M.TECH.-ENVIRONMENTAL ENGINEERING

CE 59011 : ENVIRONMENTAL CHEMISTRY

Theory :

Unit - 1

BASIC CONCEPTS FROM GENERAL CHEMISTRY:: Chemical equations, weight relationships, oxidation-reduction equation, gas laws, equilibrium and Le-chatelier's Principle, activity and activity coefficients, ionization, solubility products.

Unit - 2

BASIC CONCEPTS FROM PHYSICAL CHEMISTRY: Thermodynamic, vapor pressure, surface tension, solution of solids in liquids, osmosis, dialysis, principles of solvent extraction, electro-chemistry (Conductivity, current and chemical change, types of electrodes, electro-chemical cells), chemical kinetics, temperature dependence of reaction rates, catalysis, adsorption.

Unit - 3

ORGANIC CHEMISTRY: Carbohydrates, sugars, fats and oils, proteins and amino acids, trace organics, soaps, synthetic detergents, Biological degradation of detergents, Biological Properties of Pesticides.

BASIC CONCEPTS FROM EQUILIBRIUM CHEMISTRY: Ion activity co-efficient solution to equilibrium problem, acids and bases, the pH and p(x) concepts, buffers.

Unit – 4

BASIC CONCEPTS FROM COLLID CHEMISTRY: Methods of formation of colloids, general properties, colloidal dispersions in liquids, electro-kinetics properties, destruction of collides, Schulze-Hardy Rule, Colloidal Dispersions in air.

Elementary biochemistry of carbohydrates, proteins, fats, and oils general biochemical pathways, biochemistry of man (changes that organic matter, taken as food, undergoes in its assage through the body).

Unit - 5

BASIC CONCEPTS FROM NUCLEAR CHEMISTRY: Neutron-Proton concept of nuclear structures, isotopes, stable and radioactive nuclides, nature of radiations (Alpha, Beta & Gamma), energies of radiations units of radioactivity, use of radioactive material as tracers, effect of radiation on man.

Books & References Recommended:

1. Sawyer C.N., Mccarty.P.L & Parkin G.F. **"*Chemistry for Environmental Engineering*",** McGraw Hills Inc.
2. Khopkar S.M**. "*Basic Concepts of Analytical Chemistry*"** Wiley Eastern Limited, New Delhi.
3. L.D Benefield, J.F.Judkins Jr. and B.L. Wernd **"*Process Chemistry for Water and Waste Water Treatment*"** Prentice-hall, inc. Englewood cliff, New Jersey

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CE 59454 : ENVIRONMENTAL CHEMISTRY LAB

Practicals :

List of Experiments:

1. To determine the pH value of given sample of water. To calculate the dose of chemical for adjusting the pH to a specific value for treating 10 MLD of water.
2. To determine the acidity of given sample of water
3. To determine the alkalinity of given sample of water
4. To determine the concentration of chlorides in the given sample of water
5. To determine the total hardness, calcium hardness and magnesium hardness in the given sample of water
6. To determine the amount of Dissolved Oxygen (D.O.) in the given sample of water
7. To determine the total, dissolved and suspended solids in the given sample of water
8. To determine the chemical oxygen demand (C.O.D.) of a given sample of sewage.
9. To determine the B.O.D of the given sample of wastewater.

Additional Assignments:

SECTION-I

1.Sampling procedure for water and wastewater analysis
2.Drinking water standards (IS 10500:2012)
3.Effluent Standards
4.River standards

SECTION-II

1. Water requirements for Domestic purposes
2. Water for Domestic and Non-Domestic needs
3. Consumption of water for Domestic animals and live-stocks.
4. Design periods for project components
5. Industrial needs
6. Water for institutional needs
7. Suspended and dissolved impurities

CE 59012 : ENVIRONMENTAL MICROBIOLOGY

Theory :

Unit - 1

CHARACTERISTICS OF BACTERIA : Anatomy of Bacteria, Cultivation, Cultivation of Bacteria, production and growth, pure culture and growth characteristics, Bacterial metabolism.

Micro-organisms other than Bacteria, Fungi, molds and yeasts, Algae, Protozoa, Viruses-General characteristics, Viruses-Infections of plants and animals, Viruses- the bacteriophase.

Unit - 2

Control of micro-organisms, micro-organisms and diseases, pathogens, virulence and infection, resistance and immunity, various communicable, diseases, air-borne infections, of man, food and water borne infections of man.

Unit - 3

Bacteriology of water, indicator organism, presumptive test, confirmed test, completed tests, differentiation of coli form groups of Bacteria, imvic test, membrane filter technique, M.F. tests for fecal pollution of water bioassay test for acute toxicity.

Role of micro-organisms in waste water treatment

Unit – 4

AQUATIC MICROBIOLOGY: Microscopy of water, plankton, phytoplankton, zooplankton, biological indicators of stream pollution, sampling techniques for microscopic examinations of water, problems, caused by algae, control of algae.

Unit - 5

Practical applications of Environmental Microbiology to waste water treatment and industrial wastes treatment operations should be dealt, keeping above topics into consideration, by Environmental Engineering faculty.

Books &References Recommended:

1. Pelczar M.J. (JR), Chan E.C.S., Kreig N.R. **"*Microbiology*",** McGraw Hills inc Fifth Edition (1986).
2. McKinney R.E**.,** ***"Microbiology for Sanitary Engineers*",** McGraw Hill inc (1962).
3. Frobisher, Hinsdill, Crabtree & Goodheart***, " Fundamental of Microbiology",*** Toppan Company Limited Taxyo Japan Ninth Editions (1974)
4. Raina M Mailer ,Ian L. Pepper,CharlesP.Gerba **"*Environmental Microbiology*",**Academic Press
5. Rose E,Mckinney**"*Microbiology for Sanitary Engineers*",**Mcgraw Hill inc. .
6. Sharma P D **"*Environmental Microbiology*",**Narosa Publication(New Delhi) **.**

CE-59455- ENVIRONMENTAL MICROBIOLOGY LAB

Practicals :

List of Experiments:

1. To study Hot Air Electric Oven to sterilize given material by dry heat.
2. To study Autoclave to sterilize culture media and aqueous solution by moist heat
3. To study B.O.D. incubator (at 20^{o}C) and Bacteriological incubator (at 37^{o}C)
4. To study Laminar air flow apparatus.
5. To study Compound Microscope.
6. To stain microorganisms by Monochrome Staining (Simple Staining).
7. To stain microorganisms by Gram Staining
8. To identify slides of various microorganisms and to study the morphology for the same
9. To study different microbiological techniques.
10. To prepare liquid and solid nutrient media
11. To determine coliform bacteria concentration by Most Probable Number (M.P.N.) method in a water/ wastewater sample
12. To determine coliform bacteria concentration by Membrane Filtration Technique (M.F.T.) in a water/ wastewater sample
13. To study bacterial Colony Counter to estimate the number of microbial colonies in a culture/ media.

Additional Assignments:

1. Preparation of culture media
2. Laboratory equipments for bacteriological tests.
3. M.P.N. Tables
4. Bacteriological quality of Drinking water (IS 10500:2012)
5. Data on shape, size and resistant forms of classes of microorganisms and selected species found in waste water.
6. List of microscopic organisms present in water
7. Description of microorganisms found in natural water, wastewater and wastewater treatment processes

CE 50009 : ADVANCE CONCRETE TECHNOLOGY

PRE-REQUISITE: XII standard (HSSC), UG Material Science

Theory:

Unit - 1.

Cement: Types of cement and their composition - Manufacture of Portland cement - Hydration of cement and hydration product - Structure of hydrated cement - Heat of hydration - Gel theories - Review of tests on properties of cement.

Aggregate: Classification of aggregates - Particle shape and texture - Bond and strength of aggregate and its influence on strength of concrete - Porosity - Absorption and moisture content and their influence - Soundness of aggregate - Alkali aggregate reaction - Sieve analysis and grading of aggregate - Review of tests on properties of aggregate.

Unit - 2.

Properties of Concrete: Mixing and batching - Workability - Factors affecting workability – Measurements of workability - Various tests and procedures - Segregation and bleeding - Vibration of concrete - Types of vibrators and their influence on composition - Analysis of fresh concrete - Strength of concrete - Water-cement ratio - Gel space ratio - Effective water in the mix - Mechanical properties of concrete - Tests and procedure - Influence of various parameters on strength of concrete - Relationship between various mechanical strengths of concrete. Curing of Concrete: Methods of curing,

Unit - 3

Shrinkage and creep of concrete: Types of shrinkage - Mechanism of shrinkage - Factors affecting shrinkage - Creep mechanism - Factors influencing creep - Effects of creep. Rheology of concrete, Modulus of Elasticity, Maturity concept - Influence of temperature on strength of concrete. Durability of Concrete: Permeability of concrete - Chemical attack on concrete - Tests on sulphate resistance - Effect of frost - Concreting in cold weather - Hot weather concreting, Concreting underwater, hot & cold weather condition, statistical quality control, field control, Non Destructive Testing of Concrete. Introduction, Surface Hardness, Ultrasonic, Penetration resistance, Pull-out test, chemical testing for chloride and carbonation- core cutting - measuring reinforcement cover

Unit – 4

Admixtures: Classification of admixtures - Chemical and mineral admixtures - Influence of various admixtures on properties of concrete and their applications. Application of admixture in repair and construction of concrete. Classification and use of Fly ash..

Special Concretes: Study of Various types of Concrete such as: Light weight Concrete, Heavy Weight concrete, Ready mix concrete, Vacuum concrete, Fiber reinforced concrete, Polymer concrete, composites, Shotcrete, Guniting, Sulphur Resistance concrete, Self-Compacting Concrete, High Volume Fly Ash Concrete, High Performance Concrete, Heat resistant concrete, Mass concrete, High Performance

Unit -5

Design of Concrete Mix : Basic considerations ,Process of mix design for various types of concrete, Factors in the choice of mix proportions and their influence, Quality control, acceptance criteria for concrete, Various methods of mix design - IS code method ,IRC method, British and ACI methods, computer aided design of concrete mix.

Books & References Recommended:

- *Concrete Technology* by Varshney RS;; Oxfored & IBH Publishing Co.
- *Concrete Technology* by MS Shetty , SChand Pulication
- *Concrete Technology* by Gambhir ML,TMH
- *Concrete Technology by A.R. Santha kumar, Oxford University Press Oct 2006.*
- *Properties of Concrete* - A.M. Neville - Pearson Education
- *Advances in Building Materials & Construction* by Mohan Rai & M.P. Jai Singh;
- *Advanced Concrete Technology* – Zong Jin Li , JOHN WILEY & SONS, INC.
- *Hand books on Materials & Technology* - Published by BMTPC & HUDCO
- *IS: 10262 - 2019* Concrete Mix Proportioning — Guidelines **(Second Revision)**

CE 59456 : ADVANCE CONCRETE TECHNOLOGY

Practicals

List of Experiment

1) Determination of fineness of cement by dry sieving and Consistency test on cement
2) Determination of soundness & setting times of cement
3) Determination of specific gravity and compressive strength of cement
4) Sieve analysis of coarse and fine aggregates
5) Determination of specific gravity of coarse and fine aggregates
6) Measurement of workability of concrete by slump cone test and compaction factor test
7) Tests for determination of compressive strength of concrete cube and cylinder
8) Tests for determination of flexural strength and splitting tensile strength of concrete
9) Non-Destructive Testing Of Concrete - Methods Of Test

Explore Your Self (New Construction Material)

- Tests on bricks (Clay Brick)
- Tests on Fly Ash Brick
- Tests of AAC (Air Aerated Concrete) Block
- Comparative Study of Clay Brick, Fly Ash Brick & AAC Block
- **Term Project :** Concrete Mix Design

  (Replicate with new innovation/idea of any research paper publish in ASCE/SCI Journal on Construction Material/Concrete/ Building Material)

ELECTIVE-I

CE 59253 : AIR POLLUTION AND CONTROL TECHNOLOGY

Theory :

Unit - 1

INTRODUCTION:: Definition, Air Pollution episodes, General nature of air pollution problems.

AIR POLLUTION SOURCE AND THEIR INVENTORY: Particulate matter, Carbon dioxide, Carbon Monoxide, Sulfur oxides, effects of Hydrocarbons, Oxides of nitrogen, Photochemical Oxidants, Asbestos and Metals on Materials and health.

Unit - 2

METROLOGY: Introduction, Solar radiation, Wind Circulation, Lapse rate, Stability, Conditions, Wind Velocity profile, Maximum mixing depth, wind rose, Turbulence, General Characteristics of stack Plumes, Heat Island effect, Global circulation of pollutants.

Unit - 3

DISPERSION OF POLLUTANTS IN THE ATMOSPHERE:.Introduction, The eddy diffusion model, The Gaussian or Normal Distribution, the Gaussian Dispersion Model, Evaluation of the Standard Deviations, The maximum Ground level in Line concentration, Calculation of effective stack height.

CONTROL OF SULPHER OXIDES : Introduction, Thermodynamics and Kinetics of Sulphur oxide formation, General control methods, Flue Gas Desulphurization processes.

Unit – 4

ATMOSPHERIC PHOTOCHEMICAL REACTIONS: Introduction, Thermodynamics of photochemical reactions, monatomic oxygen and ozone formation, Role of oxides of Nitrogen in Photo-Oxidation, Hydrocarbon in atmospheric Photochemistry, oxidants, in Photochemical smog. Hydrocarbon reactivity.

Unit - 5

EFFECT OF AIR POLLUTION ON HUMAN HEALTH: Effect of Air pollution in vegetation, effect of air pollution on material.

Settling chamber, Cyclone separators, Wet collectors, Fabric filters, electrostatic precipitators**.**

Books & References Recommended:

1. A.C. Stern, Air Pollution Vol I & IV
2. Wark & Warner, Introduction to Air Pollution.
3. Stern A.C., Noundil R.W., B.Turner & D.L. Fox, Fundamental of Air Pollution

ELECTIVE-I

CE 597__: APPLIED STATISTICS & ENVIRONMENTAL SYSTEM MODELLING

UNIT-1

GRAPHICAL PRESENTATION OF DATA: Dot and Scatter Plot, Frequency Distribution, Histogram

NUMERICAL DISTRIBUTION OF DATA: Measures of Central Tendency, Mean, Median, Mode, Measures of Dispersion- Standard Deviation, Analysis of Variance, Coefficient of Variance, Skewness and Kurtosis.

Measuring Association- Grouped Data

UNIT-2

PROBABILITY: Equally likely, Mutually Exclusive Events, Definition of Probability, Bivariance Probability, Addition and Multiplication Theorems of Probability, Baye's Theorem, Normal Probability Distribution and its application to environment related problems

SAMPLING DISTRIBUTION AND CONFIDENCE INTERVALS: Random Variables and Expectations, Sampling Distribution Functions for Continuous Variables, Important Discrete Distributions- Binomial, Poisson, Normal/ Guassian Distribution, Central Limit Theorem

UNIT-3

Testing of Hypothesis on Single Sample and Two Samples, Goodness of Fit, Chi square Test, Analysis of Variance

Simple Linear Regression and Correlation Analysis, Coefficient of Correlation and Determination, Time Series Analysis and Forecasting, Application to Environmental Data Analysis

UNIT-4

MATHEMATICAL MODELLING AND SIMULATION: Defining Systems and its Components, Types of Models and their Applications, Evaluation of Models, Graphical Analysis, Quantitative Analysis, Sensitivity Analysis and Uncertainty Analysis

UNIT-5

MASS AND ENERGY BALANCE: Advection, Molecular Diffusion, Dispersion, their Application in Modelling of Rivers-Lakes, Sediments, Wetlands, Subsurface Flow, Air Pollution Modelling.

Books & References Recommended:

1. Box G.E.P, Hunter J.S. and Hunter W.G. 'Statistics for Experimenters', John Wiley and Sons, 2005
2. Berthouex P.M and Brown L.C. 'Statistics for Environmental Engineers', CRC Press, 2002.
3. Freund J.E. and Miller I.R., 'Probability and Statistics for Engineers', Prentice–Hall of India, 1994.
4. Walpole R.E. Myers R.H., Myers S.L. and Ye K. 'Probability and Statistics for Engineers and Scientists', Pearson Education, New Delhi, 2002.
5. Ramaswami A., Milford J.B., Small M.J., 'Integrated Environmental Modeling – Pollutant Transport, Fate, and Risk in the Environment', John Wiley & Sons, 2005
6. Chapra S.C., Surface Water Quality Modeling, McGraw–Hil, Inc., New York, 1997.

ELECTIVE-I

CE-597--: ENVIRONMENTAL ECOLOGY SANITATION & HEALTH

Theory :

Unit-1

INTRODUCTION : Early and the rise of agriculture ,man's attitude to the environment, nature and natural selection ecological geography and conservation, organization of ecological systems incomplete ecosystem feature of production, consumption and decomposition

Unit-2

PRINCIPLES OF ECOLOGY : Chemical (Carbon, Nitrogen, Phosphorus and Sulpher) cycles; source of energy, food chains, food webs and trophic structures; ecologic pyramids and efficiencies, Balfora's and Liebig's Law, climagraphs, tolerance levels and pollution, structure and function of ecosystems.

