

BHARATHIAR UNIVERSITY : COIMBATORE- 641 046

M.Phil./Ph.D. in Environmental Management & Biotechnology  
(DRDO)

PART-I SYLLABUS

PAPER III : Special Papers

1. Application of Remote Sensing and GIS for Environmental Management
2. Remediation Technique for Environmental Management
3. Microbial Biotechnology

## Application Remote sensing and GIS Environmental Management

### **UNIT I. SATELLITE REMOTE SENSING**

Fundamentals: Definition- Scope- types- Energy sources – Electro Magnetic Radiation – energy interaction in the atmosphere – energy interaction with earth surface features – spectral reflectance patterns for different regions of EMR. Factors affecting remote sensing signatures – Satellites and Sensors – data capture types and systems and data recording method.

### **UNIT II. TYPES OF REMOTE SENSING**

History of Aerial Photography, Principles of photography, Elements of photography, photo interpretation elements, Aerial Cameras, Stereoscopic Viewing, Anatomy of the human eye, stereo model. Optical Scanning, Thermal Remote Sensing – Concepts of RADAR and Microwave Remote Sensing, Resolution: Spatial, spectral, radiometric and temporal resolution of the satellites.

### **UNIT III. PRINCIPLES OF DIGITAL IMAGE PROCESSING**

Principles: Data encoding and decoding - digital image formats- band sequential and band interleaved - characteristic features - geometric correction, radiometric correction –noise removal – Methods of image enhancement : Contrast manipulation- graylevel threshold, level slicing and stretching, Filtering, Vegetation Indices, IHS colour space transformation, Classification: Types of Classifiers and post classification methods.

### **UNIT IV. PRINCIPLES OF GEOGRAPHICAL INFORMATION SYSTEM AND GPS**

Introducing GIS and spatial data analysis: Definition – computer assisted mapping and Map analysis – components of GIS – spatial data structures – Digitization –Thematic Mapping – queries - buffering and neighborhood functions - Overlay Analysis – surface Analysis – network analysis DEM, Introduction to GPS – Integration techniques, Tracking and navigation. Advantages and Applications, Future GPS

### **UNIT V. APPLICATIONS FOR RESOURCES MANAGEMENT**

**GIS for Natural Resources Management :** Natural Resources Management - Forests, Land Evaluation, Wastelands and eroded lands, Water Resources: Surface water Analysis, groundwater potential mapping, integrated watershed development, case studies

**GIS for Disaster Management :** Earthquake, Volcano and landslide, Cyclones and Flooding, Drought and Desertification : Anthropogenic Disasters, Atmospheric Disasters, Marine Disasters, GIS in Biodiversity Disasters - GIS in environmental modeling – case studies.

**Internet GIS:** Internet GIS : Internet GIS Applications - transportation, crimes, Emergency and crisis, tourism and urban land management Geographic markup language - commercial Web mapping programs – mobile GIS. Distributed GIS in data warehousing and data sharing.

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- John, R A and Jia Xinping [1999] Remotes ensing Digital Analvsis – An Introduction.Newyork : Verlag Berlin Heidelberg
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John A. Matthews (2002) Natural hazards and environmental change, Bill McGuire, Ian Mason.

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John G. Lyon (2003) GIS for water Resource and water Shed Management, Taylor and Francis.

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## Special Paper - 2 : Remediation Techniques for Environmental Management

### **UNIT I - Environmental pollution**

Types of pollution, Methods for monitoring pollution; Methodology of Environmental Management – Problem solving Approach and its limitations. Water pollution and Control : Need for water management, Measurement and sources of water pollution. Kind of Aquatic habitats (Fresh water and Marine).

### **UNIT II - Waste water treatment**

Sampling methods. Physico - Chemical properties of water, Physical, Chemical and Biological Treatment processes – primary, secondary, tertiary treatment, Activated Sludge, Oxidation ditches, Trickling filter, Rotating discs, Rotating Drums, Oxidation ponds, Anaerobic digestion, Anaerobic filters. Upflow anaerobic sludge blanket reactors. Treatment Schemes for wastewaters of Dairy, Distillery, Tannery, Sugar, and Antibiotic Industries. Management of estuarine, coastal water systems and man made reservoirs.

### **UNIT III - Xenobiotics and environment**

Xenobiotics : Ecological considerations, Degradative plasmids; Hydrocarbon and substituted hydrocarbons, Cellulosic and non – cellulosic wastes. Oil pollution, pesticides and explosives. Bioremediation of contaminated soil and waste lands. Solid waste management: Sources and management (Composting, Vermiculture and Methane production). Environmental mutagenesis and toxicity testing.

