

**PROPOSED COURSE STRUCTURE FOR M.E.CIVIL (Environmental Engg.)
(2010 Course) (w.e.f.June-2010)**

SEMESTER-I

CODE	Subject	Teaching Scheme		Examination Scheme					Credits
		Lect.	Pr.	Paper	TW	Oral	Pr	Total	
	Numerical Methods and Applied Statistics	3	--	100	--	--	--	100	3
	Air Pollution and Control	3	--	100	--	--	--	100	3
	Physico-Chemical Process for Water and Waste Water Treatment	3	--	100	--	--	--	100	3
	Elective-I	3	--	100	--	--	--	100	3
	Elective II	3	--	100	--	--	--	100	3
	Lab Practice-I	--	6	--	50	--	--	50	3
	Seminar-I	--	4	--	50	--	--	50	2
Total of First Term		15	10	500	100	--	--	600	20

SEMESTER-II

CODE	Subject	Teaching Scheme		Examination Scheme					Credits
		Lect.	Pr.	Paper	TW	Oral	Pr	Total	
	Industrial Waste Water Management	3	--	100	--	--	--	100	3
	Environmental Chemistry and Micro-biology	3	--	100	--	--	--	100	3
	Solid waste and Hazardous Waste Management	3	--	100	--	--	--	100	3
	Elective-III	3	--	100	--	--	--	100	3
	Elective- IV	3	--	100	--	--	--	100	3
	Lab Practice-II	--	6	--	50	--	--	50	3
	Seminar-II	--	4	--	50	--	--	50	2
Total of Second Term		15	10	500	100	--	--	600	20

SEMESTER- III

CODE	Subject	Teaching Scheme		Examination Scheme					Credits
		Lect.	Pr.	Paper	TW	Oral	Pr	Total	
	Seminar-III (Based on Project)	--	4	--	50	--	--	50	2
	Project Stage -I	--	18	--	50	--	--	50	6
Total of Third Term		--	22	--	100	--	--	100	08

SEMESTER-IV

CODE	Subject	Teaching Scheme		Examination Scheme					Credits
		Lect.	Pr.	Project	TW	Oral	Pr	Total	
	Project Stage -II	--	18	--	150*	50		200	12
Total of Fourth Term		--	18	--	150	50		200	12

*Term Work of Project Stage II of Semester IV should be assessed jointly by the pair of internal and external examiner during oral examination.

Note: The contact hrs for the calculation of load of teacher for

Seminar:-1 Hr/Week/Student
Project: - 2 Hr/Week/Student

LIST OF ELECTIVES

Elective-I	Elective-II	Elective-III	Elective-IV
Air and Water Quality Modeling	Occupation, Safety and Health	Ground Water Contamination and Pollution Transport	Open Elective
Environmental Legislation and Management System	Principles and design of biological treatment system	Agricultural Pollution Control and Environmental Biotechnology	
Environmental Impact Assessment and Management	Environmental Risk Assessment and Management	Environmental Sanitation	

Numerical Methods and Applied Statistics

UNIT-I

Linear system – Finite Difference, Gaussian elimination and Gauss, Jordan methods, matrix inversion, Gauss seidel method – Nonlinear equations – Regula falsi and Newton- Raphson methods, interpolation – Newton's and Lagrange's interpolation

UNIT-II

Linear Programming, Graphical and Simplex methods, Measures of central tendency, dispersion,

UNIT-III

Moments, Skewness and Kurtosis, Probability, conditional probability, Bayes' theorem

UNIT-IV

Random variable – two dimensional random variables – standard probability distributions Binomial Poisson and normal distributions - moment generating function

UNIT-V

Sampling distributions – confidence interval estimation of population parameters – testing of hypotheses – Large sample tests for mean and proportion – t-test, F-test and Chi-square test – curve fitting-method of least squares

UNIT-VI

Regression and correlation – rank correlation – multiple and partial correlation – analysis of variance-one way and two way classifications – experimental design – Latin square design, Time series analysis.