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Unit-3

POPULATION AND COMMUNITIES : Population and estimates, spatial distribution, sampling, fluctuations-Seasonal and random, population cycles, stresses and responses, patterns of growth and growth theories, territorialism and hierarchies, interspecific population like commonslion, mutualism, preduation, parasition, completion, competition, delineating population, amaesalism and antibloods.

Unit-4

RURAL SANITATION : Primary Health centres and their activities as regards environmental sanitation activities in rural areas.

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Unit-5

OCCUPATIONAL HEALTH : Promotion and protection of health of workers, occupational environment, occupational diseases, Indian Factories Act, The employees State Insurance Act.

Books & References Recommended:

1. Park J.E & Park K,Test Book of Preventive & Social Medicine

ELECTIVE-II

CE 59351 : HYDROLOGY, APPLIED HYDRAULICS AND GROUND WATER

Theory :

Unit - 1

Elements of Hydrology- Measurement of Precipitation, Losses and runoff - Statistical analysis of rainfall and runoff data-predication of desired magnitudes-Methods of estimating runoff from rainfall-storage and regulation of runoff-Statistical Analysis of Storage requirements-Selection and preparation of Catchments & reservoir sites-Computation of height of dam (intake structures).

Unit - 2

HYDROLOGY OF GROUND WATER: Common aquifers exploration for ground water hydraulics of ground water flow, measurement of permeability of formations flow nets and their construction, boundary conditions-unconfined and confined, steady and unsteady flows into wells and infiltration galleries, evaluation of formation constants interference ,method of images, types, design construction and maintenance of wells and infiltration galleries well strainer functions and selection, development of wells, yield tests, hydraulics of salt water intrusion and their prevention, Ground water recharge.

Unit - 3

TRANSMISSION OF WATER: Type of materials of conduits-hydraulic characteristics ,size capacity, number and shape of conduits ,location-strength and provision for water hammer appurtenances on conduits ,pumping of water ,types design and selection-economics of pump and main selection.

DISTRIBUTION OF WATER :Pressure and capacity requirement of system-provision for fire fighting. Field and office analysis of distribution networks-method of sections, Hardy cross method, and the use of electrical network analysis. Service and equalising storage capacity requirement maintenance of distribution systems, detection and prevention of faults, emergency disinfection of mains.

Unit - 4

HYDRAULICS OF SEWERS: open channel flow special reference to sewers flow at sewer transitions, length of side weirs and capacity of street inlets, Measurement of flow in sewers..

PATTERN OF SEWERAGE SYSTEMS: Estimate of waste water flow desired velocities in sewers and effect of flow variations, rational method of estimating storm drainage, intensity duration relationships, time .of concentration ,frequency of storm-investigation, design and layout of sanitary and combined sewerage system maintenance

Unit – 5

SEWER APPURTENANCES- Manholes, automatic flushing tank inverted siphons.

SEWAGE PUMPING: Selection of pumps, capacity of wet wells, household plumbing system ,design of pipe sizes for water and waste water storage tanks and fixtures.

Books &References Recommended:

1. Subramanyam K., ***"Engineering Hydrology"***, Tata McGraw Hills Publication, New Delhi. Second Edition (1994).

2. Punmia B.C., **"*Irrigation Engineering & Water Power Engineering*,"** Laxmi Publication Pvt. Ltd., New Delhi. Twelth Edition (1992).
3. ***Manual on Water Supply & Treatment***, C.P.H.E.E.O., Ministry of Urban Development, New Delhi.
4. Fair & Geyer, **"*Elements of Water Supply & Waste Water Disposal",*** John Wiley & Sons Inc. New Delhi. (1958)
5. Bhave P.R. and Gupta R.**, "*Analysis of Water Distribution Networks*"** Narosa Publishing House, New Delhi
6. ***Manual on Sewerage & Sewage Treatment***, C.P.H.E.E.O., Ministry of Urban Development, New Delhi.
7. Er.Bajwa G.S. **"*Practical Handbook on PUBLIC HEALTH ENGINEERING*",** Deep Publishers Shimla.

ELECTIVE-II

EN-597--: DESIGN OF PHE STRUCTURES

Theory :

Unit-1 Design Principles of public Health Engineering Structures. Scope and some case studies of computer applications in design of PHE Structures.

Unit-2

Design of Rectangular Water tank resting on ground.
Design of underground rectangular water tank.

Unit-3

Design of overhead rectangular water tank
Design of circular water tank resting on ground and overhead.
Structural design of overhead reservoir.

Unit-4

Design of intake structures, setting basins.

Unit-5

Design of thurst blocks for pumping and gravity mains.

Books & References Recommended:

1. N.Krishna Raju, "Advanced Reinforced Concrete design" CBS Publishers and Distributors, Delhi
2. Syal I.C. and Goel A.K., "Reinforced Concrete Structures" S.Chand and Company LTD, Ram nagar, New Delhi
3. Punmia B.C., "Reinforced Concrete Design", Laxmi Publications(P) LTD

ELECTIVE-II

CE-597--: SYSTEMS ENGG. APPROACH TO ENVIRONMENTAL ENGG.

Theory :

Unit-1 Formulation of Environmental Engg. Problems. Nonlinear Programming models. Methods of Lagrange Multipliers. Unconstrained and constrained optimization, Sequential search algorithm, Box's algorithm

Unit-2 Linear programming Models, Simplex Method, Dual Linear Programming Model, Sensitivity analysis, Separable and Integer Programming portation models.

Unit-3

Assignment Problem, Dynamic Programming Models Capacity Expansion Problems.

Unit-4

Application to water supply and waste water treatment plants, Air Pollution control equipment, Water and Air Quality Management, solid Waste facility location and collection.

