

VII SEMESTER

COMPUTER APPLICATIONS IN ENVIRONMENTAL ENGINEERING

Subject Code : **10EV71**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Computer Programming and Computer Aided Design, software and analytical tools, requirements and benefits of CAD, CAD languages and their requirements.

4 Hours

UNIT - 2

POPULATION FORECAST PROGRAMS: Arithmetic increase method, geometric increase method, incremental increase method and logistic curve method.

4 Hours

UNIT - 3

WATER SUPPLY AND TREATMENT PROGRAMS: Rising main design, pumping unit, service reservoir capacity calculation, Distribution network analysis & design – (One to three loops only). Water treatment units design – Cascade aerator & Spray aerator, plain sedimentation tank, clariflocculator tank, filters (rapid and slow) – Mechanical rapid mix Unit.

10 Hours

UNIT - 4

WASTEWATER COLLECTION AND TREATMENT UNITS PROGRAMS: Sewer Network analysis and design, wastewater treatment units – Septic tank, Screen, Grit chamber, Secondary settling tank, ASP, Trickling filter, waste stabilization pond, Oxidation ditch, Sludge digester, Sludge drying beds.

10 Hours

PART - B

UNIT - 5

AQUATIC SYSTEMS PROGRAMS: Water quality in rivers due to discharge of conservative and non-conservative waste, DO models for rivers (Streeter- Phelps equation) and lakes, Water quality in mixing zone – critical point method.

6 Hours

UNIT - 6

AIR QUALITY PROGRAMS: Programs on stack effective height calculation, Gaussian Plume Model for gaseous and particulate dispersion from point sources. Line source Gaussian model, Instantaneous puff dispersion model. Estimate for various sampling times and decay of pollutant. Design of particulate control devices – Settling chamber, cyclones.

10 Hours

UNIT - 7

INTRODUCTION TO GIS: Components of GIS, Application and benefits of GIS. GIS Operations – Spatial Data Input, Data Management Display, Exploration Analysis & GIS Modeling.

4 Hours

UNIT - 8

Introduction to Computer graphics – Applications.
Introduction to DBMS – Components of DBMS

4 Hours

REFERENCES

1. Thomann, R.V., and Mueller, J.A., (1987), **Principles of Surface Water Quality Modeling and Control** –Harper Int. Edition.
2. Krishna Murthy, C.S., and Rajeev, S., (1998), **Computer Aided Design software and Analytical Tools**–Norosa Publishing House.
3. Wark, K., Warner, G.F., and Davis, W.T., (1998), **Air Pollution its Origin and Control** – Addison- Wesley.
4. M. Crawford, (1980), **Air Pollution Control Theory**–Tata McGraw Hill Edition.
5. Mahajan, (1989), **Pollution Control in Process Industries**, Tata Mc. Graw Hill.
6. Sincero & Sincero, (1989). **Pollution Control in Process Industries**–Tata Mc. Graw Hill.
7. **“Manual on water supply and Treatment”**, CPHEEO, Ministry of Urban Development, Gol, New Delhi, 1999.
8. **“Manual on Sewerage and Sewage Treatment”**, CPHEEO, Ministry of Urban Development, Gol, New Delhi, 1993.

ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT

Subject Code : **10EV72**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Scope of Ecology; Sub – Divisions in Ecology, Ecosystem Concepts: Nature, Interactions, Structure and Functions. Ecological Pyramids, Food Chain and Food Webs, Measurement of Productivity.

6 Hours

UNIT - 2

ENERGY FLOW IN ECOSYSTEM: Perfect and Imperfect Biogeochemical Cycles, Diversity, Dominance and Evenness Indices – Problems. Aquatic Ecosystems: Lotic & Lentic Systems – Structure and Zonation. Eutrophication of Lakes: Causes, Limiting Nutrients and Control Methods.

6 Hours

UNIT - 3

POPULATION GROWTH FORMS: Carrying Capacity and Environmental Resistance, Maximum Sustainable Yield, Quantitative Ecology, Concepts of Modeling and Ecosystem Modelling.

5 Hours

UNIT - 4

INTRODUCTION TO EIA: Definition, Evaluation of EIA in India, Rapid and Comprehensive EIA, EIS, FONSI and NDS. Need for EIA Studies, Baseline data. Step – by – step procedure for conducting EIA, Advantages and Limitations of EIA. Hierarchy in EIA, Statutory Requirements in EIA, MoEF Guidelines in Siting Developmental Projects.

9 Hours

PART - B

UNIT - 5

OBJECTIVES AND SCOPE OF EIA: Contents of EIA. Methodologies and Evaluation Techniques of EIA, Technique selection for Specific Projects.

5 Hours

UNIT - 6

ENVIRONMENTAL ATTRIBUTES: Value Functions, Prediction Equations and Mitigation of Impact on Air, Water, Land, Ecology and Socio-economic Environment. Input requirements for Computer Models.

5 Hours

UNIT - 7

PUBLIC PARTICIPATION IN EIA: Elements of Effective Public Participation and Benefits and Procedures. Environmental and Disaster Management Plans.

PROJECT ACTIVITY: Attribute - Activity Relationship, Matrices & BEES.

9 Hours

UNIT - 8

IMPACT QUANTIFICATIONS of : Water Resources Developmental Projects, Mass Transit Systems (MTS), Hazardous Waste Disposal Sites, Sanitary Landfilling, Mining Project, Construction Activity, Thermal Power Plant (Coal- based), Pharmaceutical Industries.

7 Hours

REFERENCES

1. Canter L.W., (1996), **Environmental Impact Assessment**, 2nd edition–McGraw Hill Inc. New York
2. Odum (1964), **Fundamentals of Ecology** –Addison Co.
3. Jain, R. K., Urban, L. V. and Stacey, G. S. (1977) “**Environmental Impact Assessment**” Van Nostrand Reinhold.
4. Anjaneyulu Y., (2002), **Environmental Impact Assessment Methodologies** –B.S. Publications, Hyderabad.
5. Kormondy (1989), **Concepts of Ecology** –Prentice Hall, New Delhi
6. **Guidelines for EIA of Developmental Projects**. Ministry of Environment and Forests, Government of India.

INDUSTRIAL POLLUTION CONTROL TECHNOLOGY

Subject Code : **10EV73**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Sources of Industrial Wastewaters. Inventory of Industrial Pollution sources, Effluent and Stream standards, Assimilation capacity of a receiving body.

4 Hours

UNIT - 2

VARIATION IN QUANTITY AND QUALITY OF INDUSTRIAL

WASTEWATER: Flow monitoring, Sampling and Characteristics. Concentration and mass load calculations.

6 Hours

UNIT - 3

TOXICITY OF INDUSTRIAL WASTEWATERS TO AQUATIC

BIOTA: Testing Methods and Units, Biomonitoring of Effluents.

5 Hours

UNIT - 4

INDUSTRIAL WASTEWATER: Flow Quantification, Types and Categorization, Effects on receiving bodies (air, water and land).

6 Hours

PART - B

UNIT - 5

COMBINED TREATMENT: Raw Industrial Wastes and Domestic Wastewater after Mixing Partly or fully. Selection of Treatment Methods.

5 Hours

UNIT - 6

APPROACHES TO WASTE MINIMIZATION - Volume Reduction, Strength Reduction, Equalization, Neutralization and Proportioning and floatation Design Examples.

6 Hours

UNIT - 7

INDUSTRIAL WASTE - PROCESS LINE DIAGRAMS: Characteristics, Effects and Treatment of Industrial Wastes from - Sugar & Distilleries, Pulp & Paper, Pharmaceuticals, Tanneries and Food processing, Textile, Fertilizer, Steel & Dairy Industries.

Wastewater Reuse and Waste Recovery from Different Industries, Recycle options. **12 Hours**

UNIT - 8

TREATABILITY STUDIES FOR INDUSTRIAL WASTEWATERS: Bench-scale & pilot scale studies. Estimation of Bio Kinetic Coefficients.

TOXIC AND HAZARDOUS WASTE – Generation, storage, transportation, treatment and disposal options of Solid, Liquid and Gaseous wastes.

8 Hours

REFERENCES

1. Nemerow N.L. (1982), **Liquid Waste of Industry- Theories, Practice and Treatment –** Addison Wesley.
2. Rao M.N., and Datta A.K. (1987), **Wastewater Treatment –**Oxford and IBM Publishers.
3. Mahajan S.P. (1987), **Pollution Control in Process industry**, TMH Co.
4. Metcalf and Eddy, (2003), **Wastewater Engineering, Treatment and Reuse –** 4th Edition, Tata McGraw Hill Publishing Co. Ltd.
5. Lagrega M.D., Buckingham P.L., and Evans J.C. (1994), **Hazardous Waste Management** , McGraw Hill International Edition.
6. Wentz C.A. (1995), **Hazardous Waste Management –**McGraw Hill International Edition.
7. Patwardhan ,A.D.(2009),**Industrial Wastewater Treatment –** PHI Learning Pvt. Ltd., New Delhi

ESTIMATION, SPECIFICATIONS & FINANCIAL ASPECTS OF ENVIRONMENTAL FACILITIES

Subject Code : **10EV74**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

EARTHWORK: Volume by cross-section (including prismoidal and curvature corrections), spot levels and contour – construction of mass diagram, calculation of haul, over haul and economic haul lead and lift.

7 Hours

UNIT - 2

WORKING OUT DATA : Procedure for working out quantities and rates for the following items – lime and cement mortars, lime and cement concrete, brick and stone masonry, flooring, plastering, RCC works, centering and form works for different RCC items, doors, windows and ventilators

7 Hours

UNIT - 3

SPECIFICATIONS: Drawing up specifications for several construction materials such as coarse aggregate lime, cement, mortars, plain and reinforce concrete, brick masonry, stone masonry, flooring, roofing, plastering, wood work, earthwork and surfacing, water supply distribution lines. Surface and sub-surface drainage line (including stone-ware pipes).

8 Hours

UNIT - 4

ESTIMATION: Methods of taking out quantities, preparation of detailed and abstract estimates for the following environmental engineering works - Septic tank, manhole, pump house, store room. Calculation for procuring steel for reinforcement for various basic components such as small slabs, chejja and lintels.

12 Hours

PART - B

UNIT - 5

VALUE ENGINEERING: Necessity, method and objections to its study.

4 Hours

UNIT - 6

FINANCIAL ASPECTS: Definition, purpose. Cost price – value – different forms of value – gross income – net income – outgoings – types of out goings – obsolescence, annuity, year's purchase.

5 Hours

UNIT - 7

Capital cost, operating cost, capitalized value, time value of money, sinking fund – depreciation – methods of calculation of depreciation, cost fixation on the produced commodity.

5 Hours

UNIT - 8

FISCAL INCENTIVES FOR ENVIRONMENTAL PROTECTION:

Exemption from IT, Investment and Depreciation Allowance, Exemption from Tax to Capital Gains, Rebate in Cess Levied on Consumption of Water.

4 Hours

REFERENCES

1. B. N. Dutta (2008), **Estimating And Costing In Civil Engineering**, Ubs Publishers Distributors Pvt.ltd
2. Mahajan S P (2006), **Civil Estimating & Costing Valuation & Specifications –**. Satya Prakashan
3. R.K.Amin (1963), **Economics for Engineers–** Charotar Book Stall, .
4. Tarachand. (1996) **Engineering Economics**, Nem Chand & Brothers
5. **Manual on water supply and Treatment**", CPHEEO, Ministry of Urban Development, Gol, New Delhi, 1999.
6. **Manual on Sewerage and Sewage Treatment**", CPHEEO, Ministry of Urban Development, Gol, New Delhi,
7. **Current Schedule of Rates (SR)** of PWD, KUWS&DB.

NUCLEAR, RADIOACTIVE AND BIOMEDICAL WASTE TECHNOLOGY

Subject Code : **10EV751**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Nuclear fission and fusion. Nature and sources of radiation, types of radiation on the basis of ionization. interactions of radiation with matter,

6 Hours

UNIT - 2

MEASUREMENT METHODS: Units of radiation and radiation standards, measurement techniques, measuring instruments, measurement procedure.

6 Hours

UNIT - 3

EFFECTS: General biological effects of ionizing radiation, radiation effect on aqueous environment and moist air system, effect of radiation at molecular levels, external radiation hazards.

8 Hours

UNIT - 4

RADIATION PROTECTION: Control of radiation hazards, survey, contamination monitoring, radiation hazards from reactors, radiological emergencies and control, protection against X-rays, quantitative risk assessment.

8 Hours

PART - B

UNIT - 5

CASE STUDIES: Chernobyl reactor accident. Hiroshima and Nagasaki Episodes. Short and long term effects of groundwater chemistry around a nuclear waste deposits.

8 Hours

UNIT - 6

Biohazard – sources, effects & control. Biohazard standards. Biological weapons, mass destruction weapons.

4 Hours

UNIT - 7

Biomedical wastes – sources, generation rate, Characterization
Biomedical wastes (Management & Handling) rules 2009.

6 Hours

UNIT - 8

Biomedical waste management – Principles & ethics, collection, transportation, treatment & safe disposal options.

6 Hours

REFERENCES

1. Chaatwal, G.R., Mehra, S.C., Satake, M., Katya, M. and Nagahiro, T. (1994), **Environmental Radiation and Thermal Pollution and their Control** – Anmol Publications, New Delhi.
2. Mookerjee A., and Bhattacharjee S.B. (1994). **Aspects of Radiation Biophysics** – Interprint publishers.
3. Lagrega M.D., Buckingham, P.L. and Evans, J.B. (1995), **Hazardous Waste Management** – McGraw Hill Inc.
4. **NEERI**, Nagpur Publications on Biomedical waste management.

OCCUPATIONAL SAFETY AND HEALTH

Subject Code : **10EV752**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: History and Development, Occupational Safety and Health Act, Occupational Safety and Health Administration, Right to know Laws.

6 Hours

UNIT - 2

ACCIDENT CAUSATION: Cause of Accidents, Deaths in Work Accidents, work injuries, type of accidents, chemical and heat burn injuries.

5 Hours

UNIT - 3

Theories of Accident Causation: Domino, Human Factor, Petersew's Accident Incident, Epidemiological, Human Error Model.

5 Hours

UNIT - 4

ERGONOMICS: Definition, factors associated with physical stress, worksite analysis programme, hazard prevention and control. Specific ergonomic problems and problem solving strategies, economics of ergonomics.

6 Hours

PART - B

UNIT - 5

OCCUPATIONAL HAZARD AND CONTROL: Hazard Analysis, Human Error Analysis in Causation with Hazard Analysis, Fault Tree Analysis, Emergency Response, Decision for Action, Purpose and Considerations, Right Decision, Wrong Remedy

6 Hours

UNIT - 6

Engineering Versus Management Control, Hazard Control Measures, Hazards and their Control in Pharmaceutical, Construction, Textiles, Petroleum Refineries and LPG Bottling, Iron & Steel Industries

6 Hours

UNIT - 7

FIRE PREVENTION AND PROTECTION: Fire Development and its Severity, Effect of Enclosure, need for early Detection of Fire, Extinguishing Fire, Electrical Safety, Product Safety, Technical Requirements of Product Safety Programme.

8 Hours

UNIT - 8

OCCUPATIONAL HEALTH: Health and Safety Considerations, Personal Protective Equipment, Effects of Exposure and Treatment for Metal Working Trades, Municipal Solid Waste, Epoxy Resins, and Foundries. Occupational Health and Safety Considerations in Wastewater Treatment Plants.

10 Hours

REFERENCES

1. Colling D.A., (1990), **Industrial Safety Management and Technology**–, Prentice Hall, New Delhi.
2. Della D.E. and Giustina (1996), **Safety and Environmental Management**–Van Nostrand Reinhold International Thomson Publishing Inc,
3. Anand Gopal Mukherjee(1986), **Environmental Pollution and Health Hazards**–, Causes and Control, Galgotia Publications Pvt. Ltd., New Delhi
4. Trevethick R.A. (1973) **Environmental and Industrial Health Hazards**–William Heinemann Medical Books Ltd., London
5. Goetsch D.L., (1999), **Occupational Safety and Health For Technologist, Engineers & Managers** –3rd Edition, Prentice Hall,

RURAL PUBLIC HEALTH ENGINEERING

Subject Code : **10EV753**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART A

UNIT 1

Rural Health policy, Historical perspective on rural health, Public health issues, Equity in rural health and health care, Access to health care.

6 Hours

UNIT 2

Rural sanitation, Infectious diseases, their transmission, Chronic diseases in Rural health, Rural women's health.

6 Hours

UNIT 3

Village level operation and maintenance, role of women and children in rural areas
Rural occupational health and safety, Rural health and community based models

6 Hours

UNIT 4

An integrated approach to improving health and health care in rural communities
Quality of care in rural communities, impact of Water supply and sanitation systems on quality of life in rural areas.

8 Hours

PART B

UNIT 5

Health behaviour and health threats in rural communities, Improving population health and personal health care. Role of paramedics, anganawadi workers and school teachers in rural health.

6 Hours

UNIT 6

Rural sanitation Options – Low cost sanitation systems, Septic tank and Soak Pits, garbage pits, Ecological sanitation – Ecotoilet, its features and advantages over conventional sanitation systems.

8 Hours

UNIT 7

Information, Education and Communication (IEC) activities to promote rural sanitation, Quality improvement activities in rural areas, Key components of comprehensive quality improvement program, Current status of quality improvement efforts in rural areas.

6 Hours

UNIT 8

Role of various governmental and Non-governmental agencies for promotion, implementation and sustainability of programmes, Recruiting, training and retaining Rural health professionals, Funding of rural health care, Medicare programs in Rural areas

6 Hours

REFERENCES

1. Loue, S., and Quill B.E., (2001), Handbook of Rural Health, Kluwer Academic/ Plenum Publishers, New York
2. Sinha, B.D., and Menon P.S.K., (2000), "**Environmental Sanitation Health and Panchayati Raj**", Concept Publishing Company, New Delhi
3. Ricketts T.C., (1999), "**Rural Health in United States**", Oxford University Press
4. Health Care Services (2005), "**Quality through collaboration: The future of rural health care**", The National academies press, Washington D.C.
5. Chanlet E.W., "Environmental Protection", Tata McGraw Hill Publishers.

ENVIRONMENTAL ASPECTS OF DEVELOPMENTAL PROJECTS

Subject Code : **10EV761**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Environment, Sustainable Development, Quality of Life (GDP, GNP), Need for Development and Environmental Protection, Ambient and Effluent Emission Standards, Regulation for Environmental Pollution Control, Environmental Ethics. Carrying capacity concept – applications for regional planning development.

8 Hours

UNIT - 2

INFRASTRUCTURAL PROJECTS: Highways, Airports, Water Supply and Sanitation, Wastewater Treatment – Salient Details and Environmental Aspects.

8 Hours

UNIT - 3

CONSTRUCTION PROJECTS: Construction activities and their environmental effects, Mitigation Measures.

6 Hours

UNIT - 4

WATERSHED DEVELOPMENT - RESERVOIRS & DAMS: Microclimatic changes, Submergence of land, forest & habitation – social effects. Effects on Flora & Fauna, Pollution accumulation on Sediments, Reservoir Sedimentation.

6 Hours

PART - B

UNIT - 5

IRRIGATION & AGRICULTURAL ACTIVITIES: Water logging, Malaria Cause and Salinity Problems - Mitigative measures for Environmental Protection. Natural – Earthquake, Tsunami, Cyclone & Land slides, Threats & their Management.

8 Hours

UNIT - 6

POWER PROJECTS: Hydro thermal and Nuclear projects, Power Transmission lines and Influence on Environment and Mitigation Methods.

4 Hours

UNIT - 7

INDUSTRIAL DEVELOPMENTAL PROJECTS: Process Flow Diagrams and Waste Generation Points for Pig Iron Plant, Coke oven, fertilizer, Textile and Food Industry.

6 Hours

UNIT - 8

Plastics and Polymer Industry, Electroplating Industry, Mining Activity. Pollution Control Measures, Recycle & Reuse, Cleaner development mechanisms

6 Hours

REFERENCES

1. Lohani B. N., (1984), **Environmental Quality Management** South Asian Publishers Pvt. Ltd.
2. Henry J.G. and Heinke G.W. (1996),**Environmental Science and Engineering**– Prentice Hall of India.
3. **Environment and Sustainable Development Journals**– UNEP/UNDP.
4. Ashwathanarayana U., (1995), **Geo-environment – An Introduction** Capital Books Pvt. Ltd., New Delhi.
5. Wilber L.C. (1989),**Handbook of Energy Systems Engineering**– Wiley and Sons.
6. R. K. Sharma & Sharma (1987), **Hydrology & Water resources Engineering**– Dhanpat Rai publishers,

ENVIRONMENTAL APPLICATIONS OF REMOTE SENSING AND GIS

Subject Code : **10EV762**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

REMOTE SENSING: Definition – Ideal Remote Sensing System–Sensors and Types.

4 Hours

UNIT - 2

Remote Sensing Satellite – IRS and INSAT specifications – Applications of remote sensing – DIP Techniques.

6 Hours

UNIT - 3

GIS: Definition, Components of GIS, Data and Types, Sources of data - Global Positioning System (GPS).

4 Hours

UNIT - 4

DATA STRUCTURE: Types of Analysis, Errors, Errors analysis & correction, general Applications of GIS.

6 Hours

PART - B

UNIT - 5

Environmental Applications of RS and GIS in Optimal Routing of Solidwastes collection system of an urban area. Environmental Siting of Industries and Zoning Atlas Development using Remote Sensing Data and GIS.

8 Hours

UNIT - 6

Re-modelling of Water Distribution & Sewer Network Systems using GIS.

8 Hours

UNIT - 7

GIS for Sustainable Urban Development Planning. Storm water system management using GIS

8 Hours

UNIT - 8

Groundwater Vulnerability Modelling using GIS. Environmental Degradation Assessment using RS and GIS (Forest covers Reservoir capacity, Catchments area).

8 Hours

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** –Shanthy Nivas, Hyderabad.
5. Anji Reddy, (2001), **Remote Sensing and GIS** –B.S. Publications, Hyderabad.
6. Sabine F.F., (1987), **Remote Sensing – Principles and Interpretations**, W.H. Freeman & Co. New York
7. N. Demas, (2000), **Fundamentals of GIS** –John Wiley & Sons, Inc Case Studies Reports
8. Basudeb Bhatta, (2008), **“Remote Sensing and GIS”**, Oxford University Press.
9. George Joseph, (2008), **“Fundamentals of Remote Sensing”**, University Press.
10. Korte, G.B.(2009), ‘ **The GIS Book**’, Cengage Learning, New Delhi

BIOREMEDIATION TECHNOLOGY

Subject Code : **10EV763**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART A

UNIT 1

Bioremediation for Soil Environment - Environment of Soil Microorganisms, Soil Organic Matter and Characteristics, Soil Microorganisms Association with Plants, Pesticides and Microorganisms, Petroleum Hydrocarbons and Microorganisms, Industrial solvents and Microorganisms.

8 hours

UNIT 2

Biotechnologies for Ex-Situ Remediation of Soil, Biotechnologies for in-Situ Remediation of Soil, Phytoremediation Technology for Soil Decontamination.

6 Hours

UNIT 3

Bioremediation for Air Environment - Atmospheric Environment for Microorganisms, Microbial Degradation of Contaminants in Gas Phase, Biological Filtration Processes for Decontamination of Air Stream. Biofiltration, Biotrickling Filtration and Bioscrubbers

6 Hours

UNIT 4

Bioremediation for Water Environment - Biochemical, Molecular, and Ecological Foundations of Bioremediation, Contaminants in Groundwater, Ex-situ Decontamination of Groundwater, Characterizing the Site and Contaminant Complexity, Selecting the Bioremediation Option, Process Optimization.

6 Hours

PART B

UNIT 5

In-situ Bioremediation of Groundwater, Factors Affecting Bioaugmentation, Delivery Systems for Oxygen, Nutrients, and Inoculation,

6 Hours

UNIT 6

Landfill Leachate Biotreatment Technologies, Industrial Wastewater Biotreatment Technologies Biotreatment of Surface Waters

8 Hours

UNIT 7

Biotreatment of Metals - Microbial Transformation of Metals, Biological Treatment Technologies for Metals Remediation.

6 Hours

UNIT 8

Bioleaching and Biobenifiation, Bioaccumulation, Oxidation/Reduction Processes, Biological Methylation, Case studies

6 Hours

REFERENCES

1. Sikdar, S.K., and Irvine R.L., (1998), "**Bioremediation Technologies: Principles and Practice**", Technomic publishing company, Inc,
2. Crawford, R.L., and Crawford D.L., 1996), "**Bioremediation: principles and applications**", published by Press Syndicate of the university of Cambridge
3. Valdes J.J., (2000)" **Bioremediation**" , Kluwer Academic Publishers
4. Baker, K.H., and Herson D.S., (1994), "**Bioremediation**", McGraw-Hill,
5. Atlas, R.M., and Philip, J., (2005), "**Bioremediation: applied microbial solutions for real-world environmental cleanup**", ASM press
6. Singh, S.N. and Tripathi R.D., (2007), "**Environmental bioremediation technologies**" springer- verlag Berlin Heidelberg
7. Eweis, J.B.(1998), **Bioremediation principles**, PublisherWCB/McGraw-Hill

COMPUTER AIDED DESIGN AND DRAWING OF ENVIRONMENTAL SYSTEMS – II

Subject Code : **10EVR77**
No. of Practical Hours/ Week : 04
Total No. Practical Hours : 42

IA Marks : 25
Exam Hours : 03
Exam Marks : 50

PART - A

UNIT - 1

DESIGN & DRAWING OF STORM DRAINS: Street Inlet and L, V and Box Drains, Manhole.
Design & Drawing of Septic Tank, Dispersion Trench and Soak Pit.

UNIT - 2

Design & Drawing of Grit Chamber and Screens.
Hydraulic Profile of Wastewater Treatment Systems.

UNIT - 3

Layout drawing of typical wastewater plant
Design & Drawing of Secondary Treatment systems. ASP.

UNIT - 4

Design & Drawing of Trickling Filters, RBC, Bio Towers.

PART - B

UNIT - 5

Design Principles & drawing of Aerated Lagoon, Stabilization Ponds – Oxidation pond.

UNIT - 6

Design & Drawing of Anaerobic Digester & Sludge Drying Beds.

UNIT - 7

Design & Drawing of Sanitary Landfill for Municipal Solid Waste Disposal with leachate & gas collection systems.

UNIT - 8

Design & Drawing of Air Pollution Control Systems – Settling Chambers, Cyclone separator, Bag Filter and Wet Scrubber.

REFERENCES

1. Quasim, S.R., (1985), **Wastewater Treatment Plants – Planning, Design and Operation** – Holt Rinehart and Winston, CBS College Publishing.
2. **“Manual on Sewerage and Sewage Treatment”**, CPHEEO, Ministry of Urban Development, Gol, New Delhi
3. Sincero A.P., and Sincero G.A. (1999), **Environmental Engineering – A Design Approach**– Prentice Hall of India.
4. **Air Pollution Control Methods** – Park D

COMPUTER APPLICATIONS LABORATORY

Subject Code : **10EVL78**
No. of Practical Hours/ Week : 03
Total Practical Hours : 42

IA Marks : 25
Exam Hours : 03
Exam Marks : 50

Introduction to DOS & UNIX operating system environment along with file handling commands (like- open, copy, rename, delete etc.)

I. Writing programmes in C-language & Running for the following.

- 1) Exercises on data sorting and searching, matrix operation, numerical Integration and curve fitting.
- 2) Exercises on statistical analysis of data – mean, median, std. Deviation & variance for grouped and ungrouped data.
- 3) Population forecast: AM, GM, incremental and logistic curve method.
- 4) Rising main design, pumping UNIT design and water distribution system (two to three loops).
- 5) Design of water and wastewater treatment units, sewer design and septic tank design.
- 6) DO model for river (Streeter – Phelps) and lake, river mixing zone water quality – critical point method.
- 7) Air quality system: Gaussian Plume model for gaseous and particulate dispersion, effective stack height determination and particulate control devices design.

II. Running following application software packages:

- a. WAT PLANT and DOWATTS for treatment units.
- b. WADISO, BRANCH, LOOP, QUALOOP and EPANET for water Distribution system.
- c. RMAIN - water rising main design.
- d. SEWER – sewer network design.
- e. WRPLOT (USEPA) – Wind rose plot
- f. ISCST / ISCLT (USEPA) versions air quality predictions from industrial sources.
- g. CALINE (USEPA) versions model for air quality near Highways.

REFERENCES

1. **Manual on water supply and Treatment**, CPHEEO, Ministry of Urban Development, Gol, New Delhi, 1999.
2. **“Manual on Sewerage and Sewage Treatment”**, CPHEEO, Ministry of Urban Development, Gol, New Delhi,
3. **Software Package Manual on BRANCH, LOOP, SEWER** – UNDP/UNEP.
4. **WATPLANT and QUALOOP Softwares.** – CPHEEO – Manual.
5. **Relevant Software Manuals– USEPA**
6. Wark.K, Warner G.F. and Davis W.T (1998) – **Air Pollution its origin and control**, Addison-Wesley,
7. Thomann R.V and Mueller J.A (1987.)–. **Principles of surface water quality modeling and control**, Harper & Row Publishers,
8. Sincerio A.P.& Sincerio G.A. (1999.)–, **Environmental Engineering – A Design Approach** Prentice Hall of India.

VIII SEMESTER

MANAGEMENT FOR ENVIRONMENTAL ENGINEERS

Subject Code : **10EV81**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Historical Perspective, Contribution of HL Gantt and others to the evolution of management as scientific discipline, recent trends, relevance of management science in the Indian context.

2 Hours

MANAGEMENT AND ITS FUNCTIONS: Definition of Management, Purpose, Types of Management, Project Manager and Key Roles, Time Management, Management Style – Autocratic and Group, SWOT, Motivation of Staff and key factors of effective Management. Institutional Development.

4 Hours

UNIT - 2

ENVIRONMENTAL LEGISLATION- Acts and rules related to Environmental Protection, Air, Hazardous Waste and Biomedical waste, Environmental protection Act. Command and Control Agencies Central, State, Individual Industry, NGO's.

6 Hours

UNIT - 3

TOTAL QUALITY MANAGEMENT IN ENVIRONMENTAL

PROTECTION: ISO 14000 and 18000 series of standards, Preventive Environmental Policy. Environmental Audit: General Procedure, Types of Audit, Features, Effective Auditing.

8 Hours

UNIT - 4

Program Planning, Commitment by Management, Confidentiality, Audit Report of Action Plan, Water & Energy Audit, Case Studies.

6 Hours

PART - B

UNIT - 5

PROJECT FORMULATION & MANAGEMENT CONCEPTS: Levels of Projects, Characteristics, Classification and Implementation, Network analysis – Critical Path Method (CPM), Program Evaluation and Review Techniques (PERT).

8 Hours

UNIT - 6

ENGINEERING ECONOMICS AND CONTRACTS: Basic Concepts of Economics, Engineer – Contractor relationships, Types of Contracts, Contract procedures – Tenders and Various Deposits.

6 Hours

UNIT - 7

FINANCIAL MANAGEMENT: Basic Concepts in Accounting, Balancesheet, Profit – Loss Account, Water Traiff Fixation by various methods. Purchasing and Stores: Purchasing Policies, Centralized and Decentralized Purchasing, budget and Payment Procedures, Function of Stores.

6 Hours

UNIT - 8

ENVIRONMENTAL ECONOMICS: Externalities, Internalization, Valuation Techniques, Social Cost, Analysis, Benefits & Costs of Pollution Control, Contingent Valuation of Economics. Personnel Management: Recruitment and Selection and Training Personnel, Employer – Employee Relationship, Authority and Delegation of Powers, Career Development, performance Appraisal, Leadership Qualities and Communication Skill.

6 Hours

REFERENCES

1. Peurifoy R. L., (1979), **Construction Planning Equipment and Methods**, McGraw Hill.
2. Lohani B. N., (1984), **Environmental Quality Management**, South Asian Publishers, New Delhi.,
3. Koontz and Weibrich, H , (1989) ,**Management**, McGraw Hill.
4. Banga & Sharma, (2007), **Industrial Organisation and Engineering Economics**. Khanna Publishers.
5. Ulaganathan Shankar, (2001), **Environmental Economics** , Oxford University Press.
6. Richard Welford, (1999), **Corporate Environmental Management** , Universities Press.

WATER QUALITY ASSESSMENT IN NATURAL SYSTEMS

Subject Code : **10EV82**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Ultimate Disposal of Wastewater in Water Bodies and on Land. Merits and Demerits. Criteria and Standards for Disposal in Water Bodies and Land. Classification of Pollution – Point Source and Non-point source

5 Hours

UNIT - 2

WASTEWATER DISPOSAL IN RIVERS: Effects of Oxygen Demanding Waste, Bacteria and Nutrients. One and Two Dimensional Equations. Streeter - Phelph's Equation and Expressions for Critical Point.

6 Hours

UNIT - 3

Mixing Zone Concept, Steady state Stream Tube Model Equation for Bank Outfall, and Expression for Critical Point for Conservative and Exponentially Decaying Toxic Pollutants. Pipe and Diffuser Outfalls - Mixing Patterns, Merits and Demerits. Applications to Evaluate Impacts under different Treatment Options and Stream Flow Regimes, Impacts of Combined Toxic Pollutants.

6 Hours

UNIT - 4

WASTEWATER DISPOSAL IN LAKES: Steady state Dissolved Oxygen Analysis for completely Mixed and Stratified Lakes, Mass Balance Diagrams, Nutrient Loading Relationships.

8 Hours

PART - B

UNIT - 5

Wastewater Disposal in Estuaries: Characteristics of Estuarial Flow Regimes. 1-D Steady State Equation for fully mixed estuary. Impact of wastewater discharge on dissolved oxygen regime for different treatment options.

6 Hours

UNIT - 6

WASTEWATER DISPOSAL IN COASTAL ZONES OF OCEANS: One and Two Dimensional Equations. Outfall Design - Hydraulics of Diffusers and Design Example.

6 Hours

UNIT - 7

SUBSURFACE WATER QUALITY ASSESSMENT: Basic one and Two Dimensional Mass Balance Equations and their Analytical Solutions. Impacts of Point Source Discharges and Leachate from Land Fill Sites. Simple Problems.

7 Hours

UNIT - 8

IMPACT OF WASTEWATER APPLICATION ON LAND: Effects of Application Rates – Leaching Factor, Mode etc., on different types of Soils. Sodium Absorption Ratio (SAR). Microbiological Effects in different Soils with and without Treatment of Wastewater. Seasonal Effects. Design Problems.

8 Hours

REFERENCES

1. Thomann, R.V., and Mueller, J.A., (1997), **Principles of surface water quality modelling and control**, Prentice Hall
2. Velz C.J. and Freez A. and Cherry , (1979), **Applied stream Sanitation** , Prentice Hall,
3. Metcalf and Eddy, (1995), **Wastewater Engineering, Treatment and Disposal**, Tata McGraw Hill,.
4. Steven C. Chopra , (1997), **Surface Water Quality Modeling**, McGraw Hill Inc.
5. Todd D.K., (2006), **Ground Water Hydrology, 2nd Edition**, John Wiley India, New Delhi.

CLIMATE CHANGE AND CARBON TRADING

Subject Code : **10EV831**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART A

UNIT 1

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 CO₂ Emission, Global Warming Potential (GWP) of GHGs **8 Hours**

UNIT 2

Modeling Climate change, Ozone layer depletion and its control **6 Hours**

UNIT 3

Impacts of climate change – Global and India, Temperature Rise, Sea Level rise, Coastal Erosion and landslides, Inland & Coastal Flooding, Wetlands and Estuaries loss, Climate change Refugees **8 Hours**

UNIT 4

Kyoto Protocol – Importance, Significance and its role in Climate Change, Copen Hagen Summit and its implications **6 Hours**

UNIT 5

Carbon Trading - Carbon Credits – definition, types, Standard and Branded Credits and Mechanisms , Various Models (European, Indian) Global and Indian Scenario **6 Hours**

UNIT 6

Cleaner Development Mechanisms – Various Projects related to CO₂ Emission Reduction such as Power sector, agricultural sector, forestry, industry. **6 Hours**

UNIT 7

Alternatives of Carbon Sequestration – Conventional and non-conventional techniques , Role of Countries and Citizens in Containing Global Warming **6 Hours**

UNIT 8

Best Management Practices and Case Studies related to Global Warming and its control

6 Hours

REFERENCES

1. Barry R.G., and Chorley R.L., (1992), “**Atmosphere, Weather and Climate**”, 4th 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.
11. Wood C.M. and McDonald D.G., (2005), **Global Warming : Implications for Fresh Water and Marine Fish**, Academic Press
12. Lohmann L (2006), Carbon Trading : A Critical Conversation on Climate Change, Privatization and Power, Media Print, Uddevalla, Sweden

ENVIRONMENTAL MANAGEMENT SYSTEMS

Subject Code : **10EV832**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

ENVIRONMENT AND SUSTAINABLE DEVELOPMENT: Importance of Planning – local, regional, state and national planning concepts, site and location with reference to environmental pollution. Zoning – physical planning.

6 Hours

UNIT - 2

ECONOMICS OF POLLUTION CONTROL: Cost benefit ratios, total cost of development and environmental protection cost. Reliability and risk analysis, case studies on regional carrying capacity, National capital region – Delhi area.

8 Hours

UNIT - 3

ENVIRONMENTAL EDUCATION: Introduction, objectives, formal and non-formal education. Organizational structure for Environmental Management at central and state levels.

4 Hours

UNIT - 4

LEGISLATION RELATED TO ENVIRONMENTAL

MANAGEMENT: Water, Air, Environmental protection, Wild life protection, Forest conservation, Motor vehicle act, Hazardous waste, Biomedical waste and Noise pollution.

10 Hours

PART - B

UNIT - 5

ENVIRONMENTAL PROTECTION: Economic development and social welfare consideration in socio-economic development policies and planning.

4 Hours

UNIT - 6

CLEANER TECHNOLOGIES AND THEIR ROLE IN

ENVIRONMENTAL MANAGEMENT: Total Quality Management (TQM) in environmental management and protection, ISO – 14000 Series of standards.

6 Hours

UNIT - 7

INTERNATIONAL EFFORTS FOR ENVIRONMENTAL

PROTECTION: Stockholm Conference – 1972, UNEP – 1982, control of transboundary movements and disposal of hazardous wastes, Earth Summit – 1992, Montreal Protocol, Kyoto and Copen Hagen Protocols, Manila declaration.

8 Hours

UNIT - 8

ENVIRONMENTAL AUDIT: Air, water, soil and its importance in environmental management.

6 Hours

REFERENCES

1. Danoy G.E., and Warner R.F. (1969), **Planning and Design of Engineering Systems**, Unwin Hyman Publications.
2. Chanlet Emil T, (1973), **Environmental Protection**, Mc Graw Hill Publication.
3. Lohani B.N, (1984), **Environmental Quality Management**, South Asian Publishers, New Delhi
4. **Environmental Sustainable Development – UNEP / UNDP.**
5. J. Glynn Henry; Gary W. Heinke, (1997) , Environmental Science and Engineering, **American Institute of Biological Sciences.**
6. **Journal of Indian Association for Environmental Management,1995-1997.**
7. **Carrying Capacity Based Developmental Planning Studies for the National Capital Region – MOEF, Government of India (1995- 1996). NEERI (1995 and 1996)., Nagpur, Annual Reports**
8. Suresh K., and Dhameja, (2000), **Environmental Engineering and Management** , S.K. Kataria & Sons.

HAZARDOUS WASTE TECHNOLOGY

Subject Code : **10EV833**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Definition, sources and classification, regulations for Hazardous Waste Management (Both India and USA).

6 Hours

UNIT - 2

CHARACTERISATION OF HAZARDOUS WASTE: Ignitability, corrosivity, reactivity, toxicity, quantification, designated hazardous waste, assessment of hazardous sites.

6 Hours

UNIT - 3

TOXICOLOGY AND RISK ASSESSMENT: Toxic effects, dose-response relationships, carcinogens, ecotoxicology, risk, exposure and toxicity assessment, risk characterization, ecological risk assessment.

8 Hours

UNIT - 4

WASTE MINIMIZATION AND RESOURCE RECOVERY: Approaches to waste reduction, development of a waste tracking system, selection of waste minimization process – case studies on by-product recovery – plating and solvent. Waste to waste compatibility for storage, treatment and disposal.

10 Hours

PART - B

UNIT - 5

PHYSICO-CHEMICAL AND BIOLOGICAL TREATMENT: Air stripping, soil vapour extraction, carbon absorption, steam stripping, stabilization and solidification – mechanisms, testing, field implementation, thermal methods – combustion, liquid injection incinerators, biological methods – conventional treatment, in-situ bio-remediation, slurry-phase treatment and solid phase treatment.

7 Hours

UNIT - 6

TRANSPORTATION OF HAZARDOUS WASTE: Regulations, containers for hazardous materials, bulk and non-bulk transport, hazardous substances emergency response.

4 Hours

UNIT - 7

LAND DISPOSAL: Landfill operations, site selection, liner and leachate collection systems, cover systems, contaminant transport through landfill barriers, landfill stability, closure and post-closure care, other types of land disposal facilities.

7 Hours

UNIT - 8

SITE REMEDIATION: Site assessment and inspection, remedial action, monitoring of disposal sites.

04 Hours

REFERENCES

1. Lagrega M.D., Buckingham P.L., and Evans J.C. (1994), **Hazardous Waste Management** , McGraw Hill International Edition.
2. Wentz C.A. (1995), **Hazardous Waste Management** –McGraw Hill International Edition.
3. Dawson and Mercer (1981),**Hazardous Waste Management** –John Wiley.
4. Cashman J.R. (1986), **Management of Hazardous Waste**, Technomic Publishing.
5. Lehman (1983), **Hazardous Waste Disposal** Plenum Press.
6. Fawcett (1984), **Hazardous and Toxic Materials: Safe Handling and Disposal** –John, Wiley.

**OPERATION AND MAINTENANCE OF ENVIRONMENTAL
FACILITIES**

Subject Code : **10EV841**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Importance of Operation & Maintenance, Basic Principles of Operation & Maintenance – Corrective and Preventive Maintenance. Data Base of Facilities for O&M – Detailed Plans, Drawings, Operation Manuals, Computer Applications in O&M.

6 Hours

UNIT - 2

O&M OF WATER SUPPLY FACILITIES: Intakes, Pumps, Rising Mains, Water Treatment Process Control, Water Quantity and Water Quality Monitoring.

6 Hours

UNIT - 3

Loss of carrying capacity of pipes, Causes, Leak Detection, Projection of Pipe Break Rates, Record Keeping, Appurtenances – Valves, Hydrants and Fittings. Use of Network Models in O&M.

8 Hours

UNIT - 4

O&M OF WASTEWATER FACILITIES: Sewer Network: Inspection Methods for Sewers and Appurtenances – Manual and Television, Cleaning. Rehabilitation – Sealing, Repair and Replacement.

Safety in Sewer Inspection: Monitoring, Operational Problems and Corrective Measures in Different Units of Treatment.

8 Hours

PART - B

UNIT - 5

O&M OF SANITARY LANDFILLS AND HAZARDOUS WASTE DISPOSAL SITES:

Leachate control, gases control, closure of landfills, surface and ground water Monitoring, abandoned sites management, Operation and Maintenance of incinerators

8 Hours

UNIT - 6

O&M OF AIR POLLUTION CONTROL FACILITIES: Regular Inspection of Devices, SPM Control Equipment, Gravity Settlers, Cyclone Separators, Bag Filters, Scrubbers, Electrostatic Precipitators.

6 Hours

UNIT - 7

GASEOUS EMISSION CONTROL DEVICES – Absorption Beds and Adsorption Columns, Thermal Oxidisers, Incinerators and their Trouble Shooting.

4 Hours

UNIT - 8

OPERATION & MAINTENANCE PLANNING: Organizational Structure, Work Planning, Preparation and Scheduling, Cost Estimates, training – needs & planning.

6 Hours

REFERENCES

1. Hammer, M.J., (1986), **Water and Wastewater Technology**–SI Version, 2nd Edition, John Wiley and Sons.
2. Quasim, S.R., (1985), **Wastewater Treatment Plants – Planning, Design and Operation**– Holt Rinehart and Winston, CBS College Publishing Neumann W.L.,

3. [William L. Heumann](#) (1997), **Industrial Air Pollution Control Systems** – McGraw-Hill Professional;
4. **Manual on water supply and Treatment**”, CPHEEO, Ministry of Urban Development, Gol, New Delhi, 1999.
5. **“Manual on Sewerage and Sewage Treatment”**, CPHEEO, Ministry of Urban Development, Gol, New Delhi,
6. **Training Manual on O&M for Municipal Staff**, Asian Development Bank, Government of Karnataka.
7. Walski T.M. (1987), **Analysis of Water Distribution Systems** – CBS Publications, New Delhi.
8. Metcalf & Eddy Inc, 2003, **Wastewater Engineering, Treatment and reuse-** 4th Edition, Tata McGraw Hill Publishers Co. Ltd, New Delhi
9. Lagrega M.D., Buckingham P.L., and Evans J.C. (1994), **Hazardous Waste Management** , McGraw Hill International Edition.
10. Sasikumar K and Krishna S. G., (2009), **Solid Waste Management**, PHI Learning Pvt. Ltd., New Delhi.

NON-POINT POLLUTION SOURCES & MANAGEMENT

Subject Code : **10EV842**
No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

IA Marks : 25
Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

INTRODUCTION: Non-Point Sources of Pollution - Definition, Magnitude and Control laws, urban storm runoff, agricultural runoff, mining residues, leachate.

5 Hours

UNIT - 2

HYDRAULIC AND CONSIDERATIONS: Precipitation runoff, overland routing, interflow, groundwater flow, and surface water problems – waste assimilative capacity.

6 Hours

UNIT - 3

POLLUTION FROM ATMOSPHERE – Atmospheric inputs. Erosion and Sediment Yield – Definition, Sediment yield estimation, sediment delivery. Transport of pollutants and loading effects on soils, soil nitrogen and microorganisms.

7 Hours

UNIT - 4

GROUNDWATER POLLUTION – Sources, Ground Water movement, Factors influencing fate & transport of contaminants, groundwater quality, groundwater quality models (1, 2 & 3D models).

6 Hours

PART - B

UNIT - 5

POLLUTION FROM IMPERVIOUS URBAN AREAS – deposition and accumulation of pollutants from impervious surfaces, removal of solids from street surfaces, pervious pavements.

10 Hours

UNIT - 6

LANDUSE AND NON-POINT POLLUTION: Landuse effects on nonpoint sources of pollution, comparative assessment of pollutants from landuses, effect of hydraulic modifications.

8 Hours

UNIT - 7

BEST MANAGEMENT PRACTICES AND EFFECTIVE

MANAGEMENT PRACTICES OF STORMWATER QUALITY – Introduction – Source control measures - ex-filtration trench, detention pond, swales.

6 Hours

UNIT - 8

PLANNING FOR CONTROL – Water quality planning process, selection of best alternatives, and strategy for non-point pollution control.

4 Hours

REFERENCES

1. **Novotny, V. and G. Chesters**,(1995), **Hand Book on Nonpoint sources & Management**.
2. LaGrega, MD, Buckingham, PL, Evans, JC,(1991), **Hazardous Waste Management**, McGraw Hill Inc.
3. Subramanya K , (1985), **Engineering Hydrology**, Tata McGraw Hill, New Delhi.
4. Fair, Geyer & Okun (1968), **Water & Wastewater Engineering** –Vol-I & II, John Wiley & Sons
5. **Water Quality & Treatment**, (1971)– AWWA, Tata McGraw Hill.

RECOVERY, RECYCLE AND REUSE TECHNOLOGY

No. of Lecture Hours/ Week : 04
Total No. of Lecture Hours : 52

Exam Hours : 03
Exam Marks : 100

PART - A

UNIT - 1

WASTE AS A RESOURCE: Resource Economics, Disposable Materials, Recovery , Recycling, Collection, Processing, Governmental Role in Waste Management, Potential for Reuse.

6 Hours

UNIT - 2

WASTE ANALYSIS: Sampling, Composition, Categorization, Determination of Waste Properties, Ash and Fines Analysis, Energy Content.

5 Hours

UNIT - 3

SYSTEM DESIGN: Design of Recycling Systems, Collection System, Process Train Design and Complexity, Product Design of Recycling, Conveyance, Transport Safety, Efficiency of Operation Systems.

8 Hours

UNIT - 4

WATER REUSE: Direct and Indirect Reuse, Intentional Reuse, Groundwater Recharge, Case studies of Water Reuse, Close Cycle and Open Cycle Reuse, Recreational Reuse.

8 Hours

UNIT - 5

ENERGY RECOVERY: Combustion, Energy Losses, Energy Recovery Analysis, Emission Control, Residue Control, In-plant Operations, Refuse Derived Fuel-cogeneration and tri generation concepts.

8 Hours

PART - B

UNIT - 6

METALS RECOVERY: Ferrous Metals, Properties, Principles of Magnetic Field-ferrous Material Interactions, Magnetic Separation Equipment, Non-ferrous Metal Separation, Eddy-Current Separation – Theory and Types, Extraction of Material from a Bed.

8 Hours

UNIT - 7

REUSE OF INDUSTRIAL EFFLUENT: Urban Effluent Reuse for Agriculture in Arid and Semiarid Zones, Uses of in Pisciculture, Groundwater Recharge using treated Domestic wastewater.

5 Hours

UNIT - 8

HEALTH ASPECTS OF WATER REUSE: Guidelines for Evaluating Recreational Water Reuse, Resource Conservation and Recovery Act.

4 Hours

REFERENCES

1. R.I. Stessel (1996), **Recycling and Resource Recovery Engineering** – Springer-Verlag Berlin and Heidelberg GmbH & Co. K
2. **Proceedings of the International Symposium ICE: Reuse of Sewage Effluent** (1985), Thomas Felford, London.
3. Dean R.B., and Lund E. (1981), **Water Reuse Problems and Solutions** –Academic Press.
4. **Waste Recycling for Energy Conservation** – Kut D., and Hase G., John Wiley & Sons Inc.