

CEMAC 501 ADVANCED ENGINEERING MATHEMATICS

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

PARTIAL DIFFERENTIAL EQUATIONS

Formation by elimination of arbitrary constants and arbitrary functions – Solutions of equations by the methods of separation of variables in case of simple boundary conditions pertaining to (i) one dimensional wave equation and (ii) two dimensional wave equation satisfied by vibrating membrane (No numerical problems).

UNIT – II

SPECIAL FUNCTIONS

Gamma and Beta functions Bessel – function – Legendre polynomials – Recurrence relations for $J_n(x)$ and $P_n(x)$. Orthogonality of Legendre Polynomials – Rodrigues formula.

UNIT – III

STATISTICS

Empirical distributions – Log-normal-Binomial, poisson, gamma, extreme value and uniform distributions – Estimation of parameters by method of moments and maximum likely hood methods – Multiple correlation and regression.

UNIT – IV

COMPLEX VARIABLES AND LAPLACE TRANSFORMS

Complex variables – Cauchy – Reimann equations – Laplace equation – Conformal transformations including Joukowski's and Schwaz and Christoffel transformations.

LEPLACE TRANSFORMS

Laplace transformation of Impulse function (Dirac-Delta function) and its applications to differential equation.

UNIT – V

NUMERICAL METHODS

Numerical solutions of partial differential equations – Laplace and poisson equations by iteration method, heat equation by Schmidt method.

Reference Books :

1. Dr. B.S. Grewal, Higher Engineering Mathematics.
2. S.C. Gupta, V.K. Kapur Foundations of Mathematics Statistics.

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CEEEEC 502 ENVIRONMENTAL CHEMISTRY

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

REACTION KINETICS : The rate law – Order of reactions ,Zero and First order reactions, second order reactions, Pseudo first order reactions– half life and its relationship to the rate constant – Factors affecting rate of reactions.

RECTORS-BATCH, CONTINUOUS, PLUG FLOW, PROCESS SELECTION

Reactors- mass balance analysis- batch, completely mixed and plug flow reactors – process selection

Solution equilibrium – Le Chatlier principle -Activity and activity coefficients –Ion activity coeffs – solubility of salts – oxidation-reduction reactions - complex formation, solubility product, LCD for solubility determination, Oxidation-Reduction equilibria.

UNIT – II

CHEMICAL THERMODYNAMICS AND EQUILIBRIUM: Heat and work-Energy-Enthalpy, Free energy and its relationship to the equilibrium constant, calculation of change free energy at standard and ambient conditions. Entropy, Free energy.

EQUILIBRIUM PROCESSES : Volatilization – Air – water equilibrium – Henry's constant with units for a gas dissolving in a liquid – Dimensionless Henry's constant for species transferring from a liquid to a gas.

UNIT – III

ACID – BASE EQUILIBRIUM: Hydrogen ion concentration (pH) – acids and bases and their equilibrium constants, PC-PH diagram: Log concentration Diagram – The carbonate system, alkalinity, and buffering capacity – Hydrolysis of salts and gases.

CHEMISTRY OF ORGANICS: Major groups of organic compounds – Difference between organics and inorganics – Organic compounds generally encountered in industrial wastewater – Biodegradable and non - biodegradable organics. Hydrocarbons, Alcohols, Aldehydes, ketones and Acids, Carbohydrates, detergents, fats of organics.

UNIT –IV

NUCLEAR CHEMISTRY- Atomic structure-stable and radioactive nuclides nuclear reactions-Nuclear Fission-Nuclear fusion-Effect of Radiation on man, safety of nuclear reactors.

SURFACE AND COLLOIDAL CHEMISTRY-Properties of colloids, environmental significance, colloidal dispersion in liquids and air, EDL Theory, destabilization of colloids, Adsorption at solid-liquid interfaces.

UNIT-V

TREATMENT OF COOLING WATER: Water stabilization, Langmuir saturation Index, Caldwell-Lawrence diagrams, water softening- Chemical precipitation , split treatment and Ion exchange process.

BIOCHEMISTRY-Biodegradation of carbohydrates, protein, fats and oils, biochemical pathways, Energetics and bacterial growth, enzymes.

Reference Books :

1. Sawyer, C.N., P.L. Mc Carty, and G.F.Parkin, (1994). Chemistry for Environmental Engineering, McGraw Hill, New York.
2. De, A.K. (1994). Environmental Chemistry, Wiley Eastern Limited, New Delhi.
3. Warner Stumn and James J. Morgen (1996). Aquatic Chemistry, 3rd ed., Wiley-Interscience series of tests and monographs.
4. Larry D. Benefield and Joseph F. Judkins. Jr. and Barron L. Weand (1981). Process Chemistry for water and waste water treatment, Printice Hall Inc.

CEEEC 503 ENVIRONMENTAL MICROBIOLOGY

L + T / week : 3+1 Hrs
University Exam: 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I GENERAL: Importance of Microorganisms. Classification of Microorganisms based on nutrition and metabolic activity

PROCARYOTIC AND EUCARYOTIC MICRO ORGANISMS:

BACTERIA: Distribution, cytology, forms, size, cell structure, chemical composition, metabolism and classification.

FUNGI : Classification, identification, terminology and cultivation, chemical composition

ALGAE : Classification, identification, culture media, metabolism, pigments.

HIGHER FORMS : Protozoa - identification, classification, metabolism, nutrition. Rotifers; crustaceans; worms and larvae.

UNIT – II : STUDY OF MICROORGANISMS: Stains and staining.

STUDY OF MICROSCOPES: ordinary, dark field, reflectance and electron microscopes.

GROWTH PATTERN OF MICROORGANISMS: Growth curve, food-microorganism relationship, aerobic-anaerobic growth, temperature, types of culture media, inhibitory media, Fungi media, Algae media, Protozoa media and isolation of microorganisms. Estimation of bacterial numbers.

NUTRITIONAL REQUIREMENTS FOR GROWTH: Required elements, organic growth factor requirements, Carbon source, Nitrogen source, control of synthetic reaction, energy source and selective effect of nutrients.

CONTROL OF MICROORGANISMS: Pattern of death, heat, disinfection, oxidizing agents, surfactants, heavy metals, Antimetabolites and Antibiotics, and PH.

UNIT – III : QUANTATIVE MEASUREMENT OF GROWTH:

Measurement of usable substrate, Measurement of oxygen uptake, Measurement of biomass, relationships between X and S.

ENZYMES AND GENETICS : Enzymes - Nature of enzymes, mode of action, effect of temperature, pH, salts and heavy metals on enzyme activity; Colloidal nature of enzyme, extracellular and intracellular enzymes, hydrolytic enzymes, oxidation-reduction enzymes, classification of enzymes. Genetics.

MICROBIOLOGY OF WATER: Bacterial content of various types of water sources - water borne diseases, differentiation of fecal and non-fecal coli forms, M.P.N. and other microbiological tests on water.

UNIT – IV : MICROBIOLOGY OF WASTEWATER: Aerobic and anaerobic metabolism.

CENTRAL PATHWAYS OF METABOLISM: Embden Meyerhof pathway, Tricarboxylic Acid Cycle (TCA), Hexose Monophosphate (HMP) pathway, Entner-Doudoroff pathway.

AEROBIC METABOLISM- Metabolism of carbohydrates, metabolism of proteins, metabolism of lipids, metabolism of nucleic acids, metabolism of hydrocarbons.

ANAEROBIC METABOLISM- Fermentation of sugars-Formation of pyruvate from Glyceraldehyde 3-phosphate, formation of lactic acid, Decarboxylation of pyruvate, Formation of butanediol, Formation of butyric acid and butanol, Formation of propionic acid, Formation of glycerol. Fermentation of non carbohydrate substrates. Anaerobic digestion process.

UNIT – V : MICROBIOLOGY OF COMPOSTING: Microorganisms involved in composting process.

MICROBIOLOGY OF AIR: Types of microorganisms, Air-borne diseases, control of air-borne diseases.

SOIL MICROBIOLOGY: Types of microorganisms, distribution, Bioremediation.

References Books:

1. R.E. McKinney, (1977), Microbiology for Sanitary Engineers, McGraw Hill, New York.
2. Anthony F. Gaudy and Elizabeth T. Gaudy (1980), Microbiology for environmental scientists and engineers McGraw Hill publishers, Tokyo.
3. Michael J. Pelczar, JR. Chan, E.C.S. and Noel R. Krieg (2004), Microbiology, McGraw Hill, Inc., New York.
4. Ralph Mitchel and Ji Dongu Gu (2010). Environmental Microbiology. John Wiley and sons. Canada.

CEEEEC 504 ADVANCED WATER TREATMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT –I

WATER QUALITY AND CRITERIA: Water quality criteria and standards for different uses-drinking, irrigation, industrial and construction. Water quality indices, physical, chemical and physicochemical unit operations and processes -Typical treatment flow sheet of surface and underground water.

AERATION: Aeration, solubility of gases-two film theory, aeration methods, design of different aeration systems-sprinkler, cascade and mechanical.

UNIT –II

SEDIMENTATION: Different types of settling, settling column analysis, settling velocity and design principles of sedimentation tank, Tube settlers.

COAGULATION AND FLOCCULATION: Theory and mechanism of chemical coagulation and flocculation, determination of optimum coagulant doses, Chemical feed system. Theory of flocculation – orthokinetic and perikinetic, G and Gt factor, Hydraulic and mechanical mixing arrangements, design of different types of flash mixing and flocculator units.

UNIT –III

FILTRATION : Theory of filtration, Filter media-characteristics, hydraulics of flow through porous media, slow sand filtration, rapid sand filtration, precoat filtration, direct filtration of water, their design, back washing of filters – design of backwash , Operational and maintenance problems.

DISINFECTION : Mechanism of disinfection, Factors affecting the disinfection process. Common disinfectants. Chemistry of chlorination, Chlorine handling and dosing, Ozonation, U.V. Disinfection - design criteria.

UNIT –IV

OTHER TREATMENT METHODS: Removal of taste and odour, colour, iron and manganese, fluorides, arsenic, nitrates and desalination of water.

INDUSTRIAL WATER TREATMENT: Boiler feed water-Softening , Ion – exchange and reverse osmosis, Water stabilization, process water for food processing industries.

UNIT –V

WATER PLANT WASTE MANAGEMENT: Need for sludge management, Characteristics and quantities of water processing sludges, Design of water – treatment sludge thickeners. Application of pressure filtration and centrifugation for dewatering of sludges. Alum recovery practices. Ultimate disposal of dewatered sludges.

LAYOUT AND HYDRAULIC DESIGN OF WATER TREATMENT PLANTS

Reference Books :

1. Montgomery, water treatment principles and design, Johnwiley and sons, Newyork..
2. Warren Viessman, Jrand Mark J. Hammer, Water Supply and Pollution Control by Harper & Row Publishers, New York.
3. Hazard S. Peavy, Donald R. Rowe and George Tchobanoglous, (1985). Environmental Engineering, McGraw-Hill Book Company, New York.
4. J.RWeber (1972), Physicochemical Processes for Water Quality Control, John Wiley and Sons, USA.

CEEEP 507 ENVIRONMENTAL ENGINEERING Lab – I (Practical)

Practicals / week : 2 Hrs
University Exam : 3 Hrs

Sessional Marks : 40
End Exam Marks : 60

Water and Air Analysis

1. (a) Determination of Colour
(b) Determination of Turbidity
(c) Determination of pH
(d) Determination of Temperature and Odour
2. (a) Determination of Total Solids, Dissolved Solids, Suspended Solids.
(b) Determination of Total Volatile and Fixed Solids.
(c) Determination of Electrical Conductivity
3. (a) Determination of Total Acidity
(b) Determination of Total Alkalinity
(c) Determination of Dissolved oxygen
4. (a) Determination of Total Hardness
(b) Determination of Chlorides
(c) Determination of Sulphates
5. (a) Determination of Residual chlorine content
(b) Disinfection Efficiency
6. Determination of Optimum dose of coagulant – pH, Turbidity Concentration
7. Determination of MPN Index:
Presumptive Test
Confirmation Test
Completed Test
Grams Staining Technique
8. Sedimentation Column Analysis
9. Filtration – Studies using filter Column.
10. Demonstration of Ambient air quality measurement using High Volume Sampler.
Analysis – SPM, NO_x, RSPM, SO_x.

CEEEEC 601 ADVANCED WASTEWATER TREATMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

GENERAL:

CONSTITUENTS IN DOMESTIC WASTEWATER - BOD, COD, TOC, N AND P – biodegradability, non biodegradable organics and other inorganic.

TREATMENT PROCESS AND EFFLUENT DISPOSAL STANDARDS.

PRIMARY TREATMENT - Design of Screens, Grit chamber, Sedimentation tanks.

SUSPENDED GROWTH PROCESS: Activated Sludge Process-ASP and its modifications, process design considerations, evaluation of Biokinetic parameter, Aeration, diffused aeration system.

UNIT – II

ATTACHED GROWTH PROCESS: Substrate removal in attached growth process - design of Trickling filter, rotating biological contactors.

PHOSPHOROUS REMOVAL: Biological phosphorus removal, chemical processes-chemical coagulation, precipitation and oxidation. Tracing phosphorous through treatment processes.

NITROGEN REMOVAL: Biological nitrification and denitrification, ammonia stripping, break point chlorination, and ion-exchange for ammonium (NH_4^+); Combined removal of nitrogen and phosphorus. Tracing nitrogen through treatment processes.

UNIT – III

ADVANCED PROCESSES:

Granular media filtration, micro screening, MSP like Reverse Osmosis, Electrodialysis, Ultra Filtration, Disinfection of waste water.

REMOVAL OF TOXIC COMPOUNDS AND REFRACTORY ORGANICS : Toxic and refractory organics – Detergents, PCB, phenol, Hydrogenated hydrocarbons, Pesticides and Aromatics. Removal by adsorption, chemical coagulation, Advanced Oxidation Process(AOP).

UNIT – IV

WASTE WATER RECYCLE, REUSE AND RECLAMATION

Ponds, Ditches, Lagoons, UASB, MBR, Constructed wetlands.

Waste water Reuse Applications, Waste water Reclamation Technologies- Constituent Removal Technologies-Conventional waste water Treatment process flow diagrams for water Reclamation-Advanced waste water treatment process flow diagrams.

EMERGING CONTAMINANTS IN WASTE WATER- organic compounds and microorganism, Priority pollutants.

UNIT – V

WASTEWATER TREATMENT PLANT RESIDUE MANAGEMENT

Solids sources, characteristics and quantities-solid processing flow diagram-preliminary operations-Thickening-Digestion-condition-dewatering-Heat drying and composting-Thermal reduction-Reuse.

ENVIRONMENTAL AND HYDRAULIC DESIGN OF WASTE WATER TREATMENT PLANTS

Stages of Design- data collection-site layout-Environmental and Hydraulic design.

