

CIVIL ENGINEERING
M.E. (ENVIRONMENTAL ENGINEERING AND MANAGEMENT)
EEM – FOUR SEMESTER COURSE
SCHEME OF INSTRUCTION AND EXAMINATION

I – SEMESTER

Code No.	Course title	Scheme of Instruction		Scheme of Examination			Total	Credits
		Lec.	Tut/drw.	Duration of Exam. (hrs)	Theory/ Lab./Viva	Sess.		
EEM 1.1	Hydrology & Hydraulics	4	--	3	70	30	100	4
EEM 1.2	Environmental Chemistry	4	--	3	70	30	100	4
EEM 1.3	Environmental Microbiology	4	--	3	70	30	100	4
EEM 1.4	Environmental Sanitation	4	--	3	70	30	100	4
EEM 1.5	Statistics & Numerical Techniques	4	--	3	70	30	100	4
EEM 1.6	Computer Techniques	--	4	--	50	50	100	2
EEM 1.7	Lab Tech. –I	--	3	--	50	50	100	2
Total		20 + 7= 27			450	250	700	24

II – SEMESTER

Code No.	Course title	Scheme of Instruction		Scheme of Examination			Total	Credits
		Lec.	Tut/drw.	Duration of Exam. (hrs)	Theory/ Lab./Viva	Sess.		
EEM 2.1	Applied Ecology & EIA	4	--	3	70	30	100	4
EEM 2.2	Advanced Water Treatment	4	--	3	70	30	100	4
EEM 2.3	Advanced Sewage Treatment	4	--	3	70	30	100	4
EEM 2.4	Air Pollution & its Control	4	--	3	70	30	100	4
EEM 2.5	Solid & Hazardous Waste Management	4	--	3	70	30	100	4
EEM 2.6	Parasitology & Occupational Health		4	--	50	50	100	2
EEM 2.7	Lab Tech. –II	--	3	--	50	50	100	2
Total		20 + 7= 27			450	250	700	24

III – SEMESTER

Code No.	Course title	Scheme of Instruction		Scheme of Examination			Total	Credits
		Lec.	Tut/drw.	Duration of Exam. (hrs)	Theory/ Lab./Viva	Sess.		
EEM 3.1	Water Quality Management	4	--	3	70	30	100	4
EEM 3.2	Industrial Waste Treatment	4	--	3	70	30	100	4
EEM 3.3	Design Project	--	3	--	50	50	100	4
EEM 3.4	Thesis	--	2	--				
Total		8+5=13			190	110	300	12

IV-SEMESTER

EEM-4.1	Thesis/Dissertation	100 MARKS	Credits: 20
GRAND TOTAL		1800	80

- Notes:**
- Students have to start Thesis / Dissertation / Project work in III semester itself and have to complete by the end of the IV semester. The thesis is evaluated through defence and Vive-Voce examination with one external examiner nominated by University, HOD, Chairman Board of studies and research guide.
 - The viva-voce for the labs / design projects shall be held with course instructor and one external member from academic institution / industry / R & D organisation.

CIVIL ENGINEERING
M.E. (ENVIRONMENTAL ENGINEERING AND MANAGEMENT)
EEM – FOUR SEMESTER COURSE

I - SEMESTER

EEM 1.1 : HYDROLOGY AND HYDRAULICS

- Chapter 1 : Statistical analysis of Hydrological Data - Rainfall and Runoff estimation, Intensity–Duration frequency Curves, Draft storage with different risks.
- Chapter 2 : Hydraulics of ground water flow - Non–equilibrium flow, Yield estimations, Interferences - Infiltration galleries, ground water recharge, flow through porous media.
- Chapter 3 : Transportation of water - Storage capacity, Pumping of Water, Design and selection of economical diameter of pumping main.
- Chapter 4 : Distribution of Water - Pressure and capacity requirements of distribution system, Analysis of networks, Appurtenances in a distribution layout, detection and prevention of mains.
- Chapter 5 : Hydraulics of Sewers - Sewers, Sewerage and its appurtenances design of sewers in full and partial flow conditions, Flow at Sewer transitions, Sewage pumping.

- Reference Books: 1. Water and waste water Engineering by Fair Gayer and Okun
 2. Waste water collection and treatment by Metcalf and Eddy

EEM 1.2 : ENVIRONMENTAL CHEMISTRY

(Basic concepts of the following branches of the chemistry as applicable to the Environmental Engineering)

- Chapter 1 : Quantitative, Qualitative and physical chemistry. Basic concepts of physical chemistry, Gas laws, Laws of Mass action, Common Ion Effect, Solutions, Vapour pressures of liquids, Binary Mixtures, Solutions of solids in Liquids, Oxidation – Reduction potentials, Ionization, Solubility products, Basics of colloidal chemistry.
- Chapter 2 : Equilibrium Chemistry : Equilibrium Calculations, Ion activity coefficients, Acids and Bases, Solubility of Salts, Buffer Index, Titration Curves, Logarithmic Concentration diagrams, p^H and p^E diagrams.
- Chapter 3 : Organic Chemistry : Properties of Organic Compounds, Sources of Organic Compounds, Isomerism, Types of Organic Compounds, Aliphatic, Aromatic and Heterocyclic.
- Chapter 4 : Biochemistry : Enzymes, factors affecting the action of Enzymes, (co-enzymes or cofactors, Temperature, pH, Micro and Macro mutants), Proteins, carbohydrates and fats.
- Chapter 5 : Nuclear Chemistry : Atomic Structure, Electron orbits, Neutron, Proton, Nuclear structure, Nomenclature of Isotopes, stable and radioactive nucleoids, Nature of Radiation, Energy of Radiation, Units of Radioactivity, half life, α , γ and neutron induced reaction, nuclear fission and nuclear fusion , use of radioactive materials as tracers.

- Reference Books : Chemistry for Environmental Engineering by Sawyer and McCarty.

EEM 1.3 : ENVIRONMENTAL MICROBIOLOGY

- Chapter 1 : Morphology of Micro Organisms : Classification of Micro-organisms, Morphology, Structure and Characteristics of Bacteria, Virus, Molds, Yeasts, Algae and Protozoa, Staining techniques, pure and mixed cultures.
- Chapter 2 : Growth and Production of Micro-organisms : Growth rates and Reproduction of micro-organisms, effect of chemical and physical agents on microbial growth, temperature, pH, Osmotic pressure, radiation, antibiotics, disinfectants, mutations, induced and spontaneous, destruction and removal (sterilization and disinfection).
- Chapter 3 : Nutrition and Metabolism of Micro-organisms : Nutrient substances and requirements of bacteria, Yeasts, molds and algae. Metabolism of Microorganisms, enzymes and their importance, nutrients as a source of energy and cell building materials. Aerobic and anaerobic respiration.
- Chapter 4 : Microbiology of Milk and Food : Microbiology of Milk, diseases transmitted through milk, inspection, testing of milk, preservation of milk and dairy products etc. Microbiology of food, pathogens in food poisoning, food preservation methods. Microbiology of air and air-borne diseases and control.
- Chapter 5 : Microbiology of Soil and Water : Exploitation of Micro-organisms, Microbiology of soils, Nitrogen, Carbon, Sulphur and Phosphorous cycles, Microbiology of water, pathogens, Role of Microbiology in Aerobic and Anaerobic treatment of waste water; uses of Yeast, Microbes as sources of proteins, organic acids and biological control of pests.

Reference books : Microbiology by Pelzer, Ecschan & N R Kreig.
Microbiology for sanitary engineers by Mckinney
Microbiology for Scientists and Engineers by Grady & Grady.

EEM 1.4 : ENVIRONMENTAL SANITATION

- Chapter 1 : Epidemiology : Communicable diseases, Micro-organisms, Methods of communication, Diseases communicated by discharges of intestines, nose and throat, other communicable diseases and their control.
- Chapter 2 : Insects and Rodent Control : Mosquitoes, life cycles, factors of diseases control methods – natural and chemical, Fly control methods and prevention of fly breeding, Rodents and public health, plague control methods, engineering and bio-control methods, disinfectants (Phenols, Lime, Chlorine, Ammonium compounds), Insecticides (DDT, BHC).
- Chapter 3 : Industrial sanitation : Schools, Public Buildings, Hospitals, Eating establishments, Swimming pools – Study of factors like Light, Heat, Ventilation, Plumbing fixtures, Cleanliness and maintenance and comfort.
- Chapter 4 : Industrial Hygiene : Occupational Hazards, Industrial poisons, Dust, Noise, Heat, Compressed air, Vibrations and shocks- Industrial plant sanitation.
- Chapter 5 : Rural Sanitation : Rural areas, Population habits and environmental conditions, problems of water supply and sanitation aspects, low cost excreta disposal systems. Rural sanitation improvement schemes.

Reference books : 1. Municipal and Rural sanitation by Victor Ehalers & Earnest W Steel

EEM 1.5 : STATISTICS AND NUMERICAL TECHNIQUES

- Chapter 1 : Probability Theories and Distribution : Addition, Multiplication theorems of probability – binomial, poisson, normal distributions use of ordinate tables and area tables of the normal curve. Correlation and regression coefficients.
- Chapter 2 : Sampling : Theory of sampling, large and small samples sampling techniques, sampling distributions of statistical estimates, standard error significance tests student, chi-square, F & Z distributions.
- Chapter 3 : Numerical Techniques : Solution of simultaneous Algebraic equations, Gauss elimination, Lagrange's interpolation, Simpson's rule.
- Chapter 4 : Numerical Solutions : Numerical solutions of differential equations, Euler's method, Taylor series method and Runge-Kutta methods.
- Chapter 5 : Matrix Algebra : Solvability of a set of linear equations orthogonal matrices characteristics equations, Eigen value and vectors.

- References :
1. Probability and Statistics for Engineers- Richard A. Johnson
 2. Numerical methods – S.Armugan, A.Thangapandi Issac, A.Someswaranadham

EEM 1.6 : COMPUTER TECHNIQUES

- Chapter 1 : Fortran Programming : Fundamentals and statements, Advanced features in Fortran 95, Problems related to Environmental Engineering applications.
- Chapter 2 : C⁺⁺ programming : Fundamentals and statements, Solving simple problems using C⁺⁺ programming.

- Reference Books :
- Fortran programming by Raja Raman
C⁺⁺ : The complete reference by Herbert Schildt

EEM 1.7 : LAB TECHNIQUES – I

Determination of the following parameters :

1. Chlorine in Bleaching powder
2. Break point chlorination
3. Fluoride
4. Iron
5. Manganese
6. Sulphate
7. Phosphate
8. Ammonical nitrogen
9. Nitrates
10. BOD
11. COD
12. Phenols

II - SEMESTER

EEM 2.1 : APPLIED ECOLOGY, EIA AND LEGAL ASPECTS

- Chapter 1 : Ecological factors and eco system : Scope of Ecology, Climatic factors - Light, Temperature, Rain fall, Wind etc., Topographical factors – Mountains, valleys, slopes. Edaphic factors – Soil profile etc. Types of eco systems, Structure and Function of an eco system, Bio-geochemical cycles; Preliminary studies of the pond, marine, grass land and desert eco systems.
- Chapter 2 : Urban and regional planning : Urban and regional planning based on ecological principles. Environmental issues in India like Silent valley, Chipko movement, Sardar sarovar project etc.
- Chapter 3 : Environmental Impact analysis : Procedures for preparing E I A, Function and purpose of impact analysis. Elements of E I A - Agency activities, Environmental Attributes – Air, Water and Ecology. Environmental impacts – identification, measurement, aggregation, secondary and cumulative impacts. Environmental audits – specific questionnaire, Environmental Impact Statement etc.
- Chapter 4 : Industrial siting criteria : Developmental projects like River valley, Nuclear, Thermal Power Plants, Mining Activities etc. and their implications on environment. The regulation for Air ports, Highways based on environmental impacts.
- Chapter 5 : Legal Aspects : Legal aspects of environmental protection, Environmental Protection Act etc., Policies and programs on protection of environment in India and World.

Reference Books : Environmental Impact Assessment by Canter
Ecology by Sarma
Environmental Protection Act, 1986

EEM 2.2 : ADVANCED WATER TREATEMENT

- Chapter 1 : Sedimentation : Principles of Sedimentation and floatation, types of settling, equations for settling of discrete particles, effect of temperature, Efficiency of ideal settling basin, reduction in efficiency by currents and other factors. Short circuiting, Sludge, moisture, specific gravity relationships, Scouring of deposited sludge, removal of sludge, design of inlet and outlets.
- Chapter 2 : Coagulation : Theory of Coagulation, use of Coagulant aids, P^H – Alkalinity relationships. Design of mechanical mixing arrangements. Design of Flocculators, mean velocity gradients, power consumption.
- Chapter 3 : Filtration : Theory of Filtration, size, shape and characteristics of granular media, preparation of filter sand. Filtration through homogeneous and stratified bed, Estimation of loss of head, development of negative head. Hydraulics of filters, auxiliary scour arrangements with air and surface wash. Variable rate filtration, Design of rapid and pressure filters.
- Chapter 4 : Disinfection : Theory of disinfection, factors affecting disinfection, concentration, time and temperature relationships. Chlorination – types of Chlorination, residual chlorine, Disinfection using other disinfectants.
- Chapter 5 : Miscellaneous methods of water treatment - Ion exchange methods, Softening, Aeration and Adsorption techniques, Defluoridation, Removal of Iron and Manganese.

Reference Books : Water and Waste Water Engineering by Fair and Gayer
Environmental Engineering by Peavy

EEM 2.3 : ADVANCED SEWAGE TREATMENT

- Chapter 1 : Waste water characteristics : Physical, Chemical, Biological characteristics of waste water, sampling, flow measurement.
- Chapter 2 : Physical and Chemical Treatment of Waste Water : Screening, Grit removal, Flow equalization, Chemical precipitation, other solids removal operations. Disinfection with Chlorine compound, Aeration, Control of odour, Control of volatile organic compounds.
- Chapter 3 : Aerobic Treatment of Waste Water : Design and construction aspects and the relevant parameters of significance of the following units. Activated Sludge Process, Trickling Filters, Aerated Lagoons, Rotating Biological Contactors, Stabilization pond. Bio-kinetic principles of attach and suspended growth systems.
- Chapter 4 : Anaerobic Treatment of Waste Water : Sludge digestion theory and principles, septic tank design and effluent disposal. Disposal of digested sludge, anaerobic ponds UASB filters.
- Chapter 5 : Miscellaneous methods of waste water treatment : Removal of Nitrogen by biological nitrification / de-nitrification, Removal of phosphorus by Chemical and biological methods. Conversion of ammonia by biological nitrification, Removal of toxic compounds, Removal of dissolved inorganic substances.

Reference Books : Waste Water Engineering by Metcalf and Eddy

EEM 2.4 : AIR POLLUTION AND ITS CONTROL

- Chapter 1 : Air Pollution and Meteorology : Sources and classification of Air Pollutants. Effects of Air Pollution on Human health, Plants, Animals and properties. Meteorology – the atmosphere and wind movements, Adiabatic lapse rates - Inversions - Plume behaviours. Measurement of meteorological variables.
- Chapter 2 : Modeling of Dispersion of Air Pollutants : Dispersion of Air pollutants – Theories on modeling of Air pollutants. Gaussian models etc. Equations of the estimation of pollutant concentrations. Plume Rise – Equations for estimation. Effective stack height and mixing depths.
- Chapter 3 : Sampling and Particulate Pollution Control Methods : Atmospheric sampling and stack sampling methods, Types of particulate pollution control methods – Settling chambers, Cyclone separators, Scrubbers, Filters and Electrostatic precipitators – their design principles.
- Chapter 4 : Gaseous pollution control methods and automobile pollution : Types of gaseous pollution control methods – absorption, adsorption and combustion processes. Automobile pollution , sources of pollution, composition of auto exhausts – Control methods.
- Chapter 5 : Air pollution Survey and Legislation – Global Problems : Planning for conducting Air pollution survey – Air Acts in India and Global problems of Air pollution and remedial measures. Case studies.

Reference Books : Air Pollution by H. C. Perkins
Environmental Engineering by Peavy

EEM 2.5 : SOLID AND HAZARDOUS WASTE MANAGEMENT

- Chapter 1 : Composition and Handling of Solid Wastes : Sources and Types of solid wastes, Characteristics of solid waste, Waste generation and handling at source, Problems due to improper disposal of solid waste.
- Chapter 2 : Collection of Solid Wastes : Collection of solid wastes, Transfer and Transport of wastes, Material segregation, Recovery and Recycling, Management strategies.
- Chapter 3 : Treatment and Disposal of Solid Waste : Volume reduction, Open dumping, land filling techniques. Design and operation of land fills, Land farming, Deep well injection, Composting
- Chapter 4 : Hazardous Waste : Classification, Generation, Toxicology, Bio-medical wastes
- Chapter 5 : Treatment and Disposal of Hazardous Waste : Physico-chemical processes, Biological methods, Stabilization and Solidification, Thermal methods, Land disposal. Remedial technologies.

