M.TECH.. ENVIRONMENTAL ENGINEERING
(SPECIALIZATION ENVIRONMENTAL ENGINEERING)

EN 5901 : 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:

EN 5902 : 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:

EN 5903 : 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

CE 5904: HYDROLOGY & APPLIED HYDRAULICS

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.

CE 5905: STATISTIC & COMPUTER PROGRAMMING

Theory :

Unit - 1

Measures of average and dispersion, normal probability distribution and transformation, sampling distribution and confidence intervals, Testing of Hypothesis, Analysis of variance, the Chi-Square Test.

Unit - 2

Regression and correlation analysis, time series analysis and forecasting. Introduction of nonparametric statistics, application to Environmental data analysis, Interpretation and presentations.

Unit - 3

Computer Organization, Hardware and software: input and output devices, analog and digital computers, personal computer organization.

Unit – 4

Principles of programming and flowcharting. Programming Languages, Interpreter and Compiler languages, Fortran language or Basic language of programming, Variables and constants, statement, conditional and non-conditional transfer of controls. Do loops and computed Go To statements, DIMENSION Statements.
Subscripted variables, Function and subroutine programs.

Unit - 5

Overall structures of FORTRAN Program structured programming. Programming errors-logical errors, machine errors, syntax errors etc
Computer Programming for Numerical Methods.

Books & References Recommended:

Text Books

EN-5954: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.

CE 5955: UNIT OPERATION-II ADVANCE 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:

CE 5956: UNIT OPERATION-I ADVANCE 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.

CE-5957 : 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:

EN-5971: 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:

EN-5972: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.

CE-5973: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

CE-5974: 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:

EN-5975: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: