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

### I – SEMESTER

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course title</th>
<th>Scheme of Instruction</th>
<th>Scheme of Examination</th>
<th>Total</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>EEM 1.1</td>
<td>Hydrology &amp; Hydraulics</td>
<td>4</td>
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<tr>
<td>EEM 1.2</td>
<td>Environmental Chemistry</td>
<td>4</td>
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<tr>
<td>EEM 1.3</td>
<td>Environmental Microbiology</td>
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<td>EEM 1.4</td>
<td>Environmental Sanitation</td>
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<td>EEM 1.5</td>
<td>Statistics &amp; Numerical Techniques</td>
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<td>EEM 1.6</td>
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<td>EEM 1.7</td>
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### II – SEMESTER

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<th>Credits</th>
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<tr>
<td>EEM 2.1</td>
<td>Applied Ecology &amp; EIA</td>
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<td>EEM 2.2</td>
<td>Advanced Water Treatment</td>
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<td>EEM 2.3</td>
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### III – SEMESTER

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<td>EEM 3.3</td>
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### IV-SEMESTER

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<td>Thesis/Dissertation</td>
<td>100 MARKS</td>
<td>20</td>
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**GRAND TOTAL**

1800               80

**Notes:**
1. 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.
2. 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.
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.


EEM 1.2 : ENVIRONMENTAL CHEMISTRY

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


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, $\alpha$, $\gamma$ 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, Sulphar 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 4 : Industrial Hygiene : Occupational Hazards, Industrial poisons, Dust, Noise, Heat, Compressed air, Vibrations and shocks- Industrial plat 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 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 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 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 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 TREATMENT


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.


Reference Books : Waste Water Engineering by Metcalf and Eddy

EEM 2.4 : AIR POLLUTION AND ITS CONTROL


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.


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 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


Reference Books : Integrated Solid Waste Management by Tchobanognous
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), Arthopods, Scabies, Lice, Bed Bugs, House Flies and mosquitoes.


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

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 yeilds, 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 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.