Unit-5

Introduction to multi objective optimization problems.

Books & References Recommended:

1. Haith, D.A. Environmental System Optimisation, John Wiley and Sons., 1962
2. Rao, S.S., Optimisation Theory and Applications, Wiley Estern Ltd. New Delhi, 1978.

SEMESTER II

CE 59515: UNIT OPERATION-II ADVANCED SEWAGE TREATMENT

Theory :

Unit-1

Chemistry and biology of Sewage. Characteristics of Sanitary Sewage, storm and combined sewage. Organic and inorganic constituents. Suspended Settable. Colloidal and Dissolved Solids. Fluctuations in quality and quantity Sampling. Preservation of samples. COD, BOD. Aerobic decomposition of organic materials .Effect of Temperature and reaction constants k, five day and ultimate values of oxygen demand. Population equivalent. Generalized BOD formulations. Object of Sewage Treatment ,Unit operations, Process design And Hydraulic Design . Period of Design pre-treatment, primary Treatment and Secondary treatment methods. Percentage removal and overall Efficiency physical ,chemical and Biological methods of treatment,. Measurements of Sewage flow.

Unit-2

Screening, designing of fixed and rotary Screens .Operation, Disposal of Screenings. Comminutors. Separation of grit. Principles of sedimentation applied to design of Grit chambers, Velocity Control devices, detritus tanks, centrifugal devices. Disposal of grit, principals of flotation, Oil and Grease Separation. Primary, intermediate and final clarification. Design of tanks, inlets, outlets. Sludge moisture content. Intermittent or continuous removal of sludge. Scum removal. Factors affecting performances. Sedimentation aided by chemicals

Unit-3

Principals of biological treatment of sewage . Mechanism of stabilization, Zoogleal films. Design and operation of Trickling filters. Natural and artificial media. Factors affecting performance. Ventilation. Expression of loading intensity. Loading and efficiency formulations. Equalization of loading. Recirculation. Treatment Efficiency of standard and high rate filters. Hydraulics design of rotary and fixed nozzles, posing tanks and under drains. Biological treatment in activated sludge process. Loading parameters. Sludge volume index, process Control. Aeration Requirements and methods of aeration hydraulics and pneumation of mechanical designs. Sludge bulking and remedial measure .low pressure aeration system. Tapered aeration and stepped aeration

Unit-4

General considerations in disposal of sludge. Sludge. pumping quantities, characteristics and behavior of Sludge. Moisture weight volume relationship. Digestibility. Fuel value, Fertilizer value. Flow characteristics. Unit operations in Sludge disposal, Sludge thickening chemical conditioning elutriation, digestion, vacuum filtration, incineration, air drying. Design of Sludge digestion tanks, Mixing capacity Requirements. Heating, Floating and fixed roofing, performance of conventional and high rate digesters. Disposal of Digested sludge, and supernatant Gas utilization, disinfection of sewage effluents

Unit-5

Design considerations in septic and imhoff tanks, Layout, Disposal of septic effluents. Standard percolation tests dispersion trenches, seepage pits, sand filter trenches, subsurface sand filters and intermittent sand filters. Effluent Disposal in high table areas. Operation and maintenance of sewage farms. Health hazards, irrigation requirements Distribution of effluents on farm land. Dosing cycles. Restricted and unrestricted irrigation treatment needs. Design considerations in oxidation or Stabilization ponds. Algae bacterial Symbiosis. Aerobic and anaerobic ponds.Moisquito control. Feed Control performance of ponds, Aerated Lagoons Pisciculture. Recreational uses.

Note : Sessional work shall consists of detailed design of different units of Sewage Treatment Plant

Books & References Recommended:

1 Metcalf & Eddy, **"*Wastewater Engineering: Treatment & Reuse*",** Fourth Edition, Tata Mc Graw-Hill Pub. Co. Ltd. New Delhi.
2 ***CPHEEO Manual on Sewerage & Sewage Treatment*** Published by Ministry of Urban Development, New - Delhi.
3 Arceivala Soli J. & Asolekar Shyam R., **"*Wastewater Treatment for Pollution Control and Reuse*"** McGraw Hill Publication.
4 Droste R.L., **"Theory *& Practice of Water & Wastewater Treatment",*** Wiley-India Publication.
5 Qasim Syed R., **"*Wastewater Treatment Plants, Planning, Design And Operation*"**, CRC Press Special Indian Edition.
6 Karia G.L. & R.A. Christian, **"*Wastewater Treatment, Concepts & Design Approach*"**, Prentice-Hall of India Private Limited.
7 Hammer & Hammer, **"*Water & Wastewater Technology*"**, PHI Learning Private Limited.

CE 59854: UNIT OPERATION-II LAB

Practicals :

List of Experiments:

1. To determine the raw water characteristics of given waste water sample such as-pH, D.O., Total Solids, C.O.D., B.O.D., Bacteriological examination by MPN & MFT
2. To determine biodegradability of a given waste water sample (COD/BOD Ratio)
3. To determine MLSS & MLVSS of given waste water sample
4. To determine Sludge Volume Index (SVI) of given waste water sample
5. To determine pH and moisture content in given solid waste sample (IS: 10158-1982)
6. To determine the volatile and non-volatile substance in a given solid waste sample.
7. To study Turbidity meter & to determine the turbidity of given sample
8. To study the characteristics of biomedical waste.
9. Design of Sewage Treatment Plant (STP) of given capacity.

Additional Assignments:

1. Inlet Quality Standards for Common Effluent Treatment Plant (CETP)
2. Treated Effluent Quality Standards For Common Effluent Treatment Plant (CETP)
3. Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options (2016 Schedule I)

CE 59516: UNIT OPERATION-I ADVANCED WATER TREATMENT

Theory:

Unit-1

Wholesomeness of water, Hygienic, Aesthetic and economic requirements. Physical, chemical and bacteriological standards for raw and treated water. Surface water, quality of under ground waters. Nature and source of impurities. Examination of waters. Requirements of water treatment facilities. Process design and hydraulic design ,unit operations. Gravity systems ,pumping systems .Period of design, Fluctuations in demand intake structures, location, choice and design. Screens ,Pumps ,conduits ,channels ,appurtenances

Unit-2

.Principles of sedimentation and flotation equations for settling or rising of discrete particles. Hindered settling. Effect of temperature, viscosity. Efficiency of an ideal settling basin. Reduction in efficiency by currents and other factors. Short circuiting. Sludge, moisture content, specific gravity relationships, Bottom scour of deposited sludge. Sludge removal. Inlets ,flow distribution .Outlets, baffles ,Up flow and sludge blanket tanks. Principles of aerations, solubility of gases. Henry's Low, vapour pressure, Gas transfer coefficients, methods of Aeration, Theories of Adsorption, Freundlich equation. Removal of taste and odour by Adsorption. Activated carbon .Dosage control. Phenol Value, other methods of Taste and odour control. Removal of Colour. Effect of fluorides, Fluoridation, Removal of Fluorides.

Unit –3

Theories of Chemical coagulation. Nature of colloids, Zeta potential, Factors in destabilization of Colloids, Electropheratic studies. Exchange capacity of Clays. Common coagulants in water .Effect of pH, alkalinity. etc. Determination of coagulant dose.Thoery and use of coagulants aids. Benitonites, clay, limestone, silicates, organic polyelectrolytes. Dosing, hydraulic and mechanical mixing arrangements. Design of mechanical flocculators. Mean velocity gradient "G", effect of temperature, power consumption

Unit-4

Theory of filtration. size and shape Characteristics of granular filtering materials. Preparation of filter sand. Hydraulics of filtration through homogeneous and stratified beds. Estimation loss of head through sand , gravel , under drains etc .Hydraulics of filter washing .Sand expansion and settling .Auxiliary scour arrangements with air, surface wash, etc. Design depth of sand and gravel beds. Filter under drains etc. Types ,Design consideration, Wash water gutters, siphon ,thoughts ,rate of flow controllers, loss of head gauges and other filter appurtenances, variable rate filtration .performance of slow, rapid ,high rate and

sand anthracite composite filters pressure filters Pressure filters Diatomaceous earth filters, microstainers. Filterability index

Unit-5

Principles of disinfection. Factors effecting disinfection concentration ,time, temperature relationships Effect of pH. Heat, ultraviolet light irradiation. Ozonization .Oligodynamic action .Surface active chemicals, acids and alkalies. Halogens chlorine and Bromin. Free and Combined available chlorination OT and OTA residues, chlorination, Breakpoint chlorination, Superchlorination, chlorine dioxide .Destruction of virus. Dosage control. Methods of dosing. Safety measures. Emergency chlorination. Disinfection of new mains. Langulier Index. Softening of water. Lime soda methods dosage control, Excess dose , Hot lime – soda, use of sludge Blanket type tanks, split treatment. Recombination. Use of polyphosphates. Disposal of Sludge. Recalcination. Softening by ion exchange Natural and synthetic media. Capacity regeneration. Anion Exchangers. Demineralization. Industrial water treatment for Boilers and process water, sequestering agents.

NOTE: Sessional work shall Consists of detailed of design of different units of Water Treatment Plant.

Books & References Recommended:

1. ***MANUAL ON WATER SUPPLY AND TREATMENT (FOURTH EDITION)*** ‘Published by Ministry of Urban Development, New – Delhi
2. Bhole A.G. **“*Design of Water Treatment Plants*”**, Published by Indian Water Works Association, Nagpur Centre, Nagpur.
3. Fair, Geyer & Okun**, “*Water & Wastewater Engineering, Volume I & II* ”**.

CE 59853: UNIT OPERATION-I LAB

Practicals :

List of Experiments:

1. To determine pH, acidity/ basicity of given alum sample
2. To determine insoluble matter present in given alum sample
3. To determine soluble iron compounds of a given alum sample
4. To determine water soluble aluminium compounds of a given alum sample
5. To study the Jar test apparatus and to determine the optimum dose of coagulant with the help of Jar test apparatus
6. To study Turbidity meter & to determine the turbidity of given sample
7. Design a Water Treatment Plant (WTP) of given capacity.

CE-59517 : INDUSTRIAL WASTE AND POLLUTION MANAGEMENT

Theory :

Unit-1

Solid liquid and gaseous effluents of industries, General Survey of Problem in River Pollution Control, Legal Aspects, And Role Of Regulating Agencies, Criteria And Desirable Standards For Treatment, Public Health, Economic Aesthetic Consideration. River Standards And Effluents Standards. Physical chemical and biological consideration in determination of stream capacity, for assimilation of organic materials. Methods of analysis, Population of streams and fish life. Sludge deposits. Effect of industrial waste on Sewers and Sewage treatment plants. Ocean disposal.

Unit-2

Location of industries, method of reduction of wastes. Simplification of treatment procedures. Segregation or intermixing of wastes. Reuse and recovery of by products, controlled discharge, screening and sedimentation, neutralization and oxidation, filtration, removal of toxic substances. Disposal of sludges, gases and residues.

Unit-3

Analysis of waste waters. Instrumentation for measurement and control of pH, redox potential, conductivity ,turbidity, chemical concentration, levels temperature, pressure etc. Materials of construction. Reliability and safety of treatment process.

