

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Master of Technology in Environmental Engineering
Choice Base Credit System (CBCS)
Scheme and Syllabus of M. Tech. Environmental Engineering

Semester 1

Subject Category	Subject Code	Subject	Teaching Scheme			Marks			
			Hours per week		No. of Credits	Internal	Univ Exam	Total	Passing
			L	P					
Core Subject -I	PGEV101T	Environmental Chemistry & Microbiology	4	--	4	30	70	100	50
Core Subject -II	PGEV102T	Municipal & Industrial Water Treatment	4	--	4	30	70	100	50
Core Subject -III	PGEV103T	Municipal Waste Water Treatment & Disposal	4	--	4	30	70	100	50
Elective –I (Discipline Specific)	PGEV104T	Elective-I	4	--	4	30	70	100	50
Elective –II (Open)	PGOPEN105T	Elective -II (Open)	4	--	4	30	70	100	50
Laboratory -I	PGEV101P	Environmental Chemistry & Microbiology Lab	--	2	1	50	50	100	50
Laboratory -II	PGEV106P	Water and Sewage Treatment Plant Design	--	2	1	50	50	100	50
		Total	20	4					
Semester Total			24		22				
Elective-I	PGEV104T	Water Resources Management							
Elective-I	PGEV104T	Environment Management							
Elective-I	PGEV104T	Hazardous Waste Management							

Semester 2

Subject Category	Subject Code	Subject	Teaching Scheme			Marks			
			Hours per week		No. of Credits	Internal	Univ Exam	Total	Passing
			L	P					
Core Subject -IV	PGEV201T	Industrial Waste Water Treatment and Disposal	4	--	4	30	70	100	50
Core Subject -V	PGEV202T	Air Quality Management	4	--	4	30	70	100	50
Core Subject -VI	PGEV203T	Municipal Solid Waste Management	4	--	4	30	70	100	50
Elective –III (Discipline Specific)	PGEV204T	Elective-III	4	--	4	30	70	100	50
Foundation Course-I	PGFD205T	Research Methodology	4	--	4	30	70	100	50
Laboratory -III	PGEV202P	Air Quality Monitoring Lab	--	2	1	50	50	100	50
Laboratory -IV	PGEV206P	Waste Water Quality Analysis	--	2	1	50	50	100	50
		Total	20	4					
Semester Total			24		22				
Elective-III	PGEV204T	Rural Water Supply & Sanitation							
Elective-III	PGEV204T	Environmental Biotechnology							
Elective-III	PGEV204T	Environmental Engineering systems & optimization							

Semester 3

Subject Category	Subject Code	Subject	Teaching Scheme			Marks			
			Hours per week		No. of Credits	Internal	Univ Exam	Total	Passing
			L	P					
Elective –IV (Open)	PGOPEN301T	Elective –IV (Open)	4	--	4	50	50	100	50
Foundation Course-II	PGFD302T	Project Planning & Management	4	--	4	50	50	100	50
Project Seminar	PGEV303P	Project Seminar	--	3*	8	50	150	200	50
Total			8	3					
Semester Total			11		16				

*Contact Hours per week per project

Semester 4

Subject Category	Subject Code	Subject	Teaching Scheme			Marks			
			Hours per week		No. of Credits	Internal	Univ Exam	Total	Passing
			L	P					
Project	PGEV401P	Project	--	6*	16	--	400	400	
Total			--	6					
Semester Total			6		16				

*Contact Hours per week per project

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PGEV101T Environmental Chemistry & Microbiology

Unit 1 General and Physical Chemistry

Theory of valency, oxidation numbers, oxidation reduction reactions, Law of mass action, stoichiometry, Gas Laws.

Buffer solutions, Indicators. Amphoteric hydroxides, chemical equilibrium and ways of shifting it. Osmosis Dialysis.

Unit 2: Organic Chemistry and Biochemistry:

Organic compounds of interest to environmental engineers (Details of preparation and chemical reactions involved are not required), General properties of the functional groups of organic compounds.

Enzymes, classification, Enzyme catalyzed reactions, Energy considerations, coupling of reaction. Breakdown and synthesis of carbohydrates, fats, proteins under aerobic and anaerobic reactions. CNP cycles under aerobic and anaerobic reactions, Concept of BOD, COD, TOC.

Unit 3: Colloidal Chemistry

Colloids, Dispersion of colloids. General and electro-kinetic properties of colloids. Colloidal solution and mixtures.

Unit 4: Environmental Chemistry

Chemistry involved in water treatment procedures like coagulation, softening, softening, fluoridation, defluoridations. Iron and Manganese removal: demineralization. Analysis of pesticide and Heavy Metals

Unit 5: Environmental Microbiology

Introduction of microbiology, Haeckel's classification and characterization of microorganisms, viruses, Morphology and structure of bacteria, nutrient requirement, growth of bacteria. Basic microbiology of water and sewage. Basic Principles involved in the analysis of faecal indicator bacteria – coliforms and streptococci, plankton analysis of pseudomonas and streptococci.

Books:

1. C. N. Sawyer and P. L. McCarty, Chemistry for Environmental Engineers, McGraw Hill
2. Pelezar Reid & Chan, Microbiology Tata McGraw Hill,
3. Powar & Dagainawala, General Microbiology Vol. I &II, Himalaya Publishing House,

PGEV102T Municipal and Industrial Water Treatment

Unit 1

Water quality criteria and standards, Requirements of water treatment facilities – unit operations and unit processes – Important physical properties of water.

Principles of sedimentations – Effect of temperature, viscosity – Efficiency short circulating – Design of inlets and outlets, up flow and sludge blanket tanks, sludge and its removal. High Rate Sedimentation.

Unit 2

Theories of chemical coagulation, common coagulant in water. Factors affecting coagulation, determination of coagulant doses, perikinetic and orthokinetic coagulation, theory and use of coagulant aids, design, construction. And operation of flocculators.

Unit 3

Theory of filtration design construction and operation of filters – hydraulics of filtration and filter back washing. Performance of slow and rapid sand filters. High rate and variable rate filtration. Two layer filters. Pressure filters, diatomaceous earth filters. Modern developments in filtration. Factors affecting disinfection – free and combined available chlorine, ultraviolet irradiation, ozonation disinfection of new mains – emergency chlorination.

Water treatment for swimming pools.

Unit 4

Theories of adsorption. Freundlich equation. Removal of tet and dur by adsorption. Activated carbon phenol value. Other method of taste and odour control and colour removal.

Boiler, cooling and other industrial water requirements. Langelier index. Softening of water Lime – soda methods. Dosage control Excess dose. Hot lime-soda. Split treatment. Recarbonation. Use of polyphosphates. Disposal of sludge.

Unit 5

Softening by ion exchange. Natural and synthetic media, capacity, regeneration. Ion exchange Demineralization. Miscellaneous methods of water treatment; iron and Mn removal, Desalination, Nitrate, Phosphate and Arsenic removal and recent advances.

Text/Reference Books:-

1. Fair Geyer & Okun, Water and Waste water Engineering Vol I and II, John Wiley & Sons
2. W.J. Weber Physiochemical process for water quality control, John Wiley & Sons
3. ASCE, AWWA Water treatment plant design
4. CPHEEO, Manual on Water supply and Treatment, Govt. of India Publication.
5. R.L. Sank, Water treatment plant for practicing engineers, Ann Arbor Science.

PGEV103T Municipal Wastewater Treatment and Disposal

Unit 1

General objectives of sewage treatment, sewage treatment, sewage characteristics conventional sewage treatment flow sheet, functions of different unit processes, treatment requirements.

Process analysis: Reaction and reaction kinetics, mass balance analysis, reactors and their hydraulic characteristics, reactor selection, practical aspects of reactor design.

Unit 2

Physical and chemical treatment: Screening, grit removal, flow equalization and mixing, flocculation, sedimentation, flotation, disinfection.

Unit 3

Biological treatment: Principles of biological treatment, kinetics of biological growth, aerobic and anaerobic treatment of sewage. Activated sludge, trickling filters, biological disc, packed bed and fluidized bed treatment, stabilization ponds.

Unit 4

Sludge treatment: Sludge treatment flow-sheets, sludge quality and quantity, various methods of sludge treatment aerobic and anaerobic sludge digestion, sludge conditioning, dewatering of sludge, conveyance, storage and disposal, disposal by dilution.

Unit 5

Advanced waste water treatment: Principles of tertiary treatment, reuse and resource recovery, and recent developments.

Text/Reference Books:

1. S.J. Arceivala, wastewater Treatment and Disposal, Marcel Dekker 1981.
2. N.F. Grey, Activated Sludge process, Theory and Practices, Oxford University Press 1990.
3. Metcalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third Edition McGraw hill 1991.
4. Qasim S.R.. Wastewater Treatment Plant Planning, Design and Operation, Holt, Rinehart and Winston, N.Y.

PGEV104T-1 Elective-I Water Resources Management

Unit 1

Introduction:; Water Resources planning, multi-objective planning role in national development, basic concepts of hydrology and hydrogeology.

River monitoring, gauging silting, silt load etc.

Unit 2

Ground water pollution.

National water plicity.

Water Resources planning and processes: Management of water bodies.

Unit 3

Application of Remote-sensing Techniques.

Integrated approach – carrying capacity based planning.

Water resources conservation: quantity aspects, surface and ground water development,

Unit 4

Rainwater harvesting, Ground water Recharge, conjuctive use of ground and surface water

Water resources development in coastal areas.

Basic concepts of economics, welfare economics.

Unit 5

Inter basin transfer of water.

EIA of water Resource development projects.

Text/Reference Book

1. Linsley R.K. & Franzini, J.B.; Water resources Engineering. McGraw Hill 1979.
2. Grigg N.S. Water Resources planning McGraw Hill Book company.

PGEV104T-2 Elective-I Environmental Management

Unit 1

General Global and India scenario

National environmental policy

Environmental organizations for planning and implementation sustainable development.

Preventive and reactive strategies for environmental pollution control.

Unit 2

Environmental impact and risk assessment.

Methodologies: Adhoc, checklist, network, matrix etc.

Unit 3

Env. Management Plan.

Typical case studies of environmental impact assessment.

Environmental impact statements

Unit 4

Environmental Audit

Unit 5

Environmental Legislation

Air, Water and environmental acts.

Text/Reference Books:-

1. Rosencranz, S. Divan, M.L. Noble, Environmental law and policy in India, cases, materials and statutes, Tripathi pvt. Ltd. Bombay.
2. S. Musharaf, legal aspects of Environmental pollution and its management, C.B.S publishers, Delhi 19932.
3. R.K. Jain L.V. Urban, G.S. Stacey H. E. Balbach, Environmental Assessment McGraw-Hill, Inc. N.Y. Rao, J. G. and Wooten, Environmental Impact Analysis, Handbook, 1980.
4. Canter L.W., Environmental Impact Assessment, - N.Y. McGraw-hill Book Co., 1977

PGEV104T-3 Elective-I Hazardous Waste Management

Unit 1

Definition of Hazardous waste, U.S.E.P.A. classification, global scenario, episodes.

Hazardous waste (management and handling) rules, 1989 and Indian scenario.

Unit 2

Sources of Hazardous waste, types of waste inventerisation procedures.

Sampling and analytical procedures.

Unit 3

Overview of treatment and disposal methods-waste minimization.

Physicochemical methods and biological methods.

Thermal Processes.

Unit 4

Solidification/stabilization and innovation techniques.

Unit 5

Secure landfill.

Site selection methodology for establishing treatment and disposal methods and EIRA methodology

Text/Reference Books:-

1. The Safe Disposal of Hazardous Waste, Vol. I, II & III Batstone, Smith, Wilson, Joint study Sponsored by: The world Bank, The WHO & UN Env. Program UNEP, The World Bank, Washington D.C. World Bank Tech Paper No. 93.
2. Freeman H.M., Standard Handbook of Hazardous Waste Treatment and Disposal., 1989

PGOPEN105T-1 Elective-II: Global Warming and Climate Change

Unit 1: Earth's Climate System: Role of ozone in environment-ozone layer-ozone depleting gases-Green House Effect, Radiative Effects of Greenhouse Gases-The Hydrological Cycle-Green House Gases and Global Warming- Carbon Cycle.

Unit 2: Atmosphere And Its Components: Importance of Atmosphere, Physical Chemical Characteristics of Atmosphere, Vertical structure of the atmosphere, Composition of the atmosphere, Atmospheric stability, Temperature profile of the atmosphere, Lapse rates, Temperature inversion, effects of inversion on pollution dispersion.

Unit 3: Impacts Of Climate Change: Causes of Climate change- Change of Temperature in the environment-Melting of ice Pole, sea level rise, Impacts of Climate Change on various sectors-Agriculture, Forestry and Ecosystem, Water Resources, Human Health, Industry, Settlement and Society. Methods and Scenarios, Projected Impacts for Different Regions, Uncertainties in the Projected Impacts of Climate Change, Risk of Irreversible Changes.

Unit 4: Observed Changes and Its Causes: Climate change and Carbon credits, CDM, Initiatives in India, Kyoto Protocol, Intergovernmental Panel on Climate change, Climate Sensitivity and Feedbacks, The Montreal Protocol, UNFCCC, IPCC, Evidences of Changes in Climate and Environment- on a Global Scale and in India.

Unit 5: Climate Change: Clean Development Mechanism, Carbon Trading, examples of future Clean Technology - Biodiesel, Natural Compost, Eco- Friendly Plastic, Alternate Energy, Hydrogen, Bio-fuels -Solar Energy -Wind -Hydroelectric Power.

Mitigation Measures: Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices -Energy Supply, Transport, Buildings, Industry, Agriculture, Forestry. Carbon sequestration- Carbon capture and storage (CCS)- Waste MSW & Bio waste, Biomedical, Industrial waste. International and Regional cooperation.

Books

1. Dash Sushil Kumar, "Climate Change -An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.
2. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
3. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
4. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

PGOPEN105T-2 Elective-II: Road Safety Engineering

Unit 1: Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

Unit 2: Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction

Unit 3: Road Safety in Planning And Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care

Unit 4: Role of Urban infrastructure design in safety: Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections ,Road Safety in Urban Transport, Sustainable Modes and their Safety.

Unit 5: Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

Books:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
3. Transportation Engineering – An Introduction, C.Jotin khisty, B. Kent Lall
4. Fundamentals of Traffic Engineering, Richardo G Sigua
5. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson
6. Road Safety by NCHRP

PGEV101P Environmental Chemistry & Microbiology Lab

Six practicals based on contents of **PGEV101T Environmental Chemistry & Microbiology**

PGEV106P Water and Sewage Treatment Plant Design

Design aspects of water and waste water systems ranging from pipeline to treatment plant; sanitary landfill; a detailed design of at least one unit to be completed.

Unit 1:

General environmental impact assessment due to industrial water pollution, assessment of pollution strength of Waste-BOD, COD, TOC, etc., COD/BOD/ratio, sampling and analysis of wastes, determination of BOD rate constant, standards for waste disposal for various methods.

Unit 2

Disposal of wastes in streams and estuaries, self-purification in streams – physical, chemical and biological forces of self-purification, stream constants, oxygen balance in streams.

Unit 3

Water pollution control: stream pollution control: stream surveys and investigation. Methods of water pollution control.

Unit 4

Introduction of cleaner technologies, reuse, recycling and resource recovery.

Industrial wastes: waste volume and strength reduction. Equalization and proportioning of wastes.

Neutralization of waste. General methods of treatment of industrial wastes.

Unit 5

Treatment of specific industrial wastes: Textile. Canning, dairy, fertilizer, tanning, sugar, brewery and distillery, iron and steel and metal finishing.

Common Effluent Treatment Plant

Text/Reference Books:-

1. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third Edition McGraw Hill 1991.
2. W.W. Eckenfelder, Industrial pollution control, McGraw Hill int-Edition 1990.
3. Central pollution control board, India, comprehensive industry document series.

Unit 1 General

Air pollution episodes, local and global effects of air pollution, pollution sources and emission inventories.

Unit 2 Thermodynamics and Kinetics

Combustions, equilibrium, calculation, chemical kinetics,

Unit 3 Meteorology and Transport Of Air Pollutants

Wind roses, topographical effects, temperature distribution in atmosphere, inversions, plume behavior and dispersion models.

Unit 4 Air Pollution Control

Control techniques for pollutants such as particulates sulfur oxides, nitrogen oxides, hydrocarbons etc.

Unit 5 Air Pollution Control Management

Air quality requirements, legislation, emission standards, management for air pollution control.

Text/Reference Books:

1. Stem A.C. Air pollution, Vol. I to VIII Academic Press.
2. Rao M.N. & Rao H.V.N. Air Pollution, Tata McGraw-Hill 1989.
3. Rao C.S., Environmental pollution control engineering, Willey Eastern Ltd. / New Delhi.

Unit 1

Solid waste management and organization. Sources, types, Quantity and composition sampling physical, Chemical and Biological properties.

Unit 2

Collection, transportation optimization of routes, tools and Equipment, Transfer station, Volume reduction.

Unit 3

Scientific method of disposal, Sanitary landfill, Composting Incineration, anaerobic digestion.

Unit 4

Future processing method, pyrolysis, refuse derived fuel.

Unit 5

industrial waste management; reduction, Recycle, Reuse, Recovery and Reporting; hazardous waste management

Text / Reference Books:

1. Solid waste Management in Developing Countries – A.D. Bhide, B.B. Sudresan
2. Municipal Refuse Disposal – Institute of American Public Health Association, Interstate Printer and Publisher inc-Tanvil Elinoy.
3. Solid Waste Management-D Joshep Hangertey, Joseph L. Pavoni,

PGEV204T-1 Elective-III Rural Water Supply and Sanitation

Unit 1

Concept of environment and scope of sanitation in rural areas. Magnitude of problem of water supply and sanitation – population to be covered and difficulties. National policy.

Unit 2

Various approaches for planning of water supply systems in rural areas. Selection and Development of preferred sources of water, springs, wells, infiltration wells, radial wells and infiltration galleries, collection of raw water from surface source.

Unit 3

Specific problems in rural water supply and treatment iron, manganese, fluorides etc., Low cost treatment, appropriate technology for water supply and sanitation. Improvised methods and compact system of treatment of surface and ground waters such as MB settlers, slow sand filter, chlorine diffusion cartridges etc..

Unit 4

Water supply through spot sources, hand pumps, open dug-wells., Planning of distribution system in rural areas, Water supply during fairs, festivals and emergencies.

Unit 5

Treatment and disposal of wastewater/sewage, Various methods of collection and disposal of night soil. On site sanitation system and community latrines. Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, septic tanks, soakage pits etc., Composting, land filling, Biogas plants.

Text/Reference Books:

Low cost on site sanitation option Hoffman & Occasional Nov. 1981 Paper No. 21. P.O. Box 5500 2280 HM Rijswijk, The Netherlands offices JC Monkeriaan 5 Rijswijk (The Haque).

Wagner, EG and Lanoik, N water supply for Rural areas and small communities, Geneva, W.H.O. 1959

Manual of water supply are Treatment, CPHEEO GOI, New Delhi.

PGEV204T-2 Elective-III Environmental Bio-Technology

Unit 1

Basic concept of microbial biochemistry – carbohydrates, proteins, fats and nucleic acids.

Basic concept of biodegradation, biotransformation, biobenefication, bioremediation/bioreclamation, microbial interaction.

Unit 2

Environmental monitoring – Significance of monitoring bacterial viral and protozoan pathogens.

Techniques of monitoring-Standard methods of monitoring viral bacterial – and protozoan pathogens.

Advance techniques – Gene probes biosensor, immunoassay.

Unit 3

Basic concept of genetic engineering-Chromosomal DNA, Plasmid DNA transformation, transduction conjugation, protoplast fusion, mutation recombinant DNA techniques.

Unit 4

Biotransformation of biomass/organic waste into value added chemicals energy, fertilizers, and single cell protein.

Unit 5

Aerobic and anaerobic waste treatment processes – microorganisms involved and biochemical changes of different pollutants present in liquid and solid waste, reactor technology, mathematical modeling and simulation, design and optimization.

Text/Reference Books:

C.S. Forster and D.A. John Wase, Environmental Biotechnology, Ellis Harwood, 1987

Trehan K., Biotechnology, New Delhi, Willey Eastern Ltd. 1990

Forster C.F. Biotechnology and Wastewater Treatment, Cambridge.

N.F. Grey. Biology of Wastewater Treatment, Oxford University Press, 1989.

PGEV204T-3 Elective-III Environmental Engineering systems & optimization

Unit I: Systems Approach Concept & Analysis

Model Classification, Terminology of Models, Model Building, Fundamental of Modeling, Transport Law, Chemical Equilibrium, Phase Equilibrium Routh's Law, Relative Velocity and Chemical Kinetics

Unit II: Process Modeling

Linear equilibrium system, Batch Reactor, pH system, Planning Models, Municipal solid waste management, Integrated Solid waste Management, Reuse and Recovery in paper, Plastic, glass and aluminum waste

Unit III: Water Modeling

Modeling of wastewater management systems. Modeling of pesticide management; Modeling of Modeling of municipal wastewater treatment, Model formulization and their solution, Numerical Techniques of Linear equations, Matrix inversion method, Gasses elimination and gas sidal method.

Unit IV: Programming Model

Silent feature of optimizations, Linear programming problem, Simplex method, Principals of problem in dual problem, Graphical Method, Principles related to graphical method – Optimum solution and their analysis (Minimization & Maximization) At least one problem of each method along with optimum solution.

Unit V: Air Dispersion & Equations of Continuity

Equations of continuity for rectangular, cylindrical, spherical. Derivation for rectangular coordinate. Numericals based on equation of continuity. Pollutant standard index criteria, toxic air pollutants, Motor vehicle emission, the point source Gaussian Plume models, Transportation Models.

Books:

1. Handbook of Environmental and Ecological Modeling, Halling-Sorensen B., Nielsen S.N. and Jorgensen S.E., Lewis Publishers Inc., 1995.
2. Fundamentals of Atmospheric Modeling, Jacobson Mark Z., Kluwer Academic Press, 2002.
3. An Introduction to Water Quality Modeling, James A. (Ed), (2nd Ed.), 1992.
4. Techniques for Environmental System Analysis - R.H.Pantell Wiley, NY, 2001.
5. System Analysis and Design – RJ Aguilar, Prentice Hall, Englewood Cliffs, N.J., 1993.
6. Numerical Methods and Analysis- Dr. S. K. Rathore.
7. Transport Phenomenon – Bird

PGEV202P**Air Quality Monitoring Lab**

Lab experiments based on the contents of **PGEV202T AIR QUALITY MANAGEMENT**

PGEV206P**Waste Water Quality Analysis**

1. Determination of chlorine demand, break-point chlorination and free residual chlorine
2. Estimation of Na and K in sewage sample, wastewater and natural water
3. Determination of Nitrate-nitrogen of nitrate nitrogen from the given wastewater samples.
4. Determination of iron from raw sewage, wastewater, natural surface water and compare the results
5. MLSS and MLVSS. Sludge Volume Index (SVI) and development of sludge settling characteristics curve and design of PST based on settling curve.
6. Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater
7. Determination of the Chemical Oxygen Demand (COD) for a given sample of wastewater
8. Determination of the Optimum Alum Dose for a given sample of water through Jar Test.
9. Estimation of fecal coliform (total coliform) from the swage and drinking water samples.

PGOPEN301T-1 Elective-IV: Water Resources Management

Unit 1: Introduction: World water resources, water resources in India, water as finite resource, variability of water in time & space, history of water resources development, water infrastructure-problems and perspectives, present institutional framework for water management.

Water laws: Constitutional provisions, National Water Policy, riparian rights / ground water ownership, prior appropriation, permit systems, acquisition and use of rights, scope for privatization. (3Hrs)

Economics of water: Water as economic good, intrinsic value, principles of water pricing & water allocation, capital cost, opportunity cost, internal rate of return, benefit cost analysis, principles of planning and financing of water resources project.

Unit 2: Probabilistic and statistical methods: statistical parameters, mean, mode, median, standard deviation, curtosis, probability, random events, random variable, functions of random variables, moments and expectations, common probabilistic distributions (normal, lognormal, poisson, extreme value, log-pearson etc.) estimation of parameters, goodness of fit tests, regression and correlation analysis.

Systems engineering: Systems Engg. concepts, optimizing techniques, conventional (LP, NLP, DP...) and evolutionary (ANN, fuzzy logic, genetic algorithm), simulation, applications of soft computing techniques for water resources planning and management

Unit 3: Flood management: causes of floods, structural and non-structural measures, mitigation plan, flood damage assessment, use of geoinformatics, Drought management: types of droughts, severity index, drought forecasting, damage assessment, mitigation plan, use of geoinformatics.

Unit 4: Basin scale hydrology: Estimation of surface water, estimation of ground water draft/recharge import/ export of water (interbasin water transfer), recycling and reuse, storages.

Demand and supply based management: Consumptive & non consumptive demands, irrigation demand estimation, water utilization, irrigation efficiency, water management in irrigation sector, demand estimation in hydro/thermal/nuclear power sector, estimation & forecasting of water demands of domestic & industrial sector, navigation and recreational water demands

Unit 5: Environmental management: protection of vital ecosystem, water requirements for environmental management, aquaculture, minimum flows, water quality management for various uses.

Social impact of water resources development: direct/ indirect benefits, employment generation, industrial growth, agro-industry, enhanced living standards, education & health, co-operative movement, management of rehabilitation & resettlement, control of water logging, salinity, & siltation of storages.

