.water.me.vccs.edu/courses/env108/Lesson1_print.htm
3. <http://nsdl.niscair.res.in/bitstream/123456789/558/1/MicrobialDegradation.pdf>