### **UNIT IV - Renewable energy**

Biodiesel, Bioethanol, Hydrogen production, Biopolymer, Bioplastics and Biosurfactants.

### **UNIT V - Oxidation process for organic removal**

Oxidation process for organic removal – Mechanism of oxidation of organic compounds by Chlorine, Oxygen and Ozone. Kinetics and Mechanism of reactions.

### **References:**

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2. Jogdand S. N., Environmental Biotechnology, Himalaya Publishing House, Bombay.
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4. Rao M. N. and Datta A. K. Waste water treatment, Oxford and IBH publishing Co Pvt Ltd, New Delhi.
5. De, A. K., Environmental Chemistry, Wiley Eastern Ltd., New Delhi
6. Allsopp, D. and Seal, Introduction to BioDeterioration, ELBS/Edward Arnold.
7. Skoog D. A. and West D. M. (2004), Fundamentals of Analytical Chemistry, Thompson Asia Pvt. Ltd., Singapore.
8. Reckhow D. A. and Brink D. R. (1997), Ozone in water treatment – Applications and Engineering, Lewis Publishers, USA.

## Special Paper - 3 : Microbial Biotechnology

### **Unit-I MICROBIAL DIVERSITY:**

Classification-Bacteria, Fungi, actinomycetes, Bergey's system: Molecular techniques for classification-Biochemical, microbiological, 16s rRNA sequencing, DNA-DNA hybridization, construction of phylogenetic tree, G+C analysis

Preservation and maintenance of microbes.

### **Unit - II FERMENTATION ENGINEERING:**

Fermenter: Types- stirred tank, deep-jet, air-lift and sparged tank fermenters; monitoring and control parameters

Bioreactors: types- batch, fed batch, continuous, CSTR, fluidized, immobilized cell reactors; mode of operation

Optimisation of conditions: screening of factors- Plackett Burman design. Fractional factorial design, Pareto chart: Optimisation of factors- Response Surface methodology: Model Confirmation-experimental, ANOVA, normal plot.

### **Unit –III DOWN STREAM PROCESSING:**

Separation of cells- flocculation, filtration, plate filters, rotary vacuum filters; Disintegration- mechanical and non-mechanical; Filtration- membrane filtration, ultra filtration reverse osmosis: Extraction- two phase, organic solvents, salts; Chromatography- absorption, adhesive; drying- spray driers, drum driers, freeze driers.

### **Unit –IV MICROBES IN PHARMACEUTICAL AND FOOD INDUSTRIES:**

Production, harvest, recover./, uses and mode of action- enzymes, antibiotics, vitamins (B12, B2) organic acids (acetic acid, lactic acid, citric acid), alcohol (ethanol), organic solvents (acetone- buranol), amino acids, beverages (beer, wine, brandy), microbial supplements (Lactic acid, bacteris) as medicine, biopolymer, biofertilizers, biocides. Steroid biotransformation. Improvement in production – improved strains by protoplast fusion, recombination. Alteration in metabolic pathway; immobilization of cells.

### **Unit -V BIOREMEDIATION:**

Xenobiotics-microbial mechanism; Microbial mining, ore leaching, oil recovery; solid waste treatment-coraposting, vermicomposting, biofuel, animal feed, mushroom cultivation, oil spill remediation, biomedical waste treatment; Wastewater treatment- primary, secondary and tertiary (Biological), heavy metal removal, artillery industrial waste treatment

### References :

1. Microbial Biotechnology- Fundamentals of applied Microbiology by A.N. Glazer and H. Nikaido. W.H. Freeman and company.
2. Principles of Fermentation Technology, P.F. stanbury & A. Whitaker, Pergamon Press.
3. Microbial Process Development by H.W Woelle, World Scientific
4. Biotechnology Text book of Industrial Microbiology by W. Creuger and A Creuger
5. Industrial Microbiology by Casida
6. Industrial Microbiology by Prescott
7. Biochemical Engineering Fundamentals, baily,J.e and Ollis, D.F., McGraw-Hill Book Co.New York.
8. Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm.
9. Bioprocess Engineering: Basic Concepts, shuler, M.L& Kargi, P, Prentics Hall Engelwood Cliffs.
10. Bioreaction Engineering Principles, Neilson, J. and Villadsen, J., Plenum Press.