

M. TECH. -ENVIRONMENTAL MANAGEMENT COURSE STRUCTURE

I YEAR

I SEMESTER

SUBJECT CODE	SUBJECT TITLE	L	P	CREDITS
EMT-1.1	Ecology and Natural Resources	4	-	4
EMT-1.2	Environmental Chemistry	4	-	4
EMT-1.3	Environmental Microbiology and Bio-Technology	4	-	4
EMT-1.4	Environmental Pollution	4	-	4
EMT-1.5	Environmental Impact Assessment	4	-	4
EMTL-1.6	Environmental Pollution Monitoring Lab	-	8	8
EMTL-1.7	Environmental Microbiology and Bio-Technology Lab	-	8	8
Total Credits(5 Theory + 2 Lab)				36

II SEMESTER

SUBJECT CODE	SUBJECT TITLE	L	P	CREDITS
EMT-2.1	Solid & Hazardous Waste Management	4	-	4
EMT-2.2	Remote Sensing and GIS	4	-	4
EMT-2.3	Technological Solutions for Pollution control	4	-	4
EMT-2.4	Occupational Health & Safety	4	-	4
EMT-2.5	Computer Application and Modeling	4	-	4
EMTL-2.6	Remote Sensing and GIS Lab	-	8	8
EMTL-2.7	Environmental Modeling Lab	-	8	8
Total Credits(5 Theory + 2 Lab)				36

II YEAR

III & IV SEMESTERS

SUBJECT CODE	SUBJECT TITLE	L	P	CREDITS
EMTS-3.1	Seminar	-	-	24
EMTP-3.2	Project Work	-	-	48
Total Credits				72

L- No. of Lectures per week; P- No. of Practical's per week.

EMT-1.1 ECOLOGY AND NATURAL RESOURCES

UNIT I CONCEPT OF ECOSYSTEM:

Definition, Concept of a system; Biotic, abiotic and ecological systems. structure, functions and classification of ecosystems. Ecological pyramids.

Ecological energetics: Flow of energy through food chains and food webs; Laws of thermodynamics; entropy, Law of thermodynamics; ecological efficiency; food chain concentration. Biogeochemical cycles or Nutrient Cycles: General considerations of recycling; Gaseous and sedimentary cycles; rates of turnover and turnover time. Causes and consequences of disruption of nutrient cycles with reference to Greenhouse gases and SO_x. Hydrological cycle.

UNIT II POPULATION ECOLOGY:

Concept of a species and definition of a population. Biological and group attributes of populations. Density, natality, mortality, migrations and growth of populations. Natural regulation of populations. Human population explosion and its consequences.

UNIT III NATURAL RESOURCES:

Classification of natural resources, biotic resources; Renewable and non-renewable resources: mutable and immutable resources; Different types of resources and their natural sources. Demographic quotient; rate of consumption and depletion. Value system, equitable resource use.

UNIT IV MINERAL AND LAND RESOURCES:

Distribution and exploitation; environmental implications of mining; strategies for conservation of mineral resources, land evaluation and suitability, land use/land cover mapping, LU/LC for Environmental Planning.

UNIT V ENERGY RESOURCES:

Renewable and non-renewable resources energy; Alternate and additional sources of energy; depletion of energy resources; Conservation of energy resource; Energy use efficiency. Solar radiation and its technological ways of harvesting; Solar collectors, photovoltaic, solar ponds; Hydroelectric power, Tidal, Ocean Thermal Energy Conversion, Wind, Geothermal Energy, Nuclear energy-fission and fusion, Hydrogen & Fuel cells.

UNIT VI BIOTIC RESOURCES:

General account of biotic resources; Genetic resources; Food, fodder, fibre, fuel, timber and medicines. Forests and the ecological implication of depletion of forests. Concept of diversity; causes and consequences of loss of biodiversity; conservation of biodiversity.

UNIT VII SOIL AND WATER RESOURCES:

Soil formation and soil erosion; Changes in land use and land cover pattern; conservation of soil and nutrients.

Water resources: Distribution, exploitation, depletion of water resources; conservation of water; water use efficiency; water poverty index.

UNIT VIII SUSTAINABLE DEVELOPMENT:

Current concepts of conservation; sustainable development; Homeostasis; Ecological foot print; Carbon foot print; consumerism.

References:

1. Fundamentals of Ecology by EP Odum, WB Saunders & Co.
2. Environment and Natural Resources conservation by Trivedi R.K.
3. Remote sensing in Geology by Seigal, John Wiley 1999

EMT-1.2 ENVIRONMENTAL CHEMISTRY

UNIT I FUNDAMENTALS OF ENVIRONMENTAL CHEMISTRY:

Stoichiometry, chemical equilibria, acid base reactions, solubility product, solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons, radionuclides.

UNIT II ATMOSPHERIC CHEMISTRY:

Structure and composition of atmosphere - Chemical reactions in the atmosphere: Ozone chemistry- CFC's - Acid Rain - Photochemical smog - Aerosols types- production and distribution- Aerosols and Radiation - temperature inversion - Green House gases - Global warming.

UNIT III WATER CHEMISTRY:

Water resources, hydrological cycle, physical and chemical properties of water, complexation in natural and waste water, role of microorganisms, - Water pollutants- Types - Sources- Heavy metals - Metalloids - Organic - Inorganic - Biological and Radioactive - Types of reactions in various water bodies including marine environment - Eutrophication - Groundwater - Potable water.

UNIT IV SOIL CHEMISTRY & SOIL COMPOSITION:

Organic & Inorganic - Soil, Physical and Chemical Properties - Cation exchange capacity - soil pH - Environmental Properties of soils: Leaching and erosion - reactions with acids and bases - Geochemical reactions that neutralize acidity - Biological Process that neutralize acidity - salt affected soils - Trace metals in soils.

UNIT V TOXICOLOGICAL CHEMISTRY:

Introduction to toxicology and - Toxicants-Dose response relationship - Evaluation methods - LD₅₀, LC₅₀- Impact of toxic chemicals on Enzymes - Biochemical effects of arsenic, lead, mercury, Carbon monoxide, Nitrogen oxides, sulphur dioxide, ozone, PAN, cyanide, pesticides and Carcinogens.

UNIT VI GREEN ENVIRONMENTAL ISSUES:

Introduction - Ecological and Carbon foot print - Carbon Credits - Carbon Sequestration - Clean Development mechanism (CDM) - Polluters Pay principle - Consumerism -

UNIT VII GREEN CHEMISTRY:

Principles of Green chