

## **1MEV1: OPTIMIZATION TECHNIQUES & COMPUTER APPLICATIONS**

Concept of system engineering, classification and formulation of optimization problem, classical optimization methods: Using differential calculus, Lagrangian theory, Kuhn Tucker conditions, unconstrained minimization, Fibonacci, golden section and quadratic interpolation methods, Multidimensional minimization.

Univariate, Conjugate direction, gradient and variable metric methods. Constrained minimization techniques.

Penalty function methods. feasible direction and gradient projection methods and simulation.

Introduction to genetic algorithm , goal programming and simulation.

**1MEV2 : ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY**

**Physical Chemistry :**

Thermodynamics, Free Energy, osmosis, dialysis, law of mass action, chemical equilibria, basic concepts of chemical kinetics.

**Biochemistry:**

Biochemistry of carbohydrates, proteins, fats and oils, Enzymes, buffers, EMP nad TCA pathways, electron transport mechanism and oxidation phosphorylation, photosynthesis.

**General Chemistry:**

Henry's law, activity coefficients, ionization of weak bases, and acids, solubility product, common ion effect, ways of shifting chemical equilibria, Adsorption isotherms.

**Microbiology :**

General : Morphology and classification of bacteria, algae, fungi and viruses, elements of microscopy, Microorganisms of various aerobic and anaerobic biological waste treatment units, culture media for microorganisms, sterilization.

Culture of microorganisms in batch and continuous reactors, energy and kinetics of microbial growth and metabolism and biological fate of pollutants.

Microbiology of water, soil and air. Water and air borne diseases and their causative organisms, concept of indicator organisms. Tests for coliforms and streptococci and their significance, MPN and MF techniques, bacteriological standards.

**1MEV3 : AIR POLLUTION**

1. Sources and classification:  
Classification of aerosols, gases vapours, natural air pollutants, properties of air pollutants.
2. Meteorology :  
Factors influencing air pollution, wind roses, plume behaviour, estimation of plume rise.
3. Air pollution modeling :  
Dispersion models – Basquill model, ASME model, Gaussian plume model assumptions, limitations.
4. Effects of Air Pollutants :  
Effect on man, material, vegetation, art treasures. Air pollution disasters, Economic effects.
5. Global effects of Air Pollutants :  
Green house effect, acid rains, ozone hole, heat islands.
6. Air pollution due to automobiles :  
Vehicular emissions, motor fuel combustion, automobile emission control, general concepts of transport planning for prevention of air pollution.
7. Particulate control Technology :  
Dilution, control at source by equipments, settling chambers, cyclones, fabric filters, electrostatic precipitators, scrubbers.
8. Control of Gaseous Pollutants :  
Adsorption, absorption, combustion, condensation.

**2MEV2 : ADVANCED WATER TREATMENT TECHNOLOGY**  
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Water Quality Parameter

Significant water quality parameters for Municipal Water Supplies. Standards and Guidelines of Water for drinking purposes.

Water Treatment:

Settling, types of , Discrete particle settling, Flocculent Settling, Theory of Tube Settlers, Plate Settlers, Choice of Clarifiers, Ideal sedimentation Tank Concept.

Coagulation, Theory, Chemistry and Mechanism of Coagulants, Coagulant Aids, Flocculation, Orthokinetic, Perikinetic, Mean Velocity Gradient.

Long Rectangular Basin, Circular Basin Design of Clariflocculators.

Filtration, Theory of, Carman Kozeny equation, Filter Arrangement, Filter operation.

Disinfection, Types of, Mechanisms of, Factors Influencing Efficiency of Disinfectants, Chlorine Chemistry, Chlorinator.

Process and Application of Ion Exchange, Adsorption, Reverse Osmosis, Electrodialysis.

## **2MEV1 : ADVANCED WASTE WATER TREATMENT TECHNOLOGY :**

Waste Water Characteristics and their significance. B.O.D. Methods of Determination of K and Lo, Nitrification .

