

## **MICB-805E: MICROBIAL ECOLOGY**

### **UNIT-I: BASICS OF MICROBIAL ECOLOGY**

Principles and concepts of microbial diversity - Methods of studying diversity – expansion of microbial diversity- estimates of total number of species, measures and indices of diversity-Exploitation and Conservation of microbial diversity distribution, abundance, ecological niche. Types: Bacterial, Archaeal and Eukaryal. Positive and negative roles of microbes in environment; biodegradation of recalcitrant compounds – lignin, pesticides; bioaccumulation of metals and detoxification - biopesticides; bioleaching (paper, leather, wood, textiles) and bioremediation.

### **UNIT-II: BASICS OF AERO-MICROBIAL DIVERSITY**

Aeromicrobiology: Microbes diversity in air, Determination of the microbial content of the air- Droplet nuclei, aerosol, aeroallergens; assessment of air quality (solid, liquid impingement methods); air borne transmission of microbes (viruses, bacteria and fungi), their diseases and preventive measures; Air sampling techniques, Air samples enumeration.

### **UNIT-III: BASICS OF SOIL MICROBIAL DIVERSITY**

Soil classification-physiochemical characteristics, soil microflora distribution - Factors influencing the soil microflora - Role of microorganisms in soil fertility, microbial interactions symbiosis-mutualism, commensalism, competition, synergism, amensalism, parasitism, predation - Interactions between microbes and plants - rhizosphere, phyllosphere, mycorrhizae. Microbial interactions in animals; role of biogeochemical cycles in microbial diversity (carbon, nitrogen, phosphorous and sulphur); Diversity of extremophiles.

### **UNIT-IV: AQUATIC MICROBIAL DIVERSITY**

Aquatic microbiology: Sediments, Surface water, littoral habitats; Soil and associated systems & habitats, factors influencing microflora (Minerals, pH, Organic matter, water and soil texture); altitudinal variations in microflora, Microbes associated at the interface, Microbes associated with plants, animal and insects (Symbiotic and pathogenic); Parasitic microbes, symbiotic microflora, saprophytes; Sewage treatment system (primary, secondary, tertiary and final disinfection of potable water supplies); Biological indicators of water safety and their assessment.

### **Reference/Text Book:**

1. Microbial Diversity by Oladele Ogunsitan, Blackwell Publishing, 2005
2. Brock Biology of Microorganisms 11th Ed. by Madigan & Martinko, Prentice Hall, 2006.
3. Microbial Ecology 4th Ed. by Atlas & Bartha, Benjamin/Cummings, 1998.
4. Molecular Microbial Ecology by Osborn & Smith, no assigned readings, but useful background material.
5. Successful Scientific Writing: A Step by Step Guide for the Biological and Medical Sciences by Matthews & Matthews.
6. Atlas RM & Bartha R (1997) Microbial Ecology – Fundamentals and Applications
7. Kirchman DL (2008) Microbial Ecology of the Oceans
8. Barton LL & Northrup DE (2011) Microbial Ecology Wiley-Liss,

## **MICROBIAL BIOREACTOR FOR WASTE WATER TREATMENT**

**PAPER CODE:MI-806E1**

**Credit: 4**

### **Unit I:**

History of Waste water treatment/management: Regulation of discharges to water: Clean Water Act (CWA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the emergency planning and community right to know act, Pollution Prevention act 1990, an approach to problem solving: a six step method.

### **Unit II:**

Water and Waste water characteristics: Essential Biology Concepts, Ecology, Limnology; Water supply and treatment; Physical, Chemical (inorganic, organic) and biological characteristics of waste water and Collection.

### **Unit III:**

Waste Water Treatment-Conventional Physico Chemical Methods, Biological Methods of Treatment of Waste water; Non-potable applications of treated waste water, Case study of Waste Water Treatment with high as well as low C/N Ratio.

### **Unit IV:**

Reactor types: suspended growth reactors; batch reactor; continuous- Flow stirred Tank Reactor; membrane reactor; rotating drum reactors; biofilm reactors; aerobic granular sludge reactor.

### **Reference/Text Book:**

1. Environmental Engineering Principles and Practice by Richard O Mines, Jr, WileyBlackwell
2. Environmental Pollution Control Microbiology by Ross E McKinney, Marcel Dekker,Inc
3. Handbook of Water and waste water treatment plant operations, 3<sup>rd</sup> Edition by Frank R. Spellman, CRC Press, Taylor and FrancisGroup.
4. Sustainable Water Engineering Theory and Practice by Chandrappa and Das,Wiley.
5. Water Resources An integrated approach by Joseph Holden, Routledge, Taylor and FrancisGroup.
6. Drinking Water Quality Problems and Solitions, 2<sup>nd</sup> Ed, N F Gray,Cambridge.
7. Waste Water Treatment Technologies: A general Review; Economic and Social Comission for Western Asia. United Nations, New York, 2003,url:
8. Environmental Biotechnology Principles and applications. Bruce E Rittman and Perey L McCarty. TataMcGraw hill Edition (2012) ISBN.10:1-25-900288-8.

## MICB-903E: WASTE WATER TREATMENT

**Unit I:** History of Waste water treatment/management: Early civilization, Middle Age, Age of Enlightenment, the industrial revolution, the progressive era, the great depression and World War II, post war era, Present day regulation of discharges to water: Clean Water Act (CWA), Comprehensive Environmental Response Compensation and Liability Act (CERCLA), the emergency planning and community right to know act Pollution Prevention act 1990, an approach to problem solving: a six step method.

**Unit II:** Water and Waste water characteristics: Essential Biology Concepts, Ecology, Limnology; Water supply and treatment; Physical, Chemical (inorganic, organic) and biological characteristics of waste water and Collection.

**Unit III:** Waste Water Treatment-Conventional Physico Chemical Methods, Biological Methods of Treatment of Waste water; Non-potable applications of treated waste water, design of water treatment systems; Design of waste water treatment systems, Environmental sustainability, Environmental Public Health

### **Reference/Text Book:**

1. Environmental Engineering Principles and Practice by Richard O Mines, Jr, Wiley Blackwell
2. Environmental Pollution Control Microbiology by Ross E McKinney, Marcel Dekker, Inc
3. Handbook of Water and waste water treatment plant operations, 3<sup>rd</sup> Edition by Frank R. Spellman, CRC Press, Taylor and Francis Group.
4. Sustainable Water Engineering Theory and Practice by Chandrappa and Das, Wiley.
5. Water Resources An integrated approach by Joseph Holden, Routledge, Taylor and Francis Group.
6. Drinking Water Quality Problems and Solutions, 2<sup>nd</sup> Ed, N F Gray, Cambridge.
7. Waste Water Treatment Technologies: A general review; ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA. United Nations, New York, 2003, url:

*Handwritten signatures and dates:*

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