Books

1. Water Resources Systems Engg, D. P. Loucks, Prentice Hall
2. A. K. Biswas; Systems Approach to Water Management, McGraw Hill Book Co, New York.
3. Chaturvedi, M.C. "Water Resources Systems Planning and Management" Tata McGraw Hill
4. Water resources hand book; Larry W. Mays, McGraw International Edition
5. ANN in Hydrology; Govinda Raju & Ramachandra Rao; PHI
6. "Handbook of Applied Hydrology" by Van Tee Chow- McGraw Hill

PGOPEN301T-2 Elective-IV: Disaster Management and Mitigation

Unit 1: Introduction to Disaster :Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster-Dimensions & Scope of Disaster Management- India's Key Hazards - Vulnerabilities - National disaster management framework - Disaster Management Cycle.

Unit 2: Natural Disasters: Natural Disasters- Meaning and nature of natural disaster; their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

Unit 3: Anthropogenic Disasters: Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.

Unit 4: Approaches in Disaster Management : Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/ forecasting & warning - Preparing disaster preparedness plan - Land use zoning - Preparedness through Information, education. Emergency Stage - Rescue training for search & operation - Immediate relief - Assessment surveys. Post Disaster stage - Rehabilitation - Social Aspect - Economic Aspect and Environmental Aspect.

Unit 5: Disaster Mitigation: Meteorological observatory - Seismological observatory - Hydrology Laboratory and Industrial Safety inspectorate. Technology in Disaster Management- Emergency Management Systems (EMS) in the Disaster Management Cycle -Remote Sensing and Geographic Information Systems(GIS) in Disaster Management.

BOOKS:

- 1.Sharma.S.R, "Disaster management", A P H Publishers, 2011.
2. VenuGopalRao.K, "Geoinformatics for Disaster Management", Manglam Publishers and Distributors, 2010.
3. Singh.R.B, "Natural Hazards and Disaster Management: Vulnerability and Mitigation", Rawat Publications, 2006.
4. Gupta.H.K, "Disaster Management", University Press, India, 2003.
5. Gupta.M.C, "Manuals on Natural Disaster management in India", National Centre for Disaster Management,IIPA, New Delhi, 2001

PGEV303P Project Seminar

Seminar on the field of study chosen for PGEV401P PROJECT.

PGEV401P Project

Designs referred to water treatment wastewater treatment and water & wastewater collection.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur			
Scheme for absorption of students from old scheme to M Tech (Environmental Engineering) CBS 2016			
New Scheme CBS 2016		Equivalent Subject of Old Scheme	
Semester 1			
Subject Code	Subject Name	Subject Code	Subject Name
PGEV101T	Environmental Chemistry & Microbiology	Sem 1:2	Environmental Chemistry & Microbiology
PGEV102T	Municipal & Industrial Water Treatment	Sem 1:3	Municipal & Industrial Water Treatment
PGEV103T	Municipal Waste Water Treatment & Disposal	Sem 1:5	Municipal Waste Water Treatment & Disposal
PGEV104T	Elective –I (Discipline Specific)	Sem 2:5	Elective-I
PGOPEN105T	Elective-II (Open)	----	-----
PGEV101P	Environmental Chemistry & Microbiology Lab	Sem 1:2	Environmental Chemistry & Microbiology
PGEV106P	Water and Sewage Treatment Plant Design	Sem 2:2	Environment Management
----	-----	Sem 1:1	Computational Methods
Semester 2			
PGEV201T	Industrial Waste Water Treatment and Disposal	Sem 2:1	Industrial Waste Water Treatment and Disposal
PGEV202T	Air Quality Management	Sem 2:3	Air Quality Management
PGEV203T	Municipal Solid Waste Management	Sem 2:4	Municipal Solid Waste Management
PGEV204T	Elective –III (Discipline Specific)	Sem 3:1	Elective-II
PGFD205T	Research Methodology	----	-----
PGEV202P	Air Quality Monitoring Lab	Sem 2:3	Air Pollution and Solid Waste Management
PGEV206P	Waste Water Quality Analysis	Sem 2:6	Project Design
Semester 3			
PGEV301T	Elective –IV (Open)	Sem 1:4	Water Supply & Waste Water Collection
PGOPEN302T	Project Planning & Management	----	-----
PGEV303P	Project Seminar	Sem 3:2	Seminar on Dissertation
Semester 4			
PGEV401P	Project	Sem 4:1	Dissertation

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COURSE STRUCTURE AND SCHEME OF EVALUATION – (Semester wise)

MASTER OF TECHNOLOGY IN CIVIL ENGINEERING (ENVIRONMENTAL ENGINEERING)

FIRST SEMESTER

	Name of the subject	Examination	Max Marks	Min Pass Marks	Weekly Teaching Scheme		
					L	P	T
Sem 1:1	Computational methods	Theory/ Sessional	70 30	50	4	.....	3
Sem 1:2	Environmental Chemistry & Micro Biology	Theory/ Sessional /Practical	70 30 50	50 25	4	8	.....
Sem 1:3	Water supply & waste water collection	Theory/ Sessional	70 30	50	4	.....	3
Sem 1:4	Municipal and Industrial Water Treatment	Theory/ Sessional	70 30	50	4	.....	3
Sem 1:5	Municipal Waste Water Treatment and Disposal.	Theory/ Sessional	70 30	50	4	3
	Project (to be cont.in second semester)	4
		Total	550	275	20	8	16

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SECOND SEMESTER

	Name of the subject	Examination	Max Marks	Min Pass Marks	Weekly Teaching Scheme		
					L	P	T
Sem 2:1	Industrial Waste Water Treatment and Disposal	Theory/ Sessional	70 30	50	4	.....	3
Sem 2:2	Environmental Management	Theory/ Sessional	70 30	50	4	.....	3
Sem 2:3	Air quality management	Theory/ Sessional	70 30	50	4	.....	3
Sem 2:4	Municipal solid waste management	Theory/ Sessional	70 30	50	4	.....	3
Sem 2:5	Elective-1	Theory/ Sessional	70 30	50	4	.....	3
Sem 2:6	Lab. Exp. On Air pollution and Solid waste	Practical	50	25	.....	8	.....
Sem 2:7	Project Design	Sessional Viva voce	100 150	50 75	8
Total			800	400	20	8	23

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THIRD SEMESTER

	Name of the subject	Examination	Max Marks	Min Pass Marks	Weekly Teaching Scheme		
					L	P	T
Sem 3:1	Elective-II	Theory/ Sessional	70 30	50	4	.....	.....
Sem 3:2	Dissertation (Cont. to fourth sem.) Seminar on Dissertation	Sessional	150	75	.....	.....	8
Total			250	125	4	.....	8

Elective-I

- 1) **Hazardous Water Management.**
- 2) **Water Resource Management.**
- 3) **Applied structures**

Elective-II

- 1) **Environmental Engineering system optimization**
- 2) **Rural water supply & sanitation.**
- 3) **Environmental Bio-Technology.**

FORTH SEMESTER

	Name of the subject	Examination	Max Marks	Min Pass Marks	Weekly Teaching Scheme		
					L	P	T
Sem 4:1	Dissertation	Viva Voce	400	200	.....	.....	9
Total			400	200	.....	.....	9
Grand total for all the four Semester			2000	1000			

All the theory papers shall be of three hours duration except applied structures, which will be of four hours duration.