Reference Books:

1. Bowker and Liberman, Engineering Statistics, Prentice-Hall, 1972.
2. Venkatraman, M.K., Numerical Methods in Science and Engineering, National Publisher Company.
3. Numerical Methods by Krishna Raju
4. Shanthakumar M.S. Numerical Methods & Analysis
5. Berthouex, P.U., "Statistics for Environmental Engineers ", Lewis Publ., 1994
6. Freund, J.E. and Miller, I.R., "Probability and Statistics for Engineers ", Prentice Hall India, 5th Edition, New Delhi, 1994.
7. Gupta, S.C. and Kapur, V.K., "Fundamentals of Mathematical Statistics ", Sultan Chand & Sons, New Delhi, 1999.
8. Ang, A.H.S. and Tang W.H., "Probability concepts in Engineering Planning and Design – Basic Principles Vol.1 ", John Wiley and Sons, Inc. New Delhi, 1975.
9. Taha, H.A., " Operations Research: An Introduction ", Prentice - Hall of India, 6th Edition, New Delhi, 1997.
10. Wayne, R. Ott Environmental Statistics and Data Analysis, CRC Press. (1995)
11. Spiegel M. R., and Stephens L.J. Schaum's outline of theory and problems of Statistics. McGraw Hill, Singapore, 1999.

Air Pollution and Control

UNIT-I

Introduction: Definition, Sources and classification of Air Pollutants, Photochemical smog, Effects of air pollution on health, vegetation & materials, air quality, Global effects of air pollution.

UNIT-II

Meteorology: Temperature lapse rates and Stability, Wind velocity and turbulence, plume behaviour, Measurement of meteorological variables.

UNIT-III

Modeling of Dispersion of Air Pollutants: Dispersion of Air pollutants. Theories on modeling of Air pollutants. Gaussian model etc. Equations of the estimation of pollutant concentrations. Plume Rise – Equations for estimation. Effective stack height and mixing depths.

UNIT-IV

Sampling and Particulate Pollution Control Methods: Atmospheric sampling and stack sampling methods. Air quality standards. Types of particulate pollution control methods – Settling chambers, Cyclone separators, Scrubbers, Filters and Electrostatic precipitators, design aspects and principle of these air pollution control units.

UNIT-V

Gaseous pollution control methods and automobile pollution: Types of gaseous pollution control methods – absorption, adsorption and combustion processes. Automobile pollution, sources of pollution, composition of auto exhausts, Control methods.

UNIT-VI

Air pollution Survey and Legislation – Global Problems: Planning for conducting Air pollution survey – Air Acts in India and Global problems of Air pollution and remedial measures. Case studies.

Reference Books:

1. H. C. Perkins, Air Pollution.
2. Peavy and Rowe, Environmental Engineering, Mc-Graw Hill Publication.
3. N.D. Nevers, Air Pollution Control Engineering, Mc-Graw Hill Publication.
4. M. N. Rao et al. Air Pollution, Tata Mc-Graw Hill Publication.
5. Noel de Nevers, Air Pollution control Engineering, Mc-Graw Hill Publication, New York.
6. Richard W. Boubel et al., Fundamentals of Air Pollution, Academic Press, New York.
7. KVSG Murali Krishna. Air pollution and control, Kaushal and Company, Jagannaickpur, Kakinada-2.
8. Davis. Environmental Engineering, Mc-Graw Hill Publication.

9. C.S. Rao., Environmental Pollution Control Engineering, Wiley Eastern Limited, New Delhi (1991).
10. John H. Seinfeld, Air Pollution: Physical and Chemical Fundamental, Mc-Graw Hill book Co. 1988.
11. Paul N. Cheremisinoff, Richard A. Young, Air Pollution Control and Design Handbook, Part-I, Marcel Dekker Inc., New York 1977).
12. Paul N. Cheremisinoff (ed.), Encyclopedia of Environmental Control Technology, Vol. 2, Air Pollution Control, Guld Publishing Company. (1989).

Physico-Chemical Process for Water and Waste Water Treatment

UNIT-I

Water Quality: Physical, chemical and biological parameters of water- Water Quality requirement - Potable water standards -Wastewater Effluent standards -Water quality indices.

UNIT-II

Water purification systems in natural systems: Physical processes-chemical processes and biological processes-Primary, Secondary and Tertiary treatment-Unit operations-unit processes.

UNIT-III

Sedimentation: Types, Aeration and gas transfer, Coagulation and flocculation, coagulation processes - stability of colloids - destabilization of colloids transport of colloidal particles, Clariflocculation.

UNIT-IV

Filtration : theory of granular media filtration; Classification of filters; slow sand filter and rapid sand filter; mechanism of filtration; modes of operation and operational problems; negative head and air binding; dual and multimedia filtration, pressure filters, principle of working and design.

UNIT-V

Theory of disinfection: Factors affecting disinfection, Disinfection - chlorine dioxide; chloramines; ozonation; UV radiation.