Reference Books : Integrated Solid Waste Management by Tchobanogous
Hazardous Waste Management by Lagrega etal.

EEM 2.6 : PARASITOLOGY AND OCCUPATIONAL HEALTH

- Chapter 1 : Parasitology : Parasitism host - Parasite relationships; Life cycles of Parasites and Vectors – Symptoms and prevention; Protozoa; Entameoba histolitica; Plasmodium vivax; Trichomonas Helminths; schistosoma haemetabium; Nematodes (Round Worms); Trichuris trichura; (Whip Worms); Dracunculus medinensis (Guinea Worms), Arthropods, Scabies, Lice, Bed Bugs, House Flies and mosquitoes.
- Chapter 2 : Occupational Health : Occupational Hazards - Industrial poisons – Environmental factors of health. Harmful effects of radiation safety measures, Radio - active wastes disposal.

Reference Books : Parasitology by Chandler and Reid
Municipal and Rural Sanitation by Ehler and Steel.

EEM 2.7 : LAB TECHNIQUES II

- Part A :
1. Standard plate count test
 2. MPN
 3. Morphology of Algae, Fungi, Protozoa and Various insects.
- Part B :
- Experiments using the following instruments
1. Spectrophotometer
 2. Mercury Analyzer
 3. Flame Photometer
 4. High Volume Sampler
 5. Stack Monitoring Equipment
 6. Noise Level Meter
 7. Meteorological instruments.

III - SEMESTER

EEM 3.1 : WATER QUALITY MANAGEMENT

- Chapter 1 : Pollution of surface water bodies – Rivers, Reservoirs and Lakes. Sampling procedures, Fate of pollutants in surface aquatic systems.
- Chapter 2 : Hydraulics of Surface Waters – Fundamentals of mixing in rivers, reservoirs and lakes, basic models, BOD-DO models, Conventional Streeter-Phelps formulation, Critical deficit, Modified BOD-DO models.
- Chapter 3 : Fundamentals of ground water flow – variations of ground water levels, fluctuations due to Evapotranspiration, Meteorological phenomena & tides in coastal area.
- Chapter 4 : Ground Water pollution and management – Sources of ground water pollution and their effects – municipal, industrial, agricultural and miscellaneous, ground water basin investigations, evaluation of basin yields, Ground water modeling techniques – Porous media models, Analog & Digital computer models. Ground water remediation and recharging techniques.

Reference Books: Ground Water Technology by B. K. Todd.
 Water Quality Modelling by Thonana.

EEM 3.2 : INDUSTRIAL WASTE TREATMENT

- Chapter 1 : Sources of Pollution – Physical, Chemical, Organic and Biological properties of Industrial Wastes – Differences between industrial and municipal waste waters – Effects of industrial effluents on sewers and treatment plants.
- Chapter 2 : Pre and Primary Treatment – Equalization, Proportioning, Neutralization, Oil Separation by Floatation – Waste Reduction - Volume Reduction – Strength Reduction.
- Chapter 3 : Waste Treatment Methods – Nitrification and De-nitrification – Phosphorous removal – Heavy metal removal – Membrane Separation Process – Air Stripping and Absorption Processes – Special Treatment Methods – Disposal of Treated Waste and Waste Water.
- Chapter 4 : Characteristics and Composition of waste water and Manufacturing Processes of Industries like Sugar, Fermentation, Food Processing Industries, fisheries.
- Chapter 5 : Characteristics and Composition of Industries like Steel, Petroleum Refineries, Textiles, Tanneries, Atomic Energy Plants and other Mineral Processing Industries.
- Chapter 6 : Joint Treatment of Raw Industrial wastes water and Domestic Sewage – Common Effluent Plants (CETPs) – Location, Design, Operation and Maintenance Problems – Economical aspects.

Reference Books : Industrial Waste Water Pollution Control by W. Wesley Eckenfelder Jr.