

I SEMESTER

**APPLIED ENVIRONMENTAL CHEMISTRY  
AND MICROBIOLOGY**

Subject Code : **12 CEE-11**  
No. of Lecture Hrs/ Week - 04  
Total no. of Lecture Hrs. - 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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Importance of Environmental Chemistry, types of reactions, redox reactions, reaction kinetics. Electrochemistry and its applications.

**Physical and equilibrium chemistry** – fundamentals and applications. Trace Contaminants and their analyses.

**pH** – Principle, Measurement, Numerical Examples, Buffers and Buffer index.

**Colloidal Chemistry** – Properties of colloids, colloidal dispersions, stability of colloids and applications. Applications of Organic Chemistry in Environmental Engineering.

**Colourimetry** – Principles and applications.  
Applications of Analytical Chemistry – emission and absorption techniques.

**Microbiology** - Microorganisms of importance in air, water and soil environment Principles and applications of microscopy, microscopic flora and fauna of importance.  
Metabolism and metabolic pathways, Bioconcentration, Biomagnification and Bioaccumulation.

**Bacteria** – Morphology, typical growth curve and generation time, Measurement Techniques – APC, MPN (Probability and Thomas methods), MFT. Monod's equation and its applications. **Algae** - orphology, classification and their importance. **Fungi** - Protozoa - morphology, classification and their importance. Enzymes - classification, kinetics - Michaelis-Menten equation, factors influencing enzyme reaction.

**Virology** - Types, characteristics and enumeration methodology.

**REFERENCES:**

1. McKinney R.E.(1962) "**Microbiology for Sanitary Engineers**", Newyork McGraw Hill.
2. Sawyer C.N. and McCarty, P.L ., (2003), "**Chemistry for Environmental Engineering and Science**", 5<sup>th</sup> Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Pelczar M.J ,Chan ECS, Krieg, NR(1998) "**Textbook of Microbiology**" 5th edition Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Gaudy and Gaudy (1980), "**Microbiology for Environmental Scientists and Engineers**", McGraw Hill.
5. APHA, (2002), "**Standard Methods for Examination of Water and Wastewater**"; 21st Edition.
6. Stumn and Morgan(1970), "**Aquatic Chemistry**", John Willey & Sons Newyork

**7. Relevant Journals**

## WATER TREATMENT TECHNOLOGY

Subject Code : **12 CEE-12**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Introduction** – Sources of water, necessity of treatment, Critical Water quality parameters, water quality guidelines and standards for various water uses.

**Unit operations** – principles and design of aeration systems – two film theory, water in air system, air in water system. **Intake structures** – Different types, design criteria.

**Principles of sedimentation** – types of settling and settling equations, design criteria and design of settling tanks. **Principle of Coagulation and Flocculation** – types of coagulants, coagulant aids, coagulation theory, optimum dose of coagulant, design criteria and numerical examples.

**Filtration** – theory, types, hydraulics of filter bed, design criteria and design of filters, filter backwash, operational problems and trouble shooting.

**Adsorption Process** – types, factors affecting adsorption, kinetics and equilibrium – different isotherm equations and their applications.

**Unit processes** - disinfection – different types, disinfectants, factors affecting disinfection, methods of disinfection, chemistry of chlorination.

**Water Softening** – Ions causing hardness, Langelier index, various methods. **Fluoridation and defluoridation** – Principles and design.

**Trace organic contaminants** in water supplies and their removal.  
Bench Scale and Pilot Plant studies in water treatment. Rural Water Supply Systems.

### REFERENCES:

1. Fair, G.M., Geyer J.C and Okun, (1969) "**Water and Waste water Engineering**" Vol II, John Wiley Publications.
2. Weber W.J., (1975) "**Physico - Chemical Processes for Water Quality Control**".
3. AWWA, (1971), "**Water Quality and Treatment**" McGraw Hill.
4. CPHEEO Manual, (1991), "**Water Supply and Treatment**", GOI Publications.
5. Peavy, H.S., Rowe and Tchobonoglous, G., (1985), "**Environmental Engineering**", McGraw Hill
6. Raju, B.S.N., (1995), "Water Supply and Wastewater Engineering", Tata McGraw Hill Pvt. Co. Ltd., New Delhi.
7. World Health Organization, Geneva, (2004), Guidelines for Drinking Water Quality, Third Edition, Volumes 1-3.

## WATER RESOURCES ENGINEERING AND APPLIED HYDRAULICS

Subject Code : **12 CEE-13**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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Water resources of the world, India and Karnataka, National Water Policy.

**Hydrology** - Hydrologic cycle, estimation of missing precipitation and rain gauge density.

**Hydrograph theory** - Unit hydrograph – derivation, flow routing, low flow analysis.

**Urban Hydrology** - Run-off estimation – Design of Stormwater Drains.

**Basics and applications of Remote Sensing** in water resources management.

**Unsteady Flow through Conduits** - Water hammer analysis, Water hammer protection methods - surge tanks.

**Flow Measurements** – Area –Velocity method, Weir method, flumes, end-depth method & chemical and radioactive tracers method

**Groundwater** - Basic equations of flow, confined and unconfined aquifers, sea water intrusion, artificial recharge, groundwater pollution, borewells - types & design principles, open wells – types, yield tests.

### REFERENCES:

1. Raghunath H.M.(1988), "**Advanced Hydrology**", Wiley Eastern Ltd New Delhi
2. Subramanya K.S(1994)., "**Advanced Hydrology**".**Tata Mc Graw Hill, New Delhi**
3. David Keith Todd(1980), "**Ground Water Hydrology**".2nd Edition John Wiley & Sons New Delhi
4. Sabins F.F(1997)., "**Remote Sensing – Principles and Interpretations**", W.H. Freeman & Co.
5. Anji Reddy, (2001), "**Remote Sensing and GIS**", B.S. Publications, Hyderabad.
6. Ven T. Chow (1988), "**Hand Book of Applied Hydrology**", 1<sup>st</sup> Edition Mc Graw Hill Publications
7. Hammer M.J, and Mackichan K.A.(1981), "**Hydrology and Quality of Water Resources**", Newyork:Wiley.
8. John Permankian, "**Water Hammer Analysis**".
9. Linsley, Franzini, Freyberg, Tchobanoglous G.(1992), "**Water Resources Engineering**", TATA McGraw Hill Series.
10. Linsley, Kohler and Paulhes(1975), "**Hydrology for Engineers**", McGraw Hill.
11. Mays L.W. (2004), "**Water Resources Engineering**", John Wiley and Sons Publications.

## **SOLID WASTE ENGINEERING AND MANAGEMENT**

Subject Code : **12 CEE-14**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
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**Land pollution and control** – Land Pollution sources and their impacts , general control measures

**Solid waste** – sources and engineering classification, characterization, generation and quantification.

**Transport** - collection systems, collection equipment, transfer stations, collection route optimization.

**Treatment methods** - various methods of refuse processing, recovery, recycle and reuse, composting – aerobic and anaerobic, incineration, pyrolysis and energy recovery,

**Disposal methods** – Impacts of open dumping, site selection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, leachate treatment.

**Recent Developments in Solid Wastes Reuse and Disposal** – Power Generation, Blending with construction materials and Best Management Practices (BMP).

**Role of various organizations in Solid Waste Management** – Governmental, Non-Governmental, Citizen Forums.

**Biomedical Waste management** – sources, treatment and disposal

### **REFERENCES:**

1. Tchobanoglous G., Theissen H., and Eliassen R.(1991), “**Solid Waste Engineering - Principles and Management Issues**”, McGraw Hill, New York.
2. Pavoni J.L.(1973)., “**Handbook of Solid Waste Disposal**”.
3. Peavy, Rowe and Tchobanoglous (1985), “**Environmental Engineering**”, McGraw Hill Co. 4th Edition
4. Mantell C.L., (1975), “**Solid Waste Management**”, John Wiley.
5. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
6. WHO Manual on Solid Waste Management.
7. Vesiland A.(2002), “**Solid Waste Engineering**”, Thompson Books.
8. Hazardous waste (management and handling) rules, 2001
9. Biomedical (Handling and Management) Rules 2008

## ADVANCED COMPUTATIONAL METHODS AND OPTIMIZATION

Subject Code : **12 CEE-151**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Numerical Methods** - Partial differential equations, Newton-Raphson method,

**Finite difference, finite element**, method of characteristics, different methods, Successive over relaxation methods.

**Optimization** – classification and importance in Environmental Studies.

**Single and multivariable** optimization without and with constraints.

**Linear Programming** – different methods, linear approximation of non-linear optimization.

**Statistics** - Significance Tests , Frequency Distribution, Characteristics of Distributions, Method of Least Squares and Regression, Multiple Regression

**Probability** – Concepts, Methods, Binomial, Poisson and Normal distribution,

**Risk and uncertainty** analysis

### REFERENCES:

1. Rao. S.S.(1979) **Optimization: Theory & Applications Techniques**, Wiley Eastern Ltd New Delhi.
2. Taha H.A.,(2007), "**Optimization Research**":An introduction, Pearson Prentice Hall, 8<sup>th</sup> Edition
3. Shanthakumar M.S., **Numerical Methods and Analysis**, Tata McGrawhill Pubs.
4. Ross S.M.,(1987) "**Introduction to Probability and Statistics for Engineers and Scientists**", John Wiley Publications.3<sup>rd</sup> Edition, Academic press
5. Stanton(1961) R.G –"**Numerical methods for science and engineers**".Prentice Hall, Trade Edition
6. Kreyszig Erwin(2006),9<sup>th</sup> Edition" **Advanced Engineering Mathematics**", Wiley Eastern Publications.
7. Berthouex P M.,and Brown L. C.(1994), "**Statistics for Environmental Engineers**", Lishers publication, 2<sup>nd</sup> Edition

## OCCUPATIONAL SAFETY AND HEALTH

Subject Code : **12 CEE-152**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Introduction**, Occupational Safety and Health Act, Occupational Safety and Health Administration, Right to know Laws.

**Indian Acts** – Labour Act, Factories Act, OSHA

**Accident** – Causation, investigation methods and different models.

**Ergonomics** – need, Task Analysis, Preventing Ergonomic Hazards, Ergonomics Programme.

**Occupational Hazard and Control** - Hazard Analysis, Human Error and Fault Tree Analysis, Emergency Response. Hazards and their control in different manufacturing and processing industries.

**Fire Prevention and Protection** - types of Fire, Fire Development and its Severity, Effect, Extinguishing Fire, Electrical Safety, Product Safety.

**Occupational Health** - Health and Safety Considerations, Personal Protective Equipment.

**Health problems in different types of industries** – construction, textile, steel and food processing, pharmaceutical, occupational Health and Safety considerations in Wastewater Treatment Plants.

### REFERENCES:

1. Goetsch D.L., (1999), “**Occupational Safety and Health for Technologists**”, Engineers and Managers”, Prentice Hall.
2. Heinrich H.W.(1959), “**Industrial Accident Prevention**”, McGraw Hill Publication , Newyork.
3. Colling D.A.(1990), “**Industrial Safety Management and Technology**”, Prentice Hall, New Jersey.
4. Della D.E., and Giustina, (1996), “**Safety and Environmental Management**”, Van Nostrand Reinhold International Thomson Publishing Inc.
5. CPHEEO, (1999) **Manual on Sewerage and Sewage Treatment**, Ministry of Urban Development, GOI, New Delhi.
6. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), “**Industrial Safety and Pollution Control Handbook**”

## REMOTE SENSING AND GIS IN ENVIRONMENTAL ENGINEERING

Subject Code : **12 CEE-153**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Remote Sensing: Definition** – Ideal Remote Sensing System – Sensors and Types – Remote Sensing Satellite – IRS and INSAT specifications – Applications of remote sensing – DIP Techniques.

**GIS: Definition** – Data and Types – Sources of data - Global Positioning System (GPS) – Data Structure – Types of Analysis – Errors – Applications of GIS.

**Optimal Routing of Solidwastes using GIS – Case Study.**

**Environmental Siting of Industries and Zoning Atlas Development.**

**Re-modelling of Water Distribution System using GIS – Case Study.**

**Sustainable Urban Development Planning using GIS. Environmental**

**Degradation Assessment using RS and GIS.**

**Ground water vulnerability modeling using GIS**

### REFERENCES:

1. Burrough P.A., (1986), "**GIS for Land Resource Assessment**", Oxford University Press, U.K.
2. Star J.L., and Estes J.E., (1990), "**Geographic Information Systems; An Introduction**", Prentice Hall Publications.
3. Laurini R. and Thompson D., (1992), "**Fundamentals of Spatial Information Systems**", Academic Press.
4. Mishra H.C., (1997), "**GIS Handbook**", GIS India, Shanthi Nivas, Hyderabad.
5. Anji Reddy, (2001), "**Remote Sensing and GIS**", B.S. Publications, Hyderabad.
6. Floyd F.Sabins,(1996) "**Remote Sensing – Principles and Interpretations**", W.H. Freeman & Co.
7. Michael N. Demas, (2000), "**Fundamentals of GIS**", John Wiley & Sons, Inc.
8. "**Photonirvachak**", ISRS Journal Publications.

## II SEMESTER

### ATMOSPHERIC ENVIRONMENTAL POLLUTION AND CONTROL

Subject Code : **12 CEE-21**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Introduction:** sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance.

**Meteorology** - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Windrose diagram.

**General characteristics of stack emissions, plume behaviour, heat island effect.**

**Monitoring of particulate matter and gaseous pollutants** – respirable, non-respirable and nano - particulate matter. CO, CO<sub>2</sub>, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

**Pollutants dispersion models** – description and application of point, line and areal sources.

**Air Pollution Control equipment for particulate matter & gaseous pollutants** – gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP).  
– adsorption, absorption, scrubbers, condensation and combustion.

**Indoor Air Pollution** – sources, effects and control.

**Noise** - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

#### REFERENCES:

1. Wark K., Warner C.F., and Davis W.T., (1998), "**Air Pollution - Its Origin and Control**", Harper & Row Publishers, New York.
2. Lee C.C., and Lin S.D., (1999), "**Handbook of Environmental Engineering Calculations**", McGraw Hill, New York.
3. Perkins H.C.(1974), "**Air Pollution**", McGraw Hill.
4. Crawford M.,(1976) "**Air Pollution Control Theory**", TATA McGraw Hill.
5. Stern A.C., "**Air Pollution**", Vol I, II, III.
6. Seinfeld N.J., (1975), "**Air Pollution**", McGraw Hill.
7. Stern A.C.(1968), (ed) Vol. V, "**Air Quality Management**".



## ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT

Subject Code : **12 CEE-22**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Ecology** - Classification of Ecosystems, Structure and Function of Ecosystems, Energy flow in Ecosystems, Ecological Niche and succession, Bio-geo-chemical cycles, Ecological Pyramids.

**Aquatic and Terrestrial Ecosystems** - Diversity and dominance Indices, Ecosystem Models.

**Climate change and biodiversity**

**Lake Ecosystem** – trophic levels, nutrient loading, nutrient enrichment, Leibig's Law, control of eutrophication.

**Environmental Impact Assessment** – Definition, Objectives, Types – Rapid and Comprehensive EIA, EIS, FONSI. Step-by-step procedure for conducting EIA and Limitations of EIA, Prevention of Significant Deterioration (PSD) Programme.

**Frame work of Impact assessment**, scope and contents of EIA, methodologies and techniques of EIA.

**Attributes, Standards and Value functions.** Public participation in EIA. Environmental Management Plan (EMP) and Disaster Management Plan (DMP).

**EIA Case Studies** –Thermal Power Plant, Mining, Fertilizer, Construction Projects, Air port, Water and Wastewater Treatment Plants.

### REFERENCES:

1. Kormondy, (1960), "**Concepts of Ecology**", Prentice Hall Publication, New Jersey.
2. Odum, (1961), "**Fundamentals of Ecology**", Adisson Co.
3. Krebs J.,(1985) "**Ecology - The Experimental Analysis of Distribution and Abundance**", I Edition, Harper International.
4. Hall C.A.S., and Day J.W.(1977), "**Ecosystem Modeling in Theory and Practice: An Introduction with Case Histories**", John Willey.
5. Canter L., (1995), "**Environmental Impact Assessment**", McGraw Hill.
6. Jain R.K., Urban L.V., Stacey G.S., (1977), "**Environmental Impact Analysis – A New Dimension in Decision Making**", Van Nostrand Reinhold Co.
7. Clark B.C. Bisett and Tomlinson P, (1985), "**Perspective on Environmental Impact Assessment**", Allied Publishers.
8. Rau and Wooten, (1981), "**Environmental Impact Assessment Handbook**". McGraw Hill.
9. **Relevant Journals** :

## WASTEWATER TREATMENT ENGINEERING

Subject Code : **12 CEE-23**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Objectives of wastewater treatment**, characteristics, flow variations, types of reactors and reactors analysis. Wastewater Treatment Flow Diagrams and Hydraulic Profile.

**Theoretical principles and design** - screens, equalization basin, grit chamber, primary and secondary settling tanks.

**Kinetics of biological treatment systems** – biokinetic constants and their determination, batch and continuous systems.

**Theoretical principles and design** – suspended growth system - conventional activated sludge process and its modifications.

**Theoretical principles and design** – attached growth system – trickling filter, bio-towers and rotating biological contactors. Principles and design of stabilization ponds

**Sludge Processing** – separation - sludge thickeners, volume reduction, conditioning and digestion – aerobic and anaerobic.

**Advanced Wastewater Treatment** – Need and technologies used. Nitrification and Denitrification Processes, Phosphorous removal. Wastewater disinfection.

**Rural wastewater systems** – septic tanks, two-pit latrines, eco-toilet, soak pits.

### REFERENCES:

1. Benefield R.D., and Randal C.W., (1980), “**Biological Process Design for Wastewater Treatment**”, Prentice Hall, Englewood Cliffs, New Jersey.
2. Metcalf and Eddy Inc., (2003), “**Wastewater Engineering - Treatment and Reuse**”, 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Karia G.L., and Christian R.A., (2001), “**Wastewater Treatment Concepts and Design Approach**”, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Ronand L., and Droste, (1997), “**Theory and Practice of Water and Wastewater Treatment**”, John Wiley and Sons Inc.
5. Fair G.M., Geyer J.G and Okun, “**Water-wastewater Engineering**”.
6. Lee C.C., and Lin S.D., (1999), “**Handbook of Environmental Engineering Calculations**”, McGraw Hill, New York.
7. Gaudy,(1972) “**Advanced Wastewater Treatment**”.
8. “**Industrial Safety and Pollution Control Handbook**”, (1991), National Safety Council and Associate (Data) Publishers Pvt. Ltd.,

## TRANSPORT PROCESSES AND MODELLING OF AQUATIC SYSTEMS

Subject Code : **12 CEE24**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Modelling** – Introduction, applications in environmental management. **Physical phenomena** – advection, diffusion, dispersion, Fick's laws of diffusion and convective - diffusion equations for turbulent & shear flow regimes.

**Steady-state water quality modelling** - models for conservative and non-conservative substances.

**Data collection and analysis** - specialized water quality surveys, estimation of decay and reareation rates.

**1-D Oxygen balance models** - Streeter-Phelps equation, critical point method.

**Calibration and verification of 1-D oxygen model.** Error measures.

**Mixing zones in rivers** – types of outfalls and mixing regimes. Steady-state 2-D analysis. Field study methodology. Parameter estimation – lateral mixing co-efficient - critical point method – simple numerical problems. Dissolved oxygen models for lakes under completely mixed and stratified conditions.

**Eutrophication models** - simplified nutrient loading models for rivers and lakes.

**Ocean disposal of wastewater** - Siting and design of outfalls.

### REFERENCES:

1. Rich L.G., “**Environmental Systems Engineering**“, McGraw Hill.
2. Thomann R.V., and Mueller J.A., (1987), “**Principles of Water Quality Management and Control**“, Harper & Row Publications.
3. Schnoor J.L., “**Environmental Modelling – Fate and Transport of Pollutants in Water, Air and Soil**“, John Wiley and Sons.
4. Thomann R.V., (1980), “**Systems Approach to Water Quality Management**“, McGraw Hill.
5. Lee C.C., and Lin S.D., (1999), “**Handbook of Environmental Engineering Calculations**“, McGraw Hill, New York.

## ENVIRONMENTAL PLANNING AND MANAGEMENT

Subject Code : **12 CEE-251**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Environment and Sustainable Development** - carrying capacity, relationship with quality of life, carrying capacity and resource utilization.

**Engineering Methodology in Planning and its Limitations** – carrying capacity based short and long term regional planning.

**Environmental Protection** - Economic development and social welfare consideration in socio economic developmental policies and planning.

**Total cost of development and environmental protection cost.** Case studies on Regional carrying capacity.

**Engineering Economics** – Value Engineering, Time Value of Money, Cash Flows, Budgeting and Accounting.

**Environmental Economics:** Introduction, economic tools for evaluation, Green GDP, Cleaner development mechanisms and their applications.

**Environmental Audit** – methods, procedure, reporting and case studies.

**Total Quality Management in environmental management and protection** – ISO 9000, 14000 and 18000 series of standards.

### REFERENCES:

1. Lohani B.N (1984)., "**Environmental Quality Management**",South Asian Publishers, New Delhi
2. Chanlett, (1973)"**Environmental Protection**", McGraw Hill Publication, Newyork.
3. Danoy G.E., and Warner R.F., (1969), "**Planning and Design of Engineering Systems**",Unwin Hyman Publications.
4. MOEF, Government of India, "**Carrying Capacity Based Developmental Planning Studies for the National Capital Region**", 1995-96.
5. NEERI, Nagpur, Annual Reports 1995 & 1996.
6. UNEP / UNDP – "**Environmental Sustainable Development**".

## HAZARDOUS WASTE MANAGEMENT

Subject Code : **12 CEE-252**

No. of Lecture Hrs/ Week : 04

Total no. of Lecture Hrs. : 52

IA Marks : 50

Exam Hrs : 03

Exam Marks : 100

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**Introduction, Sources, Classification,** Regulations for Hazardous Waste Management.

**Hazardous Waste Characterization,** Designated Hazardous Wastes.

**Waste Minimization and Resource Recovery** – Approaches, Development of a Waste Tracking System, Selection of waste Minimization Process, Case Studies.

**Transportation of Hazardous Waste** – requirements, regulations, containers, bulk and non-bulk transport, Emergency Response.

**Physico-chemical, Chemical and Biological Treatment of hazardous waste.**

**Thermal treatment** - Incineration and pyrolysis.

**Sanitary landfill** – design approach, leachate and gaseous collection system. Facility Siting and Process Selection for treatment, storage, disposal facility (TSDF).

**Soil contamination and site remediation** – bioremediation processes, monitoring of disposal sites.

### REFERENCES:

1. Lehman, (1983), "**Hazardous Waste Disposal**", Plenum Press.
2. LaGrega M.D., Buckingham P.L., and Evans J.C., (1994), "**Hazardous Waste Management**", McGraw Hill International Edition.
3. Wentz C.A., (1989), "**Hazardous Waste Management**", McGraw Hill.
4. Dawson and Mercer, (1981), "**Hazardous Waste Management**", John Wiley.
5. Fawcett, (1984), "**Hazardous and Toxic Materials: Safe Handling and Disposal**", John Wiley.
6. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "**Industrial Safety and Pollution Control Handbook**"

## GLOBAL WARMING AND CLIMATE CHANGE

Subject Code : 12 CEE-253  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Energy Issues and Climate Change** , Alternate Energy Sources

**Green-House Effect** as a Natural Phenomenon, Green House Gases GHGs) and their Emission Sources  
Quantification of CO<sub>2</sub> Emission, Global Warming Potential (GWP) of GHGs

**Modeling Climate change, Ozone layer depletion and its control**

**Impacts of climate change** – Global and India, Temperature Rise, Sea Level rise, Coastal Erosion and landslides, Coastal Flooding, Wetlands and Estuaries loss

**Kyoto Protocol** – Importance, Significance and its role in Climate Change

**Carbon Trading** - Mechanisms , Various Models (European, Indian) Global and Indian Scenario

**Cleaner Development Mechanisms** – Various Projects related to CO<sub>2</sub> Emission Reduction

**Alternatives of Carbon Sequestration** – Conventional and non-conventional techniques , Role of Countries and Citizens in Containing Global Warming

### References:

1. Barry R.G., and Chorley R.L., (1992), “**Atmosphere, Weather and Climate**”, 4<sup>th</sup> Edition, ELBS Publication.
2. Bolin B., (Ed.), (1981), “**Carbon Cycle Modelling**”, John Wiley and Sons Publications.
3. Corell R.W., and Anderson P.A., (Eds.), (1991), “**Global Environmental Change**”, Springer Verlag Publishers.
4. Francis D., (2000), “**Global Warming: The Science and Climate Change**”, Oxford University Press.
5. Frame B., Medury Y., and Joshi Y., (Eds.), (1992), “**Global Climate Change: Science, Impact and Responses**”.
6. Linden E., (2006), “**The Winds of Change: Climate, Weather and the Destruction of Civilizations**”, Simon and Schuster Publications.
7. Mintzer I.M., (Ed.), (1982), “**Confronting Climate Change, Risks, Implications and Responses**”, Cambridge University Press.
8. Srivatsava A.K., (2007), “**Global Warming**”, APH Publications.
9. Wyman R.L., (Ed.), (1991), “**Global Climate Change and Life on Earth**”, Chapman and Hall Publications.
10. Yadav, Chander and Bhan, (2005), “**Global Warming: India’s Response and Strategy**”, RPH Publications.

### III SEMESTER

#### INDUSTRIAL WASTEWATER TREATMENT

Subject Code : **12 CEE-31**

No. of Lecture Hrs/ Week : 04

Total no. of Lecture Hrs. : 52

IA Marks : 50

Exam Hrs : 03

Exam Marks : 100

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**Effects of Industrial Wastes** on sewerage system and sewage treatment plants and receiving water bodies. Effects of waste additions on physical and chemical properties of soil.

**Effluent standards and receiving water quality standards.** Different aspects and choices of various disposal alternatives.

**Industrial Waste survey**-Process flow charts, condition of waste stream. Material balance, Sampling – Grab, Composite and integrated samples. Continuous monitoring – pH, Conductivity, Biomonitoring.

**Pretreatment of Industrial Wastewater** – Volume reduction, Strength reduction, Neutralization, Equalization and Proportion, Removal of Organic and inorganic dissolved solids.

**Wastewater Treatment in specific industries:** Distillery, Sugar, Pulp and paper, Cement, Textile, Dairy, Fertilizer, Pesticides, Pharmaceutical,

**Radio Active Wastes treatment**- Low activity and high activity radiation, application of radio active techniques for wastewater treatment. **Bio-Remediation** of contaminated soils.

**Design of complete treatment system & disposal for industries:** Distillery, Dairy, Textile, paper and pulp mill to meet P.C.B. norms.

**Environmental Auditing:** Introduction, Cost of Pollution, Environmental audit solutions, Financial and Managerial opportunities. Criminal and Regulatory liabilities.

#### REFERENCES:

1. Nemerow N.N., (1971) – “**Liquid Waste of industry theories**, “Practices and Treatment. Addison Willey New York.
2. Azad N. S.,– “**Industrial Wastewater Management Hand Book**” McGraw Hill book Co., Newyork.
3. Ross R.D. (1968)– “**Industrial Waste Disposal**”, Reinhold Environmental Series – New York.
4. Dickinson(1974)- **Practical Waste Treatment and Disposal Applied Science publication**, London.
5. Mahajan (1984) –” **Pollution control in Process industries**”. TMH, New Delhi.
6. Eckenfelder(2000)- “**Industrial Water pollution Control**”- McGraw hill Company, New Delhi American Chemical Society, Washington D.C. USA
7. **bioremediation books**

## NON – POINT SOURCES OF POLLUTION AND MANAGEMENT

Subject Code : **12 CEE-321**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Introduction** – Non-point Pollution, Problem, definitions, magnitude of Non-point Pollution, Non-point Pollution Control Laws, Waste Assimilative Capacity and Stream Standards

**Pollution From the Atmosphere** – Atmospheric Inputs – fall out, rainfall,

**Groundwater Pollution** – Sources of Groundwater Contamination, Groundwater Movement.

**Pollution from impervious urban areas** – Introduction Deposition and Accumulation of Pollutants on Impervious Surfaces

Removal of Solids from street Surfaces, Porous Pavement.

**Non point Pollution Simulation Models-** Basic Concepts Brief Description available Nonpoint Pollution Simulation Models

**Land use and non-point pollution** - Effects , Comparative Assessment of Pollution Impact from land use, agricultural runoff, mining area runoff, Effect of hydrologic Modifications

**Management Practices of Non-point pollution control-** Introduction, Source Control Measures Collection Control and Reduction of Delivery

**Planning for Nonpoint Pollution Control** – Introduction, Water Quality Planning Process, Selection of Best Management Practices for Non Point Source Pollution Control – detention ponds, exfiltration and infiltration trenches, vegetative swales.

### REFERENCES:

1. Novotny V., and Chesters G., (1981), “ **Hand Book of Non-point Pollution, Sources and Management**”, Van Nostrand Reinhold Environmental Engineering Series, New York.
2. Pavoni J L, (Ed) (1977), “**Hand Book of Water Quality Management Planning**”, Van Nostrand Reinhold, Environmental Engineering Series. New York
2. Pluarg, Pollution from Land Use Activities Reference Group Novotny V and Chesters G, (1981), “**Hand Book of Non-point Pollution, Sources and Management**”, Van Nostrand Reinhold Company.



## OPERATION AND MAINTENANCE OF ENVIRONMENTAL FACILITIES

Subject Code : **12 CEE-322**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Importance of Operation & Maintenance:** Basic Principles, Objectives, Requirements, Corrective and Preventive Maintenance.

**Data Base of Facilities for O&M** – Detailed Plans, Drawings, Operation Manuals, Record keeping, standard operating procedure

**Computer Applications in O&M – MIS and SCADA systems**

**Operation & Maintenance Planning** - Organisational Structure, Work Planning, Preparation and Scheduling, Cost Estimates.

**O&M of Water Supply Facilities:** Operational Problems and Corrective Measures in Different Units of Treatment. Use of Network Models – CPM and PERT.

**O&M of Wastewater Facilities:** Operational Problems and Corrective Measures in Different Units of Treatment.

**O&M of Air Pollution Control Facilities:** Operational Problems and Corrective Measures in Different Units of Treatment.

**Risk and Vulnerability Assessment** – Water and Wastewater treatment systems

### REFERENCES:

1. Metcalf and Eddy Inc., (2003), "**Wastewater Engineering- Treatment and Reuse**", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Hammer M.J., and Hammer Jr. M.J., (2008), "**Water and Wastewater Technology**"- Prentice Hall of India Pvt. Ltd., New Delhi.
3. CPHEEO Manual., (1991) "**Water Supply & Treatment**", GOI Publication.
4. CPHEEO Manual., (1995) on "**Sewerage & Sewerage Treatment**", GOI Publication.,
5. Training Manual on O&M for Municipal Staff, **Asian Development Bank Project**, Government of Karnataka.
6. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "**Industrial Safety and Pollution Control Handbook**"
7. **Vulnerability assessment books**

## ADVANCED ATMOSPHERIC ENVIRONMENTAL ENGINEERING

Subject Code : **12 CEE-323**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Atmospheric Processes and Chemical Reactions: Definition of terms** aerosols, particle, photolysis, gas to particle conversion, condensation, evaporation, dissolution, sublimation, specific heat, conduction, radiation. Mechanical turbulence, forced convection, advection, equation of state, first law of thermodynamics. Reaction Rates (Gas Phase Species) Atmospheric gases and their molecular structures, chemical reactions and photo processes, reaction rates, reaction rate coefficients, sets of reactions, stiff systems.

**Atmospheric Boundary Layer:** Characteristics of atmospheric boundary layer-boundary layer depth, mean velocity power-law profile, Log-Log velocity profile, spectral description of turbulence, turbulence intensity, Reynolds stress parameter, spectral density function, integral length scale, inertial subrange and small scales. Turbulent fluxes of momentum, turbulent fluxes of energy and water vapour, friction velocity, surface roughness lengths, bulk aerodynamic equations for eddy diffusion, monin-obukhov similarity theory, eddy diffusion above the surface layer, ground surface temperature and moisture.

**Urban Air Quality Simulation Modeling:** General need, alternative approaches, basic model applications, general composition of models, Numerical modeling approaches-Gaussian diffusion models, physical basis of the mass conservation approach, mathematical foundation of the mass conservation approach.

**Inherent problem in air quality simulation modeling**-boundary conditions, spatial resolution and compatibility with available data. Transportation related modeling-street canyon models, highway models, airport models. Air quality simulation models for Quasi-Inert pollutants-sulfur dioxide and particulate models, carbon monoxide models. Air quality simulation models for photochemical pollutants-background, features of photochemical air quality simulation models, model evaluation, model validation.

**Dispersion of Heavy Gases:** Introduction, characteristics of heavy gas flow, introduction to numerical modeling of heavy gas dispersion, requirements for physical models (non-dimensional parameters, choice of scaling variables).

**Mobile Sources of Pollution:** Introduction, emission standards for automobiles, Gasoline, origin exhaust emissions from gasoline engines, crankcase and evaporative emissions, alternative fuels and their utilization.

**Indoor Air Pollution:** Introduction, the IAQ problem, diagnosis and remediation of IAQ problems, the interdisciplinary approaches. Industrial hygiene and its application to IAQ, industrial hygiene methodology. Indoor air quality and industrial hygiene, sampling, analysis and interpretation. Industrial hygiene methodology, architectural and construction aspects.

**Design of Industrial Ventilation Systems:** Introduction, ventilation by dilution, hood specifications, hoods of simple geometry, experimental velocity contours, complex hood design, duct design, fan selection and performance.

## REFERENCES:

1. Jacobson. Z. A.(1999), **Fundamental of Atmospheric modeling**, Cambridge University Press, Cambridge.
2. Warren B. Johnson et. al. (1976), **Air Pollution**, Arthur C. Stern, third edition, Volume I, Academic Press, New York, .
3. Krogstad and Jacobsen, **Dispersion of heavy gases, in encyclopedia of environmental control technologies**, edited by Cheremioinoff, Volume-2, Rulf publishing company, Houston.
4. Crawford Martin, "**Air pollution control theory**", Tata McGraw- Hill publishing company Ltd. New Delhi, 1980.
5. Stull B. Roland,(1988) **Boundary Layer Meteorology**, Kluwer Academic Publishers, .
6. Snyder H. William, "**Guideline for fluid modeling of atmospheric diffusion**", U.S. Environmental Protection Agency research Triangle Park, NC 27711.
7. Wark K., Warner C.F., and Davis. W.T., Air Pollution,(1998) "**its origin and control**", Third Edition, Harper and Row Publication.
8. Steve M. Hays, Ronald V. Gobbell & Nicholas R. Ganick,(1995) "**Indoor Air Quality**"- Tata McGraw-Hill.

## HYDRAULICS OF WATER AND WASTEWATER SYSTEMS

Subject Code : **12 CEE-331**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Water Supply System** – Introduction – types of systems, population forecasting methods, water demand, pressure, design period, pipe materials and roughness coefficient.

**Storage Reservoirs** – Need, different types, capacity determination and evaluation of pumping systems.

**Pipe Networks** – Peak factors for intermittent and continuous distribution system. Branch and Grid Iron systems. Nodal demand, Design Layouts of distribution systems, Evaluation of distribution system - Computer Analysis of Pipe Networks for different options, Economic Analysis of Pipelines and Networks.

**Leak Detection** – Prediction, Prevention and Control.

**Water Quality in Distribution System** – factors affecting water quality, predictive tools and intermediate disinfection.

**Wastewater Collection System** – Separate and Combined Sewer Systems, relevant equations for flow conditions, pipe materials and roughness coefficient, design guidelines and examples. Sewer Appurtenances,

**Sewer Network** – Estimation of Nodal Flows, Pumping Stations, Evaluation of Different Network Options.

**Storm Sewers** – flooding and water quality problems, run-off calculations, storm water inlets, open drains and sewer pipes and design for different layouts.