UNIT-VI

Miscellaneous methods: Ion Exchange-processes, Application of Membrane Processes, Reverse Osmosis, Micro-filtration, Nano-filtration, Ultrafiltration and Electrolysis.

Reference Books:

1. Weber, W.J., Physicochemical processes for water quality control, John Wiley and sons, Newyork, 1983.
2. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G. Environmental Engineering, McGraw Hills, New York 1985.
3. Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse, Tata McGraw-Hill Publication, New Delhi, 2003
4. Water & Waste Water Engineering by Fair and Gayer.
5. C.A.Sastry, Water Treatment Plants, Narosa Publishing House, Bombay, 1996.

Elective-I

1. Air and Water Quality Modeling

UNIT I

Modeling Concepts : Casual and statistical models-Characteristics- Steps in model development - Importance of model building.- conservation of mass and mass balance – calibration and verification of models; Transport phenomena – Advection, diffusion, dispersion, simple transport models; chemical reaction kinetics – Law of mass action, Rate constants, reaction order, types of reactions, equilibrium principles.

UNIT II

Water Quality Modeling: Water quality models – Historical development – Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations – Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants - Ground Water Quality Modeling - Contaminant solute transport equation, Numerical methods.

UNIT III

Air Pollution Modeling: Chemistry of air Pollutants - Atmospheric reactions, sinks for air pollution –Transport of air Pollutants - Meteorological settling for dispersal of air pollutants – Vertical structure of temperature and stability, atmospheric motions, Wind and shear, self cleaning of atmosphere; transport and diffusion of stack emissions – atmospheric characteristics significant to transport and diffusion of stack emission – stack plume characteristics.

UNIT IV

Air Quality Models: Types modeling technique, modeling for non reactive pollutants, single source, short term impact, multiple sources and area sources, Fixed box models- diffusion models – Gaussian plume derivation- modifications of Gaussian plume equation- long term average-multiple cell model- receptor oriented and source oriented air pollution models- model performance, accuracy and utilization.

UNIT V

Water Quality Index: Categories of water quality index. Determination of water quality index (WQI): Industrial and municipal effluent index, ambient water quality index, combined water quality index and Delphi method.

UNIT VI

Air Quality Index: Categories of air quality index. Determination of air quality index (AQI): National AQI, Extreme value indices, Regional indices.

Reference Books:

1. Steven C. Chapra, Surface Water Quality Modeling, Tata McGraw-Hill Companies, Inc., New Delhi, 1997.

2. J.L. Schnoor, Environmental Modeling Fate and Transport of Pollutants in Water, Air and Soil, John Wiley & Sons Inc., New York, 1996.
3. Arthur C. Stern, Air Pollution, Air Pollutants, their transformation and Transport, (Ed.), (Third Ed.) Volume I, Academic Press, 2006.
4. Deaton and Wine Brake, Dynamic Modeling of Environmental Systems, Wiley & Sons, 2002
5. E.V. Thomson, Principles of Surface Water Quality Modeling and Control, Happer and Row Publishers New York, 1987.
6. M.D. Palmer, Water Quality Modeling, the World Bank Washington DC.
7. Lohani B. N. and North A. M. Environmental Quality Management, South Asian Publishers Pvt. Ltd., New Delhi, 1984.

Elective-I

2. Environmental Legislation and Management System

UNIT I

Introduction : Indian Constitution and Environmental Protection – National Environmental policies – Precautionary Principle and Polluter Pays Principle – Concept of absolute liability – multilateral environmental agreements and Protocols – Montreal Protocol, Kyoto agreement, Rio declaration – Environmental Protection Act, Water (P&CP) Act, Air (P&CP) Act – Institutional framework (SPCB/CPCB/MOEF)

UNIT II

Water (P & Cp) Act, 1974: Power & functions of regulatory agencies - responsibilities of Occupier, Provision relating to prevention and control, Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Water Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

UNIT III

Air (P & Cp) Act, 1981: Power & functions of regulatory agencies - responsibilities of Occupier, Provision relating to prevention and control, Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Air Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

UNIT IV

Environment (Protection) Act 1986: Genesis of the Act – delegation of powers – Role of Central Government - EIA Notification – Siting of Industries – Coastal Zone Regulation - Responsibilities of local bodies mitigation scheme etc., for Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorization – Biomedical waste rules – responsibilities of generators and role of Pollution Control Boards

UNIT V

Fundamentals of Environmental Management and ISO 14000 series: Background and development of ISO 14000 series. Environmental management Plans, principles and elements. The ISO 14001- Environmental management systems standard. Environmental law in India: Environmental policy and laws.

UNIT VI

Other Topics: Relevant Provisions of Indian Forest Act, Public Liability Insurance Act, CrPC, IPC -Public Interest Litigation - Writ petitions - Supreme Court Judgments in Landmark cases.

Reference Books:

1. CPCB, "Pollution Control acts, Rules and Notifications issued there under "Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997.
2. Shyam Divan and Armin Roseneranz "Environmental law and policy in India "Oxford University Press, New Delhi, 2001.
3. Greger I. Megregor, "Environmental law and enforcement", Lewis Publishers, London1994.
4. Constitution of India [Referred articles from part-III, part-IV and part-IV A]
5. Pares Distn. Environmental Laws in India (Deep, Lated edn.)
6. Handbook of environmental management and technology: Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.
7. The ISO 14000 Handbook: Joseph Cascio.
8. ISO 14004: Environmental management systems: General guidelines on principles, systems and supporting techniques (ISO 14004:1996 (E)).
9. ISO 14001: Environmental management systems: Specification with guidance for use (ISO 14001:1996b(E)) (International organization for standardization-Switzerland)

Elective-I

3. Environmental Impact Assessment and Management

UNIT I

Evolution of EIA: Concepts, Methodologies, Screening, Scoping, Base line studies, Mitigation, Matrices, Check list.

UNIT II

Methods for impact assessment: Background information, interaction matrix methodologies, network methodologies, etc, environmental setting various factors, environmental impact assessment methodology, documentation and selection process, environmental indices and indicators for describing affected environment, Life cycle assessment.

UNIT III

Prediction and assessment of impact for air and noise environment: Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise levels and standards, prediction of noise levels and assessment of impact, mitigations.

UNIT IV

Prediction and assessment of impact for water and soil environment: Basic information of water quality (Surface water and ground water), water quality standards, identification of impact, prediction of impact and assessment, mitigations. Background information of soil environment, soil and ground water standards, prediction and assessment of impact for ground water and soil, mitigations.

UNIT V

Prediction and assessment of impact on cultural and socioeconomic environment: Basic information on cultural resources, rules and regulations for cultural resources like archaeological, historical structures, Cultural system, prediction and assessment of impact, mitigations. Basic information of socioeconomic environment, description of existing socioeconomic environment, prediction and assessment of impact, mitigation, resettlement and rehabilitation.

UNIT VI

EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Categorization of Industries for seeking environmental clearance from concerned authorities, procedure for environmental clearance, procedure for conducting environmental impact assessment report, Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan, post environmental monitoring. Case studies in EIA.

Reference Books:

1. Canter R.L., Environmental Impact Assessment, Mc Graw Hill International Edition, 1997.
2. John G. Rau and David C. Wooten (Ed), Environmental Impact Analysis Handbook, McGraw Hill Book Company.
3. Peter Watten (Eds.) - 'Environmental Impact Assessment Theory and Practice', Unwin Hyman, London (1988).

Elective-II

1. Occupational Safety & Health

UNIT-I

Introduction: Occupational Safety and health act, Occupational safety and health administration, right to know laws, OSHAS 18001 Health & Safety Standards.

UNIT-II

Ergonomics: Needs, Task analysis, preventing ergonomics hazards, Ergonomics program.

UNIT-III

Occupational Hazard and Control: Hazard analysis, Human error and fault tree analysis. Hazard and their control in different manufacturing and processing industries.

UNIT-IV

Fire Prevention and Protections: Types of fires, fire development and its severity, effects, extinguishing fire, electrical safety, product safety.

UNIT-V

Occupational Health: Health and safety consideration, personal safety equipments.

Accidents: Causation, investigation methods and different models.

UNIT-VI

Health problems in different types of industries: Constructions, Textiles, Steel, Food processing, and Pharmaceuticals, Occupational health and safety considerations in waste water treatment plants.

Reference Books:

1. Goetsch D. I., Occupational safety and Health for technologist, Engineers and managers, Prentice Hall Publications, 1999.
2. Heinrich H. W., Industrial Accedent Preventions, McGraw Hill Publications, New York.
3. Colling D.A., Industrial Safety Management and Technology, Prentice Hall Publications, New Delhi.
4. Della D.E. & Giustina, Safety and Environmental Management, Van Nostrand reinhold international Thomson publishing inc., 1996.
5. CPHEEO, Manual on sewage treatment.
6. Industrial Safety and Pollution Control Handbook, National Safety Council and Associate (Data) Publisher Pvt. Ltd., 1991.

Elective-II

2. Principles and Design of Biological Treatment System

UNIT I

Principles: Objectives of biological treatment - significance - aerobic and anaerobic treatment kinetics of biological growth - factors affecting growth - attached and suspended growth. Determination of kinetic coefficients for organics removal - Biodegradability assessment – selection of process – reactors – batch - continuous type - kinetics.

UNIT II

Waste Water Characteristics: Physical, Chemical, Biological characteristics of waste water, sampling, flow measurement.

UNIT III

Physical and Chemical Treatment of Waste Water: Screening, Grit removal, Flow equalization, Chemical precipitation, other solids removal operations. Disinfection with Chlorine compound, Aeration, Control of odour, Control of volatile organic compounds.

UNIT IV

Aerobic Treatment of Waste Water: Design and construction aspects and the relevant parameters of significance of the following units. Activated Sludge Process, Trickling Filters, Aerated Lagoons, Rotating Biological Contactors, Sequential Batch Reactors (SBR) and Stabilization pond.

UNIT V

Anaerobic Treatment of Waste Water: Sludge digestion theory and principles, Septic tank design and Effluent disposal. Disposal of digested sludge, Anaerobic ponds, UASB reactors and various modifications in UASB process and anaerobic filters.

UNIT VI

Construction Operations and Maintenance Aspects: Construction and Operational Maintenance problems – Trouble shooting – Planning, Organising and Controlling of plant operations – capacity building, Case studies – sewage treatment plants – sludge management facilities.

Reference Books:

1. Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse, Tata McGraw-Hill Publication, New Delhi, 2003.
2. Arceivala S. J. Wastewater Treatment for Pollution Control, TMH, New Delhi, Second Edition, 2000.
3. Manual on “Sewerage and Sewage Treatment” CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
4. Qasim S. R. Wastewater Treatment Plant, Planning, Design & Operation, Technomic Publications, New York, 1994.

Elective-II

3. Environmental Risk Assessment and Management

UNIT-I

Introduction: Sources of Environmental hazards, Environmental and ecological risks, Environmental risk assessment framework, Regulatory perspectives and requirements, Risk Analysis and Management and historical perspective; Social benefit Vs technological risks; Path to risk analysis; Perception of risk, risk assessment in different disciplines.

UNIT-II

Elements of Environmental Risk Assessment : Hazard identification and accounting, Fate and behaviour of toxics and persistent substances in the environment, Properties, processes and parameters that control fate and transport of contaminants, Receptor exposure to Environmental Contaminants, Dose Response Evaluation, Exposure Assessment, Exposure Factors, Slope Factors, Dose Response calculations and Dose Conversion Factors, Risk Characterization and consequence determination, Vulnerability assessment, Uncertainty analysis.

UNIT-III

Different Analysis for Risk Assessment: Cause failure analysis, Event tree and fault tree modeling and analysis, Multimedia and multipathway exposure modeling of contaminant migration for estimation of contaminant concentrations in air, water, soils, vegetation and animal products, Estimation of carcinogenic and non carcinogenic risks to human health,

UNIT-IV

Methods for Risk Assessment: HAZOP and FEMA methods, Methods in Ecological risk assessment, Probabilistic risk assessments, radiation risk assessment, Data sources and evaluation.

UNIT-V

Risk Management: Risk communication and Risk Perception, comparative risks, Risk based decision making, Risk based environmental standard setting, Risk Cost Benefit optimization and tradeoffs, Emergency Preparedness Plans, Emergency planning for chemical agent release, Design of risk management programs, risk based remediation; Risk communication, adaptive management, precaution and stake holder involvement.

UNIT-VI

Application: Case studies on risk assessment and management for hazardous chemical storage, Chemical industries, Tanneries, Textile industries, Mineral processing and Petrochemical plants, Hazardous waste disposal facilities, nuclear power plants, contaminated site remediation, Case histories on Bhopal, Chernobyl, Seveso, Three Mile Island.

References:

1. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
2. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff, Risk Assessment and Management Handbook, McGraw Hill Inc., New York, 1996.
3. Kofi Asante Duah, Risk Assessment in Environmental management, John Wiley and sons, Singapore, 1998.
4. Kasperson, J.X. and Kasperson, R.E. and Kasperson,R.E., Global Environmental Risks, V.N.University Press, New York, 2003.
5. Risks and Decisions for Conservation and environmental management, Mark Burman, Cambridge University Press.
6. Susan L Cutter, Environmental Risks and Hazards, Prentice Hall of India, New Delhi, 1999.
7. Joseph F Louvar and B Diane Louver, Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey, 1997.

LAB PRACTICE I

The term work will consist of a journal giving details of determination of the parameters of following any three industries.

Parameters				
Pulp and Paper	Sugar	Textile	Dairy	Distilleries
pH	pH	pH	pH	pH
Colour	Total Solids	Total alkalinity	Total alkalinity	Total Solids
Total Solids	Total Suspended Solids	Total Solids	Total Dissolved Solids	Total Suspended Solids
Total Suspended Solids	BOD	BOD	Total Suspended Solids	BOD
BOD	COD	COD	BOD	COD
COD	Total Nitrogen	Total Chromium	COD	Sulphates
			Total Nitrogen	
			Phosphorous	
			Oil and grease	
			Chloride	

SEMESTER II

Industrial Waste Water Treatment Management

UNIT-I

Sources of Pollution: Physical, Chemical, Organic and Biological properties of Industrial Wastes – Differences between industrial and municipal waste waters –Effects of industrial effluents on sewers and treatment plants.

UNIT-II

Pre and Primary Treatment: Equalization, Proportioning, Neutralization, Oil Separation by Flootation – Waste Reduction - Volume Reduction – Strength Reduction.

UNIT-III

Waste Water Treatment Methods: Nitrification and De-nitrification – Phosphorous removal – Heavy metal removal – Membrane Separation Process – Air Stripping and Absorption Processes – Special Treatment Methods – Disposal of Treated Waste.

UNIT-IV

Manufacturing process and sources of effluent from the process of industries like chemical, fertilizer, petroleum, petro -chemical, paper, sugar, distillery, textile, tannery food processing, dairy and steel manufacturing.

UNIT-V

Characteristics and composition of effluent and different methods of treatment & disposal of effluent for the following industries:

Steel, Petroleum Refineries, Textiles, Tanneries, Atomic Energy Plants and other Mineral Processing Industries.

UNIT-VI

Common Effluent Treatment Plants (CETPs): Location, Need, Design, Operation & Maintenance Problems and Economical aspects.

Reference Books:

1. W. Wesley Eckenfelder Jr., Industrial Waste Water Pollution Control.
2. Arceivala, S.J., Wastewater Treatment for Pollution Control, McGraw-Hill, 1998.
3. Frank Woodard, Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi, 2001.
4. M.N.Rao & Datta, Waste water treatment.
5. N.L. Nemerow, Liquid waste of Industry, Addison Wesley. 1996
6. Callegly, Forster and Stafferd, Treatment of Industrial Effluent, Hodder and Stoughton. 1988
7. Hardam S. Azad, (ED), Industrial Wastewater Management Hand Book 1988.
8. Indian standards: IS: 2490 (1963), IS: 3306 (1065).

Environmental Chemistry & Microbiology

UNIT-I

Significance of Environmental Chemistry in Environmental Engineering, Units of Measurement, Stoichiometry. Basic Concepts from General Chemistry, Physical Chemistry, Organic Chemistry, Equilibrium Chemistry, Colloidal Chemistry and nuclear Chemistry as applied to the Measurement of Pollution Parameters.

UNIT-II

Principles of Optical Methods such as Absorption, Spectrophotometry, Flame photometry, Fluorometry

UNIT-III

Principles of Chromatographic Methods such as Gas chromatography, High Performance Liquid Chromatography and Ion Chromatography.

UNIT-IV

Scope and Areas of Environmental Microbiology, Cell and its Structure, Introduction to Enzyme and Metabolic Reactions, Aerobic and anaerobic respiration, Classification.

UNIT-V

Microscopy and Micrometry, Observations, Measurements and Isolation of Microorganism, Different Cultures, Media and Techniques of Staining and Enumeration of microorganism.

UNIT-VI

Applied Microbiology of Soil, Air, Water and Biological Processes of Wastewater Treatments, Industrial Microbiology.

Reference Books:

1. C.N. Sawyer, P.L. McCarty and G.F. Parkin, Chemistry for Environmental Engineering and Science, Tata McGraw-Hill, Fifth edition, New Delhi, 2003.
2. G.W. Vanloon and S.J. Duffy 'Environmental chemistry – a global perspective, Oxford University press, New York., 2000.
3. Tortora. G.J, B.R. Furke, and C.L. Case, "Microbiology-An Introduction" (4th Ed.), Benjamin/Cummings Publ. Co., Inc., California, 1992.
4. Pelczar, M.J., Chan E.C.S. and Krieg, N.R. Microbiology, Tata McGraw Hill, New Delhi, 1993
5. Benefield L.D., Judkins J.F. and Weaned R.L., Process Chemistry for Water and Wastewater Treatment, Prentice Hall, Inc. London, 1987.
6. R.E. McKinney, "Microbiology for Sanitary Engineers", McGraw Hill Book Company, 1962.
7. W.G. Walter and R.H. McBee, "General Microbiology", East West Edition, 1969.

Solid and Hazardous Waste Management

UNIT-I

Introduction: Problems and issues of solid and hazardous waste management, Waste management planning, Toxicology and risk assessment.

UNIT-II

Types and sources of solid and hazardous wastes: Need for solid and hazardous waste management - Legislations on management and handling of municipal solid wastes, hazardous wastes and biomedical wastes.

UNIT-III

Waste generation rates: Composition - Hazardous Characteristics – TCLP tests – waste sampling- reduction of wastes at source – Recycling and reuse. Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations -labeling and handling of hazardous wastes.

UNIT-IV

Waste processing: processing technologies – biological and chemical conversion technologies – Composting - thermal conversion technologies - energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes.

UNIT-V

Disposal: site selection - design and operation of sanitary landfills- secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – landfill remediation

UNIT-VI

Elements of integrated waste management. Economy and financial aspects of waste management. Other Waste Types: Nuclear and Radio Active Wastes.

Reference Books:

1. Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, Integrated Solid Waste Management, McGraw- Hill, New York, 1993
2. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000
3. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental
4. Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001.
5. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore, 2002.
6. Charles A. Wentz, Hazardous Waste Management, Second Edition, Pub: McGraw Hill International Edition, New York, 1995.

Elective-III

1. Ground Water Contamination & Pollution Transport

UNIT -I

Introduction: Ground water and the hydrologic cycles, Ground water as a resource, Ground water contamination, Ground water as a Geotechnical problem, Ground water and geologic processes, Physical properties and principles, Darcy's Law, Hydraulic Head and Fluid Potential Piezometer and Nests, Hydraulic conductivity and permeability, Homogeneity and Anisotropy porosity and voids Ratio, Unsaturated flow and the water table, Steady state flow and Transient Flow, compressibility and effective stress, Transmissivity and storativity, Equations of Ground water flow, Limitations of Darcian Approach, hydro dynamic dispersion.

UNIT -II

Hydrologic Cycle and Flow net: Hydrologic Cycle, Flow nets-Graphical construction, Flow nets by numerical simulation, steady state Regional Ground water Flow, Steady state hydrologic, budgets- Fluctuations in ground water levels.

UNIT -III

Resource Evolution: Development of Ground water Resources-Exploration for Aquifers-the response of Ideal aquifers to pumping-Measurement of parameters -Laboratory tests- Piezometer test-pumping tests-Estimation of saturated hydraulic conductivity-Numerical simulation for aquifer yield prediction-Artificial recharge and induced infiltration-Land subsidence-sea water intrusion.

UNIT -IV

Chemical Properties and Principles: Constituents-chemical equilibrium- Association and Dissociation of dissolved species-effects of concentration gradients-Mineral dissolution and solubility- Oxidation and Reduction Process-Ion exchange and Adsorption- Environmental isotopes-Field Measurement of Index parameters. Chemical Evolution: Hydro Chemical Facies- Ground water in carbonate terrain-Ground water in crystalline rocks-Ground Water in complex sedimentary systems- Geochemical interpretation of ^{14}C Dates-process rates and molecular diffusion.

UNIT -V

Solute Transport : Water Quality Standards, Transport Process, Nonreactive Constituents in Homogeneous Media and Heterogeneous Media, Transport in Fracture Media, Hydro chemical Behaviour of Contaminants, Trace Metals, Nitrogen, Trace Nonmetals Organic

Substances, Measurement of Parameters, Velocity-Dispersivity, Chemical Partitioning, Sources of Contamination, Land Disposal of Solid Wastes, Sewage Disposal on Land.