Comparison of various methods of Determination of Organics.

Screens, Grit Chamber, Floatation. Sedimentation, Zone Settling,

Classification of biological Waste water Treatment Process, Design of PST, SST.

Aeration of Waste Water.

Oxygen Transfer :

Process, Kinetic Relationship of Bio-Kinetic Parameters, Design Procedure, Modifications of A.S.P., Extended Aeration, Contact Stabilization, Step aeration, Tapered aeration, Trickling Filters. Theory of , Physical Arrangements, Design of ponds and Lagoons. Theory & Design of Rotating Biological Contactors, Concepts of Sequencing Batch Reactors Anaerobic & Filter UASB Sewage Farming.

Sludge : Sources, Characteristics, Volume- Mass relationship, Sludge Stabilization, Conventional and High Rate Digesters, Gas Production, Collection, Disposal of Sludge.

Tertiary treatment: Nitrogen removal, Phosphorus Removal.

## **2MEV3 :INDUSTRIAL WASTE WATER TRETMENT TECHNOLOGY & POLLUTION CONTROL**

### **1. General :**

Comparative study of industrial waste water with municipal waste water, Industrial waste water problems in India: Effects of discharges of Industrial Waste of Receiving Bodies of Water, Land and Sewer. Effluent and Stream Standards. Historical Development of law related to environmental Protection, Salient feature of Water Act-1974, Air Act 1981 and Environmental (Protection) Act 1986

### **2. Specific Industrial Treatment Processes :**

Neutralization, Equalization and Proportioning, Volume and strength reduction.

### **3. Raw materials, Water requirements, Process Characteristics, Composition, effects and treatment, flow sheet of Industrial Waste Waters generated from: Textile (Cotton and Synthetic), tannery, Pulp and Paper, Dairy, Metal Plating (Chromium and Cyanide problem), Slaughter house, Distillery, Dyeing and printing, Fertilizer, Copper & Cement Industry. Provision of various Indian Standards for above Industries.**

### **4. Potential of Wastewater Recycle and Reuse in Industries, Concept of Common Effluent Treatment Plants.**

### **3MEV1**

### **ENVIRONMENTAL IMPACT ASSESSMENT**

1. Concepts of EIA : Effect of human activity on environment, concept of eco-system imbalances, definition of E.I.A, E.I.S, E.M.P, industrial policy of the Govt. of India.
2. Prediction and assessment of impacts on air, water, biota, noise, cultural and socio-economic environment .  
Air quality impact : Air quality indices, air quality impact of industry transport systems, human settlements  
Methods of assessment, litigation of impact.  
Water quality impact : Water quality criteria, standards and indices, Impacts on water quality of development projects.  
Biota : Impact on fauna and flora, mitigation measures, alternatives.  
Noise : Effects of noise on people, noise scales and rating methods.  
Estimating transportation noise impacts.  
Cultural and socio economic impacts : Effect of developmental projects on cultural and social settings and economic profile of the community.  
Energy impact : EIA of hydro, thermal and nuclear power plants.
3. Methodologies for EIA, Preliminary assessment, quantification, comparison of alternatives and comprehensive E.I.As.

**4MEV1 : HYDROLOGY AND APPLIED HYDRAULICS**

**Hydrology :**

1. Evaporation and infiltration : measurement and estimation of evaporation from land and water surfaces. Infiltration, factors affecting infiltration.
2. Hydrograph analyses : Surface runoff, overland flow, factors affecting runoff. Rational formula. Hydrograph analyses, Unit hydrograph, channel and storage routing.
3. Fundamentals of ground water flow : Occurrence of Ground Water, Vertical Distribution of Ground Water, Darcy's law, Permeability, Porosity, Anisotropic Aquifers, Differential equations of Ground water flow.
4. Ground Water Development : Well development, Artificial recharge, Salinity of Ground water, Ground water pollution, Infiltration Galleries.