### REFERENCES:

1. Sincero A.P., and Sincero G.A., (1999), “**Environmental Engineering – A Design Approach**”, Prentice Hall of India Pvt. Ltd., New Delhi. Hammer M.J., and Hammer Jr. M.J., (2008),
2. “**Water and Wastewater Technology**”, Prentice Hall of India Pvt. Ltd., New Delhi.
3. Walski T.M., (1987), “**Analysis of Water Distribution Systems**”, CBS Publications, New Delhi.
4. CPHEEO **Manual on Water Supply and Treatment**, (1991), GOI Publications. CPHEEO Manual on Sewerage and Sewage Treatment, (1995), GOI Publications.

## TOXICOLOGY & ENVIRONMENTAL RISK ASSESSMENT

Subject Code : **12 CEE-332**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**Introduction to toxicology** – Significance, Applications, & Importance

**Introduction to risk assessment** – assessment methods,  
Human exposure assessment, characterization of health risks. LD50 & LC50 concentrations

**Toxicology** – exposure, toxic effects, dose response relationships, carcinogens and non-carcinogens.

**Toxicology & Epidemiology**, public health & Risk assessment, Epidemiology & its importance

**Hazard identification, exposure and toxicity assessment, Risk characterization, risk communication,**

**Ecological risk assessment – Monte Carlo methods, case studies.**

### REFERENCES:

1. LaGrega M.D., Buckingham P.L. and Evans J.C.(1994), "**Hazardous Waste Management**"- McGraw Hill, New York
2. David G.M, and Haner N.B., "**An Applied Approach to Epidemiology and Toxicology for Engineers**" – Instructor's Resource Guide, US Department of Health Education and Welfare.
3. World Health Organization Report," **Recommended Health Based Limits in Occupational Exposure to Heavy Metals**"
4. Kamrin S. E., "**A text book on Primer on Toxicology Principles & Applications**" Lewis Publishers.
5. Kalos M.H., and Whitloc P.A.(1986), **Monte Carlo Methods**, Vol. 1, Basics, Wiley Publications.
6. Fan A.M & Chang L.W, (1996), "**Toxicology & Risk Assessment- Principles , Methods & Applications**", Informa Health Care pubs.
7. Price F.T, Nancy Lane, Briq K.V, (2000), "**Environmental Toxicology & Risks Assessment – Recent Advancement in Environmental Fate & Transport** ", ASTM International
8. Landis W.G., Ming-Ho Yu, (2004), "**Introduction to Environmental Toxicology - Impacts of Chemicals upon Ecological Systems**", CRC Press

## ENERGY & ENVIRONMENT

Subject Code : **12 CEE-333**  
No. of Lecture Hrs/ Week : 04  
Total no. of Lecture Hrs. : 52

IA Marks : 50  
Exam Hrs : 03  
Exam Marks : 100

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**INTRODUCTION TO ENERGY SOURCES:** Global Energy, Environmental Resources, Energy necessity and energy crisis. Indian Energy Scenario: Energy Consumption, needs and crisis, energy sources and availability.

### **RENEWABLE SOURCES OF ENERGY AND ENVIRONMENT:**

Biomass – introduction, energy plantation, bio-mass conversion technologies (wet and dry process), photosynthesis, agricultural waste derived energy, urban waste derived energy. **BIOGAS:** Generation, factors affecting bio-digestion, advantages of anaerobic digestion, classification of bio-gas plants.

**HYDROPOWER:** Site selection for hydroelectric power plants, classification of hydroelectric power plants, submergence, ecological imbalance, catchment area treatment, advantages and disadvantages of hydroelectric power plants. Submergence, Ecological Imbalance, Catchment Area Treatment.

**TIDAL ENERGY:** OTEC (Ocean Thermal Electric Conversion), methods of ocean thermal electric power generation, site selection. Energy from tides – basic principles of tidal power, components of tidal power plant.

**SOLAR ENERGY:** Solar constants, solar radiation at earth surface, physical principles of conversion of solar radiation into heat. Concentrating collectors (focusing and non-focusing).

**WIND ENERGY:** Introduction, basic principles of wind energy conversion. Site selection considerations. Basic components of wind energy conversion system. Wind energy collectors. Natural gas – classification and comparison of different gas turbine power plants, Associated Environmental Effects.

**NUCLEAR ENERGY:** necessity, general components of nuclear reactors, different types of reactors, breeding reactors, location of nuclear power plants, disposal of nuclear wastes, Associated Environmental Effects.

**GEO-THERMAL ENERGY:** introduction, nature of geothermal fields, geo-thermal sources, binary fluid geo-thermal power system and arrangement for hybrid plants.

### **REFERENCE BOOKS:**

1. Mathur, A.N., and Rathore, N.S., “**Renewable Energy and Environment**” –Proceedings of the National Solar Energy, Himanshu Publications, Udaipur.
2. Rao and Parulekar B.B., (1977), **Energy Technology–Non-conventional, Renewable and Conventional**”, 2nd Edition, Khanna Publishers.
3. Rai, G.D , “**Non-conventional Energy Sources**”, Khanna Publications.
4. Saha, H., Saha, S.K., and Mukherjee, M.K., (1990), “**Integrated Renewable Energy for Rural Development**”, Proceedings of the National Solar Energy Convention, Calcutta, India,
5. Wilber, L.C., (1989), “**Handbook of Energy Systems Engineering**”, Wiley and Sons.
6. The Energy Research Institute (TERI), New Delhi, Publications.
7. Ministry of Environment and Forests, Government of India, Annual Reports.