UNIT -VI

Governing Equations for flow and transport in surface and subsurface waters, chemical and biological process models, simplified models for lakes, streams, and estuaries. Model complexity: Selection and development, model resolution, coupled and uncoupled models, linear and nonlinear models, solution techniques, data requirements for calibration, application and evaluation of environmental control.

Reference Books:

1. Randall J. Charbeneau, "Ground Water Hydraulics and Pollutant Transport ", 2000.
2. Allen Freeze, R. and John A. Cherry, "Ground Water ". Prentice Hall.Inc.1979.
3. B. K. Todd "Ground Water Technology".
4. Thonana "Water Quality Modelling".
5. K. Karanth ," Ground Water Assessment, Development and Management" , McGraw Hill Companies.
6. David Keith Todd and Larry W. Mays, "Groundwater Hydrology John Wiley and Sons.
7. K.R. Rushton ,"Groundwater Hydrology", John Wiley & Sons, Ltd.

Elective-III

2. Agricultural Pollution Control and Environmental Biotechnology

UNIT -I

Environmental issues in agriculture: Types of farming systems, agro meteorology, water and nutrients requirement.

UNIT -II

Fertilizers: types of fertilizers, pesticides and other agrochemicals, soil and water conservation practices.

UNIT -III

Water logging and salinity: causes and effects.

Wastewater reuse in agriculture: management and control of agricultural waste; recycling and reuse.

UNIT -IV

Concept of Environmental Biotechnology and Environmental Engineering, scope and importance. Genetic engineering structure of DNA, RNA, Replication of DNA, genetic code, Transcription, Protein synthesis.

UNIT -V

Microbiology of waste water treatment. a) Aerobic processes: Activated sludge, oxidation ditches, trickling filters, towers, rotating discs, rotating drums, oxidation ponds. b) Anaerobic processes : Anaerobic digestion, anaerobic filters, Up flow anaerobic sludge blanket reactor. Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industry.

UNIT -VI

Air pollution and its control: Biotechnology in reduction of CO₂ emission, Bioscrubbers, Biobeds, Biotrickling filters and their applications.

Novel methods of pollution control: Vermitechnology, Methane production, Root zone treatment, Membrane technology, Biodegradable plastics.

Reference Books:

1. Microbial Biotechnology : A. N. Glazer and H. Nikaido .
2. Molecular Biotechnology : Gleck and Pasternack.
3. Biotechnology : A Text Book of Industrial Microbiology, T. D. Brock,
4. Industrial Microbiology : Prescott and Dunn.
5. Biotechnology : B. D. Singh , Kalyani Publishers.
6. T.V. Ramachandra, Soil & Ground Water Pollution from Agricultural activities, TERI

Elective-III

3. Environmental Sanitation

UNIT - I

Epidemiology: Communicable diseases, Micro-organisms, Methods of communication, Diseases communicated by discharges of intestines, nose and throat, other communicable diseases and their control.

UNIT - II

Insects and Rodent Control: Mosquitoes, life cycles, factors of diseases control methods – natural and chemical, Fly control methods and prevention of fly breeding, Rodents and public health, plague control methods, engineering and bio-control methods, disinfectants (Phenols, Lime, Chlorine, Ammonium compounds), Insecticides (DDT, BHC).

UNIT - III

Industrial sanitation: Schools, Public Buildings, Hospitals, Eating establishments, Swimming pools – Study of factors like Light, Heat, Ventilation, Plumbing fixtures, Cleanliness and maintenance and comfort.

UNIT - IV

Industrial Hygiene: Occupational Hazards, Industrial poisons, Dust, Noise, Heat, Compressed air, Vibrations and shocks- Industrial plant sanitation.

UNIT - V

Rural Sanitation: Rural areas, Population habits and environmental conditions, problems of water supply and sanitation aspects, low cost excreta disposal systems.

UNIT -VI

Rural sanitation improvement schemes. Case studies on sanitation.

Reference books:

1. Victor Ehalers & Earnest W Steel, Municipal and Rural sanitation.
2. Bhatia H. S., Environmental Pollution and Control, Galgotia Publication Pvt. Ltd., New Delhi.

LAB PRACTICE II

Part A: Visits of any three of the following:

Dairy, Fertilizer, Distillery, Sugar, Pulp & Paper, Iron & Steel, Metal Plating, Refining, Thermal Power Plants, Water and Wastewater Treatment Plant.

Part B: Design of any 4 components of treatment units of the same industry or treatment plant visited.