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SYLLABUS OF M. Tech. ENVIRONMENTAL ENGINEERING

SEMESTER-I

Sem 1:1 Computational Methods

PROBABILITY AND STATISTICS:

Random Variables-discrete and continuous, cumulative distribution function and probability density function, concept of most probable member, elementary ideas of joint probability distributions. Sampling distributions t.F and χ^2 distributions, test of hypotheses.

CALCULUS OF VARIATIONS:

Functions and their extreme values. Variation of functional and its properties, Euler-Lagrange's equation. Minimization of functional. Galerkin and Ritz Methods.

OPTIMIZATION:

Linear programming (up to simplex method). Non linear and dynamic programming.

NUMERICAL METHODS:

Solution of system of linear algebraic equations. Gauss-Seidel method, Crout's method. Solution of transcendental equations by Newton-Raphson method and method of false position.

ARTIFICIAL NEURAL NETWORK (ANN)

Training methods, Fuzzy logic

Sem 1:2 ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY

GENERAL CHEMISTRY:

Theory of valency, oxidation numbers, oxidation reduction reactions, Law of mass action, stoichiometry, Gas Laws.

PHYSICAL CHEMISTRY:

Buffer solutions, Indicators. Amphoteric hydroxides, chemical equilibrium and ways of shifting it. Osmosis Dialysis.

ORGANIC CHEMISTRY AND BIOCHEMISTRY:

1. Organic compounds of interest to environmental engineers (Details of preparation and chemical reactions involved are not required), General properties of the functional groups of organic compounds.
2. Enzymes, classification, Enzyme catalyzed reactions, Energy considerations, coupling of reaction.
3. Breakdown and synthesis of carbohydrates, fats, proteins under aerobic and anaerobic reactions.

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4. CNP cycles under aerobic and anaerobic reactions
5. Concept of BOD, COD, TOC.

COLLOIDAL CHEMISTRY

Colloids, Dispersion of colloids. General and electro-kinetic properties of colloids. Colloidal solution and mixtures.

ENVOIRONMENTAL CHEMISTRY

Chemistry involved in water treatment procedures like coagulation, softening, softening, fluoridation, defluoridations. Iron and Manganese removal: demineralization. Analysis of pesticide and Heavy Metals

ENVOIRONMENTAL MICROBIOLOGY

1. Introduction of microbiology, Haecler's classification and characterization of microorganisms, viruses.
2. Morphology and structure of bacteria, nutrient requirement, growth of bacteria.
3. Basic microbiology of water and sewage.
4. Basic Principals involved in the analysis of faecal indicator bacteria – coliforms and streptococci, plankton analysis of pseudomonas and streptococci.

PRACTICALS –

Practical based on water & waste water engineering.

Text/Reference Books:

C.N. Sawyer and P.L.McCarty, chemistry for Environmental Engineering, McGraw Hill book company.

Mckinney, Microbiology for Sanitary Engineers, McGraw Hill book Co.

Sem 1:3 WATER SUPPLY AND WASTE WATER COLLECTION

WATER SUPPLY

Flow through pipes-

Equation for flow through pipes, Moody diagram, analyses of flow through pipe network.

1. Hardy cross method
2. Newton Raphsons method
3. Linear method

Reservoirs, Effect of inclusion of pumps and valves in the distribution system, Node flow analysis.

Rising Main-

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Design of rising main, water hammer, causes and prevention. Maintenance of distribution system – Detection and prevention of faults.

Design of Transmission and distribution system.

WASTE WATER COLLECTION:

General-

Objectives, types of systems and sewers, requisites for sewerage system design-Surveys and Investigations.

Hydraulics of Sewer –

Fundamentals of fluid mechanics, flow equations, pipe and open channel flow, self cleansing and damaging velocities through sewer, flow in partially filled sewers, velocity of equal cleansing, sewer shapes vis-avis their usefulness, sewer invert drop.

DESIGN OF SEWERS:

Storm Sewers-

Estimation of design flow, rational and other methods of estimation of design storm flow, rainfall intensity – duration – frequency relationships. Design of a typical storm sewerage system.

Sanitary Sewers-

House plumbing systems, estimation of design flows. Fluctuation flows. Sewer ventilation, sulfide generation in sewers, depth of sewer, design of a typical sanitary sewerage system.

Pumps and Pumping Stations-

Pumps, pump drive units, sewage pump selection, pumping station design, illustrative example.

SEWER APPURTENANCES

Manholes, street inlets, catch basins building connections, sewer junctions, inverted siphon, flushing tanks, air ejectors, regular and measuring devices.

Text/Reference Books:-

Bhave P.R., Analysis of flow in water distribution net works, Lancaster : Technomic Publishing Co., Inc. 1991.

Manual on Sewerage and sewage Treatment, CPHEEO, Govt. of India.

Sem1:4 MUNICIPAL AND INDUSTRIAL WATER TREATMENT

Water quality criteria and standards, Requirements of water treatment facilities – unit operations and unit processes – Important physical properties of water.

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Principles of sedimentations – Effect of temperature, viscosity – Efficiency short circulating – Design of inlets and outlets, up flow and sludge blanket tanks, sludge and its removal. High Rate Sedimentation.

Theories of chemical coagulation, common coagulant in water. Factors affecting coagulation, determination of coagulant doses, perikinetic and orthokinetic coagulation, theory and use of coagulant aids, design, construction. And operation of flocculators.

Theory of filtration design construction and operation of filters – hydraulics of filtration and filter back washing. Performance of slow and rapid sand filters. High rate and variable rate filtration.

Two layer filters. Pressure filters, diatomaceous earth filters. Modern developments in filtration.