Reference Books :

1. Metcalf and Eddy, Wastewater Engineering, Tata McGraw Hill Pub. Co.
2. M.J. Hammer, Water and Wastewater Technology, John Wiley and Sons.
3. Sincero Sr., A.P., and G. A. Sincero (1999), Environmental Engineering. A Design Approach Prentice-Hall of India Pvt. Ltd., New Delhi.

CEEEEC 602 MUNICIPAL AND HAZARDOUS SOLID WASTE MANAGEMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

GENERATION AND CHARACTERISTICS OF SOLID WASTE:

Goals and objectives of solid waste management; Impacts of solid waste generation in a technological society, quantities of solid wastes, elements of solid waste management system, conservation of resources.

Solid waste generation sources; classification of solid waste; data on Indian City wastes; factors influencing generation of solid wastes; components characterization and analysis of solid wastes.

UNIT – II

ONSITE HANDLING, STORAGE AND PROCESSING OF SOLID WASTE:

Public health and aesthetics, onsite handling, methods used at residential and commercial sources; onsite storage dust bins; community containers, container locations; onsite processing methods.

COLLECTION, TRANSFER AND TRANSPORT OF SOLID WASTE

Collection services, Point collection; frequency of collection, equipment and labour requirements; collection routes, transport means and methods and location of transfer stations. Design of transfer stations.

UNIT – III

PROCESSING OF SOLID WASTE

Purpose of processing; processing techniques-Mechanical and chemical volume reduction, size reduction, component separation, drying and dewatering.

PROCESSING AND RECOVERY: Thermal recovery of products – Incineration, pyrolysis and recovery of by-products, Air requirements for combustion-Incineration types-Refuse derived fuels (RDF), biological process and recovery of conversion products-Composting – static pile, windrow, Vermi composting.

UNIT – IV

DISPOSAL OF SOLID WASTES: Open dumping – problems associated with open dumping sanitary landfills - site selection – design of landfills - Gas and leachate collection and control, ocean disposal of solid wastes. Application of GIS in landfill.

MUNICIPAL SOLID WASTE MANAGEMENT HANDLING RULES (2010).

UNIT – V

HAZARDOUS WASTE MANAGEMENT: Identification and classification of Hazardous wastes, storage, collection and treatment of Hazardous wastes, hazardous waste management rules, Management of Hospital wastes, introduction to e-waste management.

Reference Books:

1. Bhide, A.D, and Sundaresan, B.B. (1983) Solid Waste Management in Developing Countries, INSDOC, New Delhi.
2. Tchobanglous, G., Theisen, H. and Ehasin, R. (1996). Solid Waste Engineering Principles and Management Issues - McGraw Hill, Tokyo.

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CEEEC 603 INDUSTRIAL WASTEWATER TREATMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

INDUSTRIAL WASTE REGULATIONS

Industrial activity in India, Guidelines for siting of industries and industrial estates. Characteristics of industrial Wastewater. Differences between industrial wastes and domestic sewage.

IMPACT OF INDUSTRIAL WASTES ON ENVIRONMENT : Impact of acids and alkalies, suspended matter, organic matter (BOD), refractory organics, coloured matter, inorganic solids, heavy metals, foaming agents (detergents), nutrients, oil and greases, biological (pathogenic) wastes, thermal waters and nuclear wastes on the environment.

DISPOSAL STANDARDS OF DISTILLERY, TANNERY, PULP AND PAPER INDUSTRIES

UNIT – II

TREATMENT METHODOLOGY

Neutralization, Equalization, Proportioning, Sedimentation, Flotation , Screening, coagulation, Evaporation, Ion Exchange, Reverse Osmosis, Lagooning, High –rate aerobic treatment, Trickling filtration ,Rotating biological contactors, Anaerobic digestion system.

UNIT-III

OUTLINES OF MANUFACTURING PROCESSES, SOURCES, VOLUMES, CHARACTERISTICS, AND TREATMENT PROCESSES OF MAJOR INDUSTRIES:

Sugarcane, distillery, tannery, pulp and paper mills, textile mill industry, fruit processing industry, steel plant industry

UNIT – IV

INDUSTRIAL WASTE MINIMIZATION PRACTICES: Volume reduction, strength reduction, process changes, equipment modifications, chemical substitution, segregation of wastes, equalization of wastes, by product recovery, proportioning wastes.

MANAGEMENT OF INDUSTRIAL SLUDGES: Sources of production of industrial sludges, anaerobic and aerobic digestion, vacuum filtration, elutriation, drying beds, Sludge Lagooning, wet combustion process, drying and incineration, centrifuging, sanitary landfill.

UNIT – V

CLEAN MANUFACTURE PROCESS-Basic concepts of clean technologies, Zero pollution industrial complexes, Introduction to ISO 14000, Life cycle Analysis, pollution pays policy, common effluent treatment plants.