Unit-4

Detailed considerations of waste produces from the following cases with special references to Indian conditions process normally followed, nature and quantity of waste their characteristic features like BOD suspended solids, pH, presence of toxic substances, acids, alkalis greases etc. Usually treatment methods for disposal, reuse or recovery. Effects on streams, Sewerage system or sewage treatment plants, etc.

a) Textile manufacture, dyeing and finishing wastes (Cotton, Wollen, Silk, Rayon, Nylon).
b) Distilleries
c) Sugar
d) Paper and Pulp Mills
e) Waste from refining and processing metals.(Iron and Steel Manufacture, Pickling, Planting etc)
f) Acid Wastes

Unit-5

a) Pharmaceuticals
b) Oil and Petroleum
c) Milk
d) Radio-active wastes
e) Tanneries
f) Food Processing Industries

Books & References Recommended:

1. Nemerow N.L., **"*Theories and Practices of Industrial Waste Treatment*"**, Addison Wesley Publishing Company California Sydney & London.
2. Rao M.N. & Datta A.K., **"*Waste Water Treatment*"**, Oxford & IBH Publishing Company Pvt. Ltd.
3. Patwardhan A.D., **"*Industrial Wastewater Treatment*"**, PHI Learning Private Limited.

ELECTIVE-III

CE-59712 :ENVIRONMENTAL IMPACT ASSESSMENT, CASE STUDY & ENV. LAWS & POLICY

Theory :

Unit-1 Planning of Industrial Locations, Buffer Zone etc.

Quality and Quantity of waters for industries : Water consumption as a unit of production and as fraction of the total for the community, Criteria formulation for industrial waters, Key parameters for different industrial waters w.r.t. relevant Indian Standard Specifications, Boiler feed waters and cooling water systems, Problems of softening, Silica, Scaling and corrosion, Heat recovery systems, Evaporation process.

Unit-2

Constituents of an environmental impact assessment : Essential components, alternatives of proposed action, full disclosure and public comment, assessment, methodology, development versus environmental preservation, project assessors, generation of employment potential , cost benefit ratio.

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Unit-3

Case histories: Case study of impacts of large petrochemical fertilizer,cement and pesticide units.

Unit-4

Legislation: Common Laws ,Historical Perspective, Constitutional Quarantees to Environmental Protection. Water Act. 1974,familiarization with important sections and clauses of water (Prevention and Control of Pollution) Act. 1974, Lacunae. Cess Act 1977, Familiarization with important sections and clauses of Act, with their lacunae.

Unit-5

Air Act 1981, lacunae, Environment Protection Act 1986, Improvement over previous Acts, Limitations. Environmental protection by law, Role of high courts and appellate authorities, need for Environmental Protection courts as special courts, case studies importance of consent, NCC and Non agricultural application forms, Role of voluntary agencies as campaigner and crusaders.

Books & References Recommended:

1. **CANTER,** Environmental Impact Assessment.
2. Dhameja S.K., **"*Environmental Engineering & Management*",** S.K. Kataria & Sons, Pub. & Dist., Delhi.
3. Goel P.K. & Sharma K.P. **"*Environmental Guidelines and Standards in India*",** Techno-Science Publications, Jaipur (India)
4. Mohanty S.K., **"*Pollution Law Act*" ,**Universal Law Publication, New Delhi.
5. Justice Mallick M.R., **"*Environment and Pollution Laws*"**, Professional Publishers, New Delhi

ELECTIVE-III

CE-597__: ENVIRONMENTAL GEOTECHNICS
Theory :

Unit-1 INTRODUCTION: Geoenvironmental Problems, Need for Geoenvironmental Engineering, Emergence of Geoenvironmental Engineering

Unit-2 FUNDAMENTAL BACKGROUND NEEDED: Relevant Environmental Laws and Regulations, Chemistry, Soil Composition and Properties, Geochemistry, Groundwater Flow, Contaminant Transport and Fate

Unit-3 HAZARDOUS SITE REMEDIATION: Contamination Sources & Remediation Approach, Contaminated Site Characterization, Risk Assessment and Remedial Strategy, In-Situ Containment Technologies, Soil Remediation Technologies, Groundwater Remediation Technologies, Special: Subaquatic Sediment Remediation

Unit-4 LANDFILLS AND IMPOUNDMENTS: Waste Characterization and Properties, Landfill Regulations and Siting, Liner Systems, Leachate Collection/Removal Systems, Integrated Liner and LCRS Analysis, Final Cover Systems, Gas Management, Groundwater Monitoring, Special Considerations for Surface Impoundments

Unit-5 TOWARDS SUSTAINABLE DEVELOPMENT: Beneficial Use of Waste/Recycled Materials, End Use of Closed Landfill Sites, Bioreactor Landfills, Green and Sustainable Remediation, Resiliency

Books & References Recommended:

1. Sharma, H.D., and Reddy, K.R., Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies, John Wiley & Sons, Inc., Hoboken, New Jersey, 2004, 992p. (ISBN:0-471-21599-6).

ELECTIVE-III

CE-597--: REMOTE SENSING & ITS APPLICATION TO ENVIRONMENTAL ENGINEERING

Theory :

Unit-1 Remote sensing techniques for investigation & control: Type of image quality, scale, relief displacement, stereoscopic parallax, flight plan, mosaic

Unit-2

Element of Image interpretation..

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Unit-3

Land forms, Drainage Characteristics. Texture, Pattern, Density etc., Drainage Analysis, Erosion, Tone, Vegetation.

Unit-4

Electro-Magnetic Radiation, different Sensors, Platforms, Interaction of EMR with matter.

Unit-5

Application of Airphoto-Interpretation and Remote Sensing Techniques in Environmental Engineering.

Books & References Recommended:

1. Qihao Weng **"*Advances in Environmental Remote Sensing : Sensors, Algorithms and Application*",** CRC Press (US).
2. Narayan L R A "***Remote Sensing and Its Application*",** Universities Press, INDIA
3. Jensen **"*Remote Sensing of the Environment*",** P E Publication

ELECTIVE IV

CE 59751: SOLID WASTE MANAGEMENT

Theory:

Unit - 1

PRINCIPLES OF SOLID WASTE MANAGEMENT:: Solid waste generation, objectives of solid waste management, waste management and reduction, composition of municipal solid waste, characteristics of solid wastes, collection, storage, treatment and disposal of waste

Unit - 2

STORAGE, COLLECTION AND TRANSPORTATION OF WASTE: Storage of waste, segregation of waste at source, collection of commingled wastes, collection of segregated waste, types of collection and hauling of vehicles, Equipments used for collection of waste, Transfer stations, Transportation of solid waste, Collection routes.

Unit - 3

PROCESSING OF SOLID WASTES: Biological processing-Composting, principles of composting, types of composting-manual and mechanised, Indore and Bangalore methods of composting, factors affecting the composting process, control of composting process, mechanical composting, Vermiculture, Anaerobic conversion, Thermal processing-Combustion and Incineration, Pyrolysis and Gasification, Pelletization, Other methods like Autoclaving, Hydroclaving etc.

Unit – 4

DISPOSAL OF WASTES: Landfill, Types of landfills, components of a landfill, decomposition of solid wastes in landfill, site selection and layout, Landfill operations, management and environmental monitoring of landfill site, Components and main elements in design of final cover.
LEACHATE MANAGEMENT: Characteristics of leachate, leachate quality and quantity, HELP Model, Landfill liners-materials used and specifications, leachate management system-leachate collection system, leak detection and remediation, leachate recirculation, treatment and disposal.

Unit - 5

RECYCLE, RECOVERY AND REUSE OF SOLID WASTES: Recyclable components, Biogas from municipal solid waste, Energy Recovery, Refused derived fuel.
HAZARDOUS WASTE MANAGEMENT: Characteristics of Hazardous wastes, management of hazardous waste, Hazardous waste landfills, Biomedical Waste Management, Radioactive Waste management, E-Waste Management.

Books & References Recommended:

1. "Municipal Solid Waste Management Manual",CPHEEO, Ministry of Urban Development, Government of India, New Delhi, **May 2016**,http://moud.gov.in,www.cpheeo.nic.in
2. Manual on **"Municipal Solid Waste Management"**CPHEEO, Ministry of Urban Development, Government of India, New Delhi, First Edition, May 2000, www.cpheeo.nic.in
3. Khan Iqbal.H and Ahsan Naved **"*Textbook of Solid Wastes Management*"**, CBS Publishers and Distributors Pvt. Ltd. ,New Delhi , First Edition , 2003.
4. Bhide,A.D., and Sundaresan, B.B. **"*Solid Waste Management in Developing Countries*",** INSDOC, New Delhi , Second Edition ,1987.
5. Vesilind P. Aarne, Worrell William A. and Reinhart Debra R. *" **Solid Waste Engineering",*** Cengage Learning India Pvt. Ltd. , New Delhi., Third Indian Edition.
6. Peavy Howard S., Rowe Donald R. and Tchobanoglous George **"Environmental Engineering",**McGraw Hill Education (India) Pvt. Ltd. New Delhi , First Edition 2013.

ELECTIVE-IV

CE-597--: INSTRUMENTATION AND ITS APPLICATION TO ENVIRONMENTAL ENGINEERING

Theory :

Unit-1

Generalised measurement systems ,Calibration & Sensitivity, Standards of Measurements of various quantities Air, Water and Wastewater sampling instruments

Unit-2

Detector-Sensor systems elements transducer and devices, Different types of sensors. Modifying and transmitting methods, Mechanical, Hydraulic, Electrical and Electronic systems.

Unit-3

Indicating systems for static and dynamic quantities .Recorders and data storage systems. Current meters, pitot tube etc.

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Unit-4

Leakage detectors, corrosion detectors, different resistivity meter, sounding rods and other systems. Instrumentations for operation and maintenance of various pumps

Unit-5

Instrumentation for monitoring of water treatment and wastewater treatment and operation of different units.

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Books & References Recommended:

a. Rangan C.S., Sharma G.R., **"*Instrumentation Devices & Systems*"**, McGraw Hills Inc.
b. ***Manual on Water Supply & Treatment, C.P.H.E.E.O***., Ministry of Urban Development, New Delhi
c. ***Manual of Instrumentation,*** NEERI, Nagpur.
4. ***Manual on Water and Waste Water Analysis***, NEERI, Nagpur

ELECTIVE-IV

CE 597__ : NUMERICAL AND SYSTEMS METHODS

Theory :

Unit – 1

Inversion of Matrix, Solutions of Simultaneous equations by elimination and Iterative methods. Solutions of ordinary differential equations by predictor corrector methods, Runge – Kutta Method.

Unit – 2

Backward, Forward and Central Difference methods, Interpolation, Extrapolation, Non-dimensionalisation.Application to partial differential equation. Summation of series, Numerical Integration and application to large elements.

Unit – 3

Introduction to optimisation, Mathematical programming techniques, Linear Programming, Integer Programming, Assignment and Transpiration Models, Dulity in L.P.

Unit – 4

Total Stage Decision Making Processes, Dynamic programming, Network Programming, Optimum project schedule, Regression Analysis.

Unit – 5

Random Variables, Discrete and Continuous Distributions, Empirical Distributions, Sampling, Point estimation, Bays Theorem, Statistical Tests of Significance.

Books & References Recommended:

1. Numerical Methods by *S.Balaguruswami, TMH Publ.*
2. Numerical Recipes in Fortran.
3. Numerical Methods in FEA by *Bathe and Wilson, PHI Publ.*
4. Operation Research by *Taha*
5. Operation Research Techniques for Management by *Benerjee, Business Book Publication House.*
6. Optimization Method in OR and system Analysis by *K.V.Mittal, Wiley Eastern Ltd.*