Factors affecting disinfection – free and combined available chlorine, ultraviolet irradiation, ozonation disinfection of new mains – emergency chlorination.

Water treatment for swimming pools.

Theories of adsorption. Freundlich equation. Removal of taste and odour by adsorption. Activated carbon phenol value. Other methods of taste and odour control and colour removal.

Boiler, cooling and other industrial water requirements. Langelier index. Softening of water Lime – soda methods. Dosage control Excess dose. Hot lime-soda. Split treatment. Recarbonation.

Use of polyphosphates. Disposal of sludge.

Softening by ion exchange. Natural and synthetic media, capacity, regeneration. Ion exchange Demineralization.

Miscellaneous methods of water treatment; iron and Mn removal, Desalination, Nitrate, Phosphate and Arsenic removal and recent advances.

Hyperfiltration.

Text/Reference Books:-

N.J. McGhee. Steel W. water supply and sewerage. McGraw Hill 1991.

..W.J. Weber. Physicochemical Processes for water quality control, John Wiley and sons 1972

Nordel, E: Water Treatment for industrial and other uses. Reinhold publishing corporation N.Y.

Sem1:5 MUNICIPAL WASTEWATER TREATMENT AND DISPOSAL

General objectives of sewage treatment, sewage treatment, sewage characteristics conventional sewage treatment flow sheet, functions of different unit processes, treatment requirements.

Process analysis: Reaction and reaction kinetics, mass balance analysis, reactors and their hydraulic characteristics, reactor selection, practical aspects of reactor design.

Physical and chemical treatment : Screening, grit removal, flow equalization and mixing, flocculation, sedimentation, flotation, disinfection.

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Biological treatment: Principles of biological treatment, kinetics of biological growth, aerobic and anaerobic treatment of sewage. Activated sludge, trickling filters, biological disc, packed bed and fluidized bed treatment, stabilization ponds.

Sludge treatment : Sludge treatment flow-sheets, sludge quality and quantity, various methods of sludge treatment aerobic and anaerobic sludge digestion, sludge conditioning, dewatering of sludge, conveyance, storage and disposal, disposal by dilution.

Advanced waste water treatment: Principles of tertiary treatment, reuse and resource recovery, and recent developments.

Text/Reference Books:

S.J. Arceivala, wastewater Treatment and Disposal, Marcel Dekker 1981.

N.F. Grey, Activated Sludge process, Theory and Practices, Oxford University Press 1990.

Metcalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third Edition McGraw hill 1991.

Qasim S.R.. Wastewater Treatment Plant Planning, Design and Operation, Holt, Rinehart and Winston, N.Y.

SEMESTER-II

Sem2:1 INDUSTRIAL WASTEWATER TREATMENT AND DISPOSAL

General environmental impact assessment due to industrial water pollution, assessment of pollution strength of Waste-BOD, COD, TOC, etc., COD/BOD/ratio, sampling and analysis of wastes, determination of BOD rate constant, standards for waste disposal for various methods.

Disposal of wastes in streams and estuaries, self-purification in streams – physical, chemical and biological forces of self-purification, stream constants, oxygen balance in streams.

Water pollution control: stream pollution control; stream surveys and investigation. Methods of water pollution control.

Introduction of cleaner technologies, reuse, recycling and resource recovery.

Industrial wastes: waste volume and strength reduction. Equalization and proportioning of wastes.

Neutralization of waste. General methods of treatment of industrial wastes.

Treatment of specific industrial wastes: Textile. Canning, dairy, fertilizer, tanning, sugar, brewery and distillery, iron and steel and metal finishing.

Common Effluent Treatment Plant

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Text/Reference Books:-

Metcalfe and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third Edition McGraw Hill 1991.

W.W. Eckenfelder, Industrial pollution control, McGraw Hill int-Edition 1990.

Central pollution control board, India, comprehensive industry document series.

W.J. Weber physicochemical processes for water quality control, John Wiley and Sons. 1972.

Nemerow, N.L. Theories and practices of industrial waste treatment. New York. Addition wisely.

Besselièvre, E.B., The treatment of industrial wastewaters, McGraw Hill Book co.

Culp R L et handbook of advanced wastewater treatment van no-strand Reinhold publ. N Y.

Sem2:1 ENVIRONMENTAL MANAGEMENT

General Global and India scenario

National environmental policy

Environmental organizations for planning and implementation sustainable development.

Preventive and reactive strategies for environmental pollution control.

Environmental impact and risk assessment.

Methodologies: Adhoc, checklist, network, matrix etc.

Env. Management Plan.

Typical case studies of environmental impact assessment.

Environmental impact statements

Environmental Audit

Environmental Legislation

Air, Water and environmental acts.

Text/Reference Books:-

A. Rosencranz, S. Divan, M.L. Noble, Environmental law and policy in india, cases, materials and statutes, tripathi pvt. Ltd. Bombay.

S. Musharaf, legal aspects of Environmental pollution and its management, C.B.S publishers, Delhi 19932.

R.K. Jain L.V. Urban, G.S. Stacey H. E. Balbach, Environmental Assessment McGraw-Hill, Inc. N.Y. Rao, J. G. and Wooten, Environmental Impact Analysis, Hanfbook, 1980.

Canter L.W., Environmental Impact Assessment, - N.Y. McGraw-hill Book Co., 1977

Sem2: 3 AIR QUALITY MANAGEMENT

General:

Air pollution episodes, local and global effects of air pollution, pollution sources and emission inventories.

THERMODYNAMICS AND KINETICS. II

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Combustions, equilibrium, calculation, chemical kinetics,

MATEOROLOGY AND TRANSPORT OF AIR POLLUTANTS III

Wind roses, topographical effects, temperature distribution in atmosphere, inversions, plume behavior and dispersion models.

AIR POLLUTION CONTROL IV

Control techniques for pollutants such as particulates sulfur oxides, nitrogen oxides, hydrocarbons etc.

AIR POLLUTION CONTROL MANAGEMENT V

Air quality requirements, legislation, emission standards, management for air pollution control.

Text/Reference Books:

Stem A.C. Air pollution, Vol. I to VIII Academic Press.

Rao M.N. & Rao H.V.N. Air Pollution, Tata McGraw-Hill 1989.

Rao C.S., Environmental pollution control engineering, Willey Eastern Ltd. / New Delhi.

Sem 2: 4 MUNICIPAL SOLID WASTE WATER MANAGEMENT

Solid water management and organization. Sources, types, Quantity and composition sampling physical, Chemical and Biological properties.

Collection, transportation optimization of rools, tools and Equipment, Transfer station, Volume reduction.