Reference Books :

1. Nemerow, N.L. (1977). Liquid waste of Industry, Theories, Practices and Treatment, Addison-Wesly Publishing Company, London.
2. Mahajan, S.P. (1990). Pollution Control Processing Industries. Tata Mc–Graw – Hill Publishing Company Limited, New Delhi.
3. Rao, M.N.andA.K.Datta. (1979). Wastewater Treatment. Rational Methods of Design and Industrial Practices. Oxford and IBH Publishing Co., New Delhi.

CEEEEC 604 AIR POLLUTION AND CONTROL

L + T / week : 3+1 Hrs
University Exam: 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

GLOBAL EFFECTS: Acid Rains, Green house effect and Ozone layer depletion.

POLLUTION SOURCES

Anthropogenic and Natural sources of Air pollutants. Types of Air pollutants. Properties of Air pollutants-Particulates, Carbon monoxide, Oxides of sulphur, Nitrogen Oxides, Hydrocarbons. **AIR POLLUTION SAMPLING AND MEASUREMENT** – Devices for sampling, Different sampling methods, Sampling of Particulate Matter and Sampling of stack gas. Analysis of air pollutants Sulphur Dioxide, Nitrogen Oxides, Carbon Monoxide, Oxidants and Ozone, Hydrocarbons, Particulate Matter.

UNIT – II

EFFECTS OF AIR POLLUTANTS:

Effects of Carbon monoxide, Particulate Matter, Sulphur Dioxide, Oxides of Nitrogen, Hydrocarbon and photochemical oxidants on human beings.

Effects on vegetation - Necrosis, Epinasty, Abcission and Chlorosis.

Effects of Arsenic, Fluorine and Lead on animals.

Effects of Air pollutants on metals, building materials, paints, textiles, electrical Materials, paper, leather, rubber and economy.

UNIT – III

METEOROLOGICAL ASPECTS OF AIR POLLUTANT DISPERSION:

Wind direction and speed, Temperature, Atmospheric stability, mixing height, Precipitation, Humidity, Solar radiation, Visibility, Inversions and plume behavior. The Gaussian Dispersion Model, Diffusion coefficients, Box model and Puff model.

UNIT - IV

AIR POLLUTION CONTROL METHODS:

CONTROL OF PARTICULATE MATTER - General methods of control - Zoning - Town planning. Control of particulate matter –Gravity settling chambers, Cyclones, Inertial separators, scrubbers, bag- filter, Electrostatic Precipitators.

REMOVAL OF GASEOUS MATTER – Control of Sulphur Dioxide by Reinluft process and Westvaco process; Control of NO_x by combustion modification, post-flame treatment; VOCs control by adsorption, combustion, condensation and process modification.

BIOMONITORING AND PHYTOREMEDIATION.

UNIT - V

AIR QUALITY AND EMISSION STANDARDS – Ambient Air Quality Standards (2015)

AUTOMOBILE POLLUTION:

Sources, emissions from diesel and petrol engines, Bharat V standards, catalytic convertors, Management of automobile pollution.

AIR POLLUTION AND LEGISLATION: Air Pollution Control Act, 1981, and Environment (Protection) Act, 1986.

Reference Books :

1. Crawford, M (1976). Air Pollution Control Theory, McGraw-Hill, New York.
2. H.C.Perkins (1974). Air Pollution, Mc-Graw Hill, Tokyo.
3. Wark, Kenneth and Cecil F. Warner (1976). Air Pollution : Its Origin and Control, Dun-Dunnelley, New York.

CEEEP 607 ENVIRONMENTAL ENGINEERING Lab – II (Practical)

Practicals / week : 2 Hrs
University Exam : 3 Hrs

Sessional Marks : 40
End Exam Marks : 60

Wastewater and Solid waste Analysis

1. Determination of BOD - Evaluation of Kinematic constants.
2. Determination of COD – Open Reflux Method, Block digester method, Colorimetric method and Titrimetric analysis.
3. Determination of Nitrates, Total Kjeldal Nitrogen, Ammonia, Nitrites.
4. Determination of Phosphates
5. Determination of Sulphates.
6. Demonstration of Rotating Biological Contactor
7. Demonstration of efficiency of Trickling Filter.
8. Analysis of Municipal Solid Waste – Component, Physical and Chemical Analysis.

CEEEP 610 COMPUTING TECHNIQUES (PRACTICAL)

Practicals / week : 3 Hrs
University Exam : 3 Hrs

Sessional Marks : 40
End Exam Marks : 60

Design of water supply pipe sections and networks using Software packages like EPANET –
Design of Wastewater collection systems, integrated design of water and wastewater treatment plants by using appropriate free domain software packages.

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ELECTIVES

1 TRANSPORT OF WATER AND WASTE WATER

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT-I

TRANSPORT OF WATER: Water Storage and Transmission- Storage requirements, impounding reservoirs, intakes, pressure conduits, hydraulics, pumps and pumping units, capacity and selection of water pumps, economic design of pumps and economic design of gravity and pumping mains.

UNIT-II

MATERIALS FOR PIPES: Specification for pipes, pipe appurtenances, types of loads and stresses, water hammer, causes and prevention, control devices. Distribution Systems : Principles of design, analysis of distribution networks, Hardy Cross, equivalent pipe and Newton Raphson methods, computer applications in distributions network analysis, optimal design of networks, maintenance of distribution systems, methods of control and prevention of corrosion, storage, distribution and balancing reservoirs.

UNIT-III

TRANSPORT OF WASTEWATER - Sanitary Sewerage: Sanitation technology selection - sanitary sewage flow estimation - sanitary sewer materials - hydraulics of flow in sanitary sewers - partial flows - sewer design - sewer layouts, Concept of model based design - hydraulic fundamentals of design models - Basic properties and model formulations for the design of wastewater of collection system - transitions in flow of sewage.

UNIT-IV

STORM DRAINAGE- Basic philosophy in storm drainage - drainage layouts - storm runoff estimation - rainfall data analysis - hydraulics of flow in storm water drains - storm water drain materials and sections - design of storm drains - storm water inlets.

UNIT-V

OPERATION & MAINTENANCE : Maintenance requirements of sanitary sewerage and storm drainage systems - manpower requirement - equipment requirement; preventive maintenance - monitoring safety requirements-corrosion in sewers - prevention and control - Specific problems related to waste water pumping.

Text Books :

1. Hazard S. Peavy, Donald R. Rowe and George Tchobanoglous, (1985). Environmental Engineering, McGraw-Hill Book Company, New York.
2. Warren Viessman, Jr. and Mark J. Hammer (1985). Water Supply and Pollution Control, Harper and Row, Publishers, New York.
3. Sincero and Sincero (1996), Environmental Engineering, Prentice hall, Michigan university.

2. WASTEWATER RECLAMATION AND REUSE

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

Unit I

INTRODUCTION –The Role of Water Recycling in the Hydrological cycle, Wastewater Reuse Applications, Need for Water Reuse.

PUBLIC HEALTH AND ENVIRONMENTAL ISSUES IN WATER REUSE- Constituents in Reclaimed Water , Public Health Issues, Environmental Issues, Environmental Issues.

Unit II

WATER RECLAMATION TECHNOLOGIES-Conventional wastewater Treatment process - Flow Diagrams for water Reclamation, Advanced Wastewater Treatment process flow diagrams, Performance expectations for water reclamation processes, Predicting the performance of Treatment process Combinations .

Unit III

STORAGE OF RECLAIMED WATER – Need for Storage, Meeting water quality discharge Requirements, Operations of Storage reservoirs, Problems involved with storage of Reclaimed Water.

AGRICULTURAL AND LANDSCAPE IRRIGATION EVALUATION OF IRRIGATION WATER QUALITY.

Unit IV

INDUSTRIAL WATER REUSE- Industrial water use, Cooling Tower Makeup water, water and salt balances in cooling Tower, Common water quality problems in cooling towers.

GROUND WATER RECHARGE WITH RECLAIMED WATER-Groundwater Recharge Methods, pretreatment Requirements for Groundwater Recharge ,Fate of Contaminants in Groundwater.

Unit- V

PLANNED INDIRECT AND DIRECT POTABLE WATER REUSE-Planned Indirect Potable Water Reuse, Planned Direct Potable Water Reuse, Planned Potable Water Reuse Criteria.

CASE STUDIES IN WASTE WATER REUSE.

Reference:-

Metcalf and Eddy(2003), Wastewater Engineering Treatment and Reuse, Fourth Edition, McGraw hill education.

3 MATHEMATICAL MODELLING IN ENVIRONMENTAL ENGINEERING

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

INTRODUCTION : Components of Environment. Necessity of mathematical models in Environmental Engineering. Mass-Volume relationships. Engineering dimensions and units. Approximations in engineering calculations. Information analysis.

FILTRATION: Mathematical models in filters for prediction of head loss and back expansion during back washing.

UNIT – II

REACTIONS : Zero-order, first-order, second-order and non-integer-order reactions. Half-life reactions and consecutive reactions.

REACTORS : Mixing models and reactor models - Mixed batch reactors, plug flow reactors, completely-mixed flow reactors in parallel and series and Arbitrary flow reactors.

UNIT – III

SURFACE WATER QUALITY MODELLING : Mathematical models for water quality - model development, calibration and verification , Model requirements and limitations. D.O. Models for Streams: sources and sinks of dissolved oxygen - estimation of system parameters - Streeter - Phelps model - oxygen 'sag' curve - determination of deoxygenating and reaeration coefficients - Benthic oxygen demand - mass transport mechanisms - Advective and diffusive mass transport - Models by O'connor, Dobbins and Thomann. Models for Estuary and Lakes.

SUBSURFACE WATER QUALITY MODELS : Groundwater and vadose zone water quality modelling.

UNIT – IV

AIR QUALITY MODELLING: Micrometeorological processes, wind rose, dispersion, coefficients and stability classes, Gaussian and dispersion model, Stack height computation, Regional air quality models, Source inventories and significance.

NOISE QUALITY MODELS: Simple noise quality models for point and non-point sources.

UNIT – V.

SOLID WASTE MANAGEMENT: Macro and Micro Routing-Heuristic- Models for the prediction of optimal routes for solid waste disposal.

Reference Books:

1. Gilbert M. Masters(1997), Introduction to Environmental Engineering and Science,second edition, Prentice-Hall of India, New Delhi
2. Nemerow, Stream sanitation.

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4 URBAN ENVIRONMENTAL QUALITY MANAGEMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

URBANISATION IN INDIA : Consequences of urbanization, demand of resources by the public.

SOURCES OF POLLUTION TO THE URBAN ENVIRONMENT : Status of pollution levels in major cities.

AIR POLLUTION SOURCES : Nature of air pollution in the Urban environment due to human activities of industrialization, effect of air pollution on Urban Environment. Air pollution Indices for assessment of status of Urban air quality.

UNIT – II

WATER DEMANDS AND POLLUTION IN URBAN AREAS : Nature of water pollutants and assimilative capacity of natural Urban aquatic systems. Urban water quality indices.

SOURCES OF LAND POLLUTION IN URBAN AREAS : Impact of Urban soil pollution on quality of living system – prediction of soil pollution indices.

UNIT – III

NOISE POLLUTION : Sources of noise pollution in Urban areas, effect of noise pollution on Urban environment, status of noise pollution in major cities.

SLUM FORMATION : Impact of slum on general quality of life on Urban elite - status of slum settlements in major cities.

UNIT – IV

MANAGEMENT OF URBAN ENVIRONMENT QUALITY : Land use planning – traffic management. Safe municipal water supply and planning of safe municipal water supply and drainage system - solid waste management including disposal – abatement of noise pollution - Provision of zones – regulation of settlements.

UNIT – V

NATURAL CONSERVATION : Planning of urbanization on ecological basis, preservation and development of green recovery areas.

URBAN DISASTER MANAGEMENT : Management of Industrial explosions, land slides, earthquakes, Floods and Management of epidemics.

Reference Books :

1. Varshney, C.K. (ed), (1985), “Water Pollution and Management”, Wiley Eastern Ltd., New Delhi.
2. M.J.Suess and S.R. Craxford, (1976), Manual on Urban Air Quality, WHO, Copenhagen,
3. Buchanan, C.D, (1963), Traffic in towns. London, H.M. Stationery Office.
4. Plowden, S. (1970), The Cost of Noise, London, Metra.
5. Gallion, A.B. and E.Simon, (1963). The Urban Pattern. Van Nistrand, New York.

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5 NOISE POLLUTION AND CONTROL

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

ACOUSTICAL CONCEPTS : Nature of Sound - Sound propagation characteristics - Propagation of sound in air - Absorption of sound in air - Hearing mechanics - Measurement scale - Equal loudness contours.

NOISE CHARACTERISTICS AND SOURCES OF NOISE : Noise characterization - Sources of noise.

UNIT – II

MEASURING INSTRUMENT AND TECHNIQUES : Methodology of noise measurements - Sound level meter - Noise dose meter - Audiometer - Noise survey techniques - Vehicular noise measurement techniques - Aircraft noise measurement techniques - Sound power determination techniques - Techniques for characterization of acoustical materials.

UNIT – III

HEALTH EFFECT OF NOISE : Annoyance - Sleep disturbance - Effect of noise on task performance and cardio-vascular system - Effect of noise on speech communication - Noise induced hearing loss (NIHL) : Effect of continuous sounds - Hearing damage due to impulse sounds.

ENVIRONMENTAL NOISE MEASUREMENTS : Introduction - Traffic noise survey - Vehicular noise level - Domestic appliances noise - Industrial noise - Aircraft noise - Community noise - Shipboard noise - Impulse noise.

UNIT – IV

NOISE STANDARDS AND LIMITS : Introduction - Legal position in India - Environmental standards - Occupational / Industrial noise standards - Road vehicles noise standards - Noise vehicles noise standards - noise standards for construction equipment and domestic appliances - Impulse noise (Fireworks) exposure standards.

NOISE IMPACT ASSESSMENT STUDIES: Definition of the problem - Elements of environmental noise - Assessment - Fractionalization approach to impact assessment - Impact of vibration environments - Case study.

UNIT – V

NOISE CONTROL TECHNIQUES: Mechanism of noise generation - Control methodology - Noise control at source - Noise control along the path - Control on the receiver end.

NOISE STRATEGY: FUTURE GUIDELINES: Current trend - Noise control measures - Environmental noise management - Noise labeling - Diagnostics - Noise strategy - Problems for future investigations.

Reference Books:

1. S.P.Singal, (1999) Noise Pollution and Control, Narosa Publishing House, New Delhi.
2. Cunniff, P.F. (1977), Environmental Noise Pollution, Wiley, New York.
3. Thumann, A., and R.K.Miller (1986). Fundamentals of Noise Control Engineering, Prentice Hall, Englewood Cliffs, N.J.

6 ENVIRONMENTAL LEGISLATION AND MANAGEMENT

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

General provisions of law for public health and safety.

Environmental protection through local bodies.

Salient features of Air (Prevention and control of pollution) Act, 1981, and Rules , 1982.

UNIT – II

Salient features of the water (prevention and control of pollution) Act 1974, and Rules, 1975.
The Water (Prevention and control of pollution) Cess Act, 1977 and Cess Rules, 1978.

Salient features of the Environment (Protection) Act 1986 and Rules 1986.

UNIT – III

Hazardous wastes (management and handling) Rules, 1989 and manufacture, storage and Import of Hazardous chemical Rules, 1989.

The National Environment Tribunal Act, 1995 and The National Environmental Appellate Authority Act, 1997.

Salient features of the wild life (Protection) Act, 1972 . The wild life (Transaction and Taxidermy) Rules, 1973, The wild life (Stock Declaration) central Rules, 1973. The wild life (Protection) Licensing (Additional matters for consideration) Rules, 1983.

UNIT – IV

Salient features of the Indian forest (conservation) Act, 1980. The forest (Conservation) Rules, 1981.

Salient features of the public Liabilities Insurance Act, 1991 and Rules, 1991.

Requirement and significance of Environmental clearances.

UNIT – V

Environmental Management System (ISO: 14000)

Important Supreme Court Judgements.

Methods to be followed for avoidance of litigation.

Reference Book :

1. S.K. Mohanty (1998). Environment and pollution Law manual, Universal Law Publishing Co. Pvt. Ltd., Delhi.

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7 GROUND WATER CONTAMINATION

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT-I

INTRODUCTION- The Hydrological cycle, Ground water Hydrology, Ground water contamination and Transport, Evolution of Ground water Information, Ground Water Remediation.

UNIT-II

SOURCES AND TYPES OF GROUNDWATER CONTAMINATION

Introduction, Underground storage tanks, Landfills, surface Impoundments, waste Disposal Injection Wells, septic systems, Agricultural wastes, Land application and Mining, Radioactive Contaminants, Military sources of contamination, classification of organic compounds, Inorganic compounds in ground water.

UNIT-III

CONTAMINANT TRANSPORT MECHANICS

Introduction, Advection process, Diffusion and Dispersion processes, Mass Transport equations, one-Dimensional Models, Governing Flow and Transport Equations, Analytical Methods, Multidimensional Methods, Tests for Dispersivity, Natural Gradient Field Tests for Dispersion.

UNIT-IV

CONTAMINATION FATE PROCESSES

Sorption and Desorption, Abiotic Fate process, Volatilization, Biodegradation, Evaluation of Fate processes.

MODELLING BIODEGRADATION AND NATURAL ATTENUATION

Kinetics and Rates of Biodegradation, Modeling Biodegradation, Biodegradation Models, Analytical Natural Attenuation Models, Numerical Natural Attenuation Models, Field Applications.

UNIT-V

GROUND WATER REMEDIATION ALTERNATIVES

Remediation Methods, Remedial Alternatives, Containment Methods for source control, Hydraulic controls and pump and treat systems, Bioremediation, soil vapour Extraction systems, Remediating NAPL sites, Emerging Remediation Technologies.

Reference Books :

1. Philip B.Bedient, Hanadi.s, J.charles (1994).Ground water contamination transport and remediation, PTR Prentice Hall.
- 2.Geo Environmental Engineering(2004), Hari D.Sharma and Krishna Reddy, John wiley and sons.

8 ADSORPTION AND ION EXCHANGE

L + T / week : 3+1 Hrs
University Exam : 3 Hrs

Sessional Marks : 20+20
End Exam Marks : 60

UNIT – I

INTRODUCTION : Definition, role and importance of adsorption in water, wastewater and air pollution control systems. Types and mechanisms of adsorption.

FACTORS AFFECTING ADSORPTION : pH, nature of sorbate and sorbent and their dosages, surface area, pore size distribution, ionic strength and temperature.

UNIT – II

SORPTION ISOTHERMS : Langmuir, Freundlich and B.E.T. isotherms, and their relative merits. Calculation of diffusivity coefficients, ultimate sorption capacity and intensity of sorption.

Design of batch and continuous flow adsorbers, mass-transport/diffusion models.

UNIT – III

SORBENTS AND SORBATES: Types of sorbent and sorbate in nature and their surface functional groups amenable for sorption of cationic and anionic pollutants.

ION EXCHANGE: Ion Exchange Materials, Exchange capacity of Ion-Exchange Resins, Application of Ion Exchange-for Nitrogen removal, Heavy metals removal, Total Dissolved solids removal.

UNIT – IV

ACTIVATED CARBON : It's manufacturing process. Different tests for it's efficiency. Methods of regeneration of activated carbon. Use of alternate adsorbents.

UNIT – V

LABORTORY STUDIES : Batch Equilibrium and Kinetic studies, Down flow column operations - B.D.S.T. model.

Methods of identification of interaction between Sorbate and sorbent description studies, infrared spectroscopic studies, X-Ray diffraction.

Reference Books :

1. Perich, J.R., Activated Carbon.
2. K.J.Weber, Physico Chemical treatment of water pollution control.
3. Culp and Culp, Advanced Water and Wastewater treatment.