**Applied Hydraulics :**

1. Water Distribution System: General design requirements. Methods of analyses, control of water hammer in long distance transmission. Introduction to optimization of water distribution system.
2. Sewerage system design : General design principles of sewers, Recent development in sewerage system design.
3. Urban Storm Drainage : Introduction to drainage problems in difficult climates. Planning concepts, Rainfall intensity-duration –frequency curves. Design of drainage system elements, control of storm water pollution.
4. Water and wastewater pumping : Classification, selection, installation, operation and maintenance of pumps for water and wastewater pumping, electrical motors, choice and installation, starters and other accessories.

**1. Introduction :**

Human Development, Socio-Economic Activities and Energy Needs; Introduction to Primary and Secondary Energy Resources ; Introduction to Energy Conservation Technologies. Energy Needs (fuel types) of Domestic /Commercial Transport and Industrial Sectors; National and Global Energy Demand and Supply.

**2. Environmental Implications of Energy Use :**

Laws of Thermodynamics, Degradation of Energy; Fuel chain, Environmental Impacts at Different Stages of the Fuel Chain; Local, Regional and global Impacts; Waste Recycling and its impacts on Energy and Environment. Air pollution from cooking Appliances, Vehicle and Power Plants, long term Emission Standards for Indian Industries and Transport Sector.

**3 Pollution Control Technologies in Energy Sector :**

Clean Fuels and Environmental Friendly Cooking and Heating Appliances, Emission Control from Diesel & Petrol Engines, New and Efficient Engines: Clean Combustion Technologies for Coal; Flue Gas Desulphurization & Recirculation; Advanced Burner Technology& Staged Firing; Selective Catalytic reduction.

**4 Energy Environment Models :**

Analysis and design of Environmental Policies; Decision Analysis, System Dynamics and Linear Programming Models for Designing Environmental Policies, Current Research on Energy environment Interactions.

**5 Environmental Economics :**

Environmental Benefits and cost of the use of various options including Fossil Fuels, Bio Gas, Solar and Wind Energy.

## **4MEV2.1 DESIGN OF ENVIRONMENTAL ENGINEERING STRUCTURES**

### **1. Conduit :**

Stresses in pipes, Strength of Conduits, Design of Concrete and steel pipes for internal and external loads. Anchor Blocks.

### **2. Tanks :**

Underground Tanks, Retaining Wall and floor Junctions. Rectangular and Circular Tanks in R.C.C. and Steel, Intz Tanks, Steel and Concrete Staging.

### **3. Treatment Units**

Clarifiers, Flocculators, Filter House, Hopper Bottom Tanks, Digesters.

## **HAZARDOUS WASTE MANAGEMENT**

### **1. Hazardous Waste :**

Definition, Magnitude of Problem, Public and Government awareness of Hazardous Waste, Definition of Hazardous Waste under RCRA. Basic idea of the Hazardous Waste (Management and Handling) Rules, 1989.

### **2 Exposure and Risk Assessment :**

Introduction, Hazard Identification, Process of Risk Assessment, Toxicity Assessment, Risk Characterization and Remediation.

### **3 Environmental Legislation :**

Environmental Legislation for Industry in India. EPA obligations and Responsibilities. Hazardous Waste Management and Handling Rules. Environment Management Systems (EMS).

### **4 Waste Minimization**

Introduction to Government Policy in Waste Reduction. Benefits of Hazardous Waste Reduction. Approaches to Hazardous Waste Reduction. Priorities in Hazardous Waste Management.

### **5 Treatment**

Physical, Chemical and Biological Treatment of Hazardous Waste.

### **6 Radio Active Waste Management :**

Radiation Sources and Radioactivity. Exposure from Sources and Radiation Hazards. Radiation Detection, Measurements and Protection. Radiation protection Standards. Disposal Methods of Radioactive Waste.