Scientific method of disposal, Sanitary landfill, Composting Incineration, anaerobic digestion.

Future processing method, phrolysis, refuse derived fuel.

References:-

- 1) Solid waste Management in Developing Countries – A.D. Bhide, B.B. Sudresan
- 2) Municipal Refuse Disposal – Institute of American Public Health Aassociation, Interstate Printer and Publisher inc-Tanvil Elinoy.
- 3) Solid Waste Management-D Joshep Hangertey, Joseph L. Pavoni,

Sem 2:5 ELECTIVE-I

1. Hazardous Waste Management

Definition of Hazardous waste, U.S.E.P.A. classification, global scenario, episodes.

Hazardous waste (management and handling) rules, 1989 and Indian scenario.

Sources of Hazardous waste, types of waste invent __isation procedures.

Sampling and analytical procedures.

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Overview of treatment and disposal methods-waste minimization.

Physicochemical methods and biological methods.

Thermal Processes.

Solidification/stabilization and innovation techniques.

Secure landfill.

Site selection methodology for establishing treatment and disposal methods and EIRA methodology

Text/Reference Books:-

The safe Disposal of Hazardous Waste, Vol. I, II & III Batstone, Smith, Wilson, Joint study
Sponsored by: The world Bank, The WHO & UN Env. Program UNEP, The World Bank,
Washington D.C. World Bank Tech Paper No. 93.

Freeman H.M., Standard Handbook of Hazardous Waste Treatment and Disposal., 1989

2. Water Resource Management

Introduction:; Water Resources planning, multi-objective planning role in national development,
basic concepts of hydrology and hydrogeology.

River monitoring, gauging silting, silt load etc.

Ground water pollution.

National water policy.

Water Resources planning and processes: Management of water bodies.

Application of Remote-sensing Techniques.

Integrated approach – carrying capacity based planning.

Water resources conservation: quantity aspects, surface and ground water development,

Rainwater harvesting, Ground water Recharge, conjunctive use of ground and surface water

Water resources development in coastal areas.

Basic concepts of economics, welfare economics.

Later basin transfer of water.

EIA of water Resource development projects.

Text/Reference Book

Linsley R.K. & Franzini, J.B.; Water resources Engineering. New Delhi; McGraw Hill Kogakusha
1979.

Grigg N.S. Water Resources planning McGraw Hill Book company.

3. Applied Structures (Paper of four hours duration)

Structural design of water supply and water collection system:

Design of pipes such as R.C.C. prestressed mild steel asbestos cement, cast iron etc.

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Estimation of loads such as gravity earth forces, super imposed loads, moving loads etc. on rigid and flexible conduits under various types of field conditions.

Design of pipe Supports, beddings, shallow and deep manholes, inverted siphons and other appurtenances etc.

Design of tanks and other structures:

Design of R.C.C. and prestressed structures for water and waste water such as circular and hopper bottom, setting tanks, pump and pump house, intakes, channels, water storage tanks, etc.

Durability criteria for environmental structures.

Text /Reference Books:

Jaikrishna & Jain O.P., Plain & reinforced concrete, Vol. II. Roorkee: New Chand & Bros, 1980.

Relevant is codes in design of pipes, ESR and GSR.

Sem 2: 6 PRACTICALS

Lab Experiments based on Air Pollution & Solid waste.

Sem 2:7 PROJECT

Designs referred to water treatment wastewater treatment and water & wastewater collection.

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SEMESTER III

Sem 3:1 ELECTIVE II

1. Environmental Engineering Systems Optimization

Optimization methods for environmental Engineering systems e.g. water supply system, waste-water collection systems water treatment systems waste water treatment systems, solid waste and air-pollution control systems.

Text/Reference Books:

Haith D.A., Environmental System Optimization, N.Y., John Willey 1982.

2. Rural Water Supply and Sanitation:

Concept of environmental and scope of sanitation in rural areas.

Magnitude of problem of water supply and sanitation – population to be covered and difficulties. National policy.

Various approaches for planning of water supply systems in rural areas.

Selection and Development of preferred sources of water, springs, wells, infiltration wells, radial wells and infiltration galleries, collection of raw water from surface source.

Specific problems in rural water supply and treatment iron, manganese, fluorides etc.

Low cost treatment, appropriate technology for water supply and sanitation.

Improvised methods and compact system of treatment of surface and ground waters such as MB settlers, slow sand filter, chlorine diffusion cartridges etc.

Water supply through spot sources, hand pumps, open dug-wells.

Planning of distribution system in rural areas.

Water supply during fairs, festivals and emergencies.

Treatment and disposal of wastewater/sewage

Various methods of collection and disposal of night soil.

On site sanitation system and community latrines.

Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, septic tanks, soakage pits etc.

Disposal of solid waste: Composting land filling, Biogas plants

Text/Reference Books:

Low cost on site sanitation option Hoffman & Occasional Nov. 1981 Paper No. 21. P.O. Box 5500 2280 HM Rijswijk, the Netherlands offices JC Monkeriaan 5 Rijswijk (The Hague).

Wagner. EG and Lanoik J.N , Water supply for Rural areas and small communities, Geneva W.H.O. 1959

Manual of water supply and Treatment 3rd edition CPHEEO GOI, New Delhi.

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3. Environmental Bio-Technology

Basic concept of microbial biochemistry – carbohydrates, proteins, fats and nucleic acids.

Basic concept of biodegradation, biotransformation, biobenefication, bioremediation/bioreclamation, microbial interaction.

Environmental monitoring – Signification of monitoring bacterial viral and protozoan pathogens.

Techniques of monitoring-Standard methods of monitoring viral bacterial – and protozoan pathogens.

Advance techniques – Gene probes biosensor, immunoassay.

Basic concept of genetic engineering-Chromosomal DNA, Plasmid DNA transformation, transduction conjugation, protoplast fusion, mutation recombinant DNA techniques.

Biotransformation of biomass/organic waste into value added chemicals energy, fertilizers, and single cell protein.

Aerobic and anaerobic waste treatment processes – microorganisms involved and biochemical changes of different pollutants present in liquid and solid waste, reactor technology, mathematical modeling and simulation, design and optimization.

Text/Reference Books:

C.S. Forster and D.A. John Wase, Environmental Biotechnology, Ellis Harwood, 1987

Trehan K., Biotechnology, New Delhi, Willey Eastern Ltd. 1990

Forster C.F. Biotechnology and Wastewater Treatment, Cambridge.

N.F. Grey. Biology of Wastewater Treatment, Oxford University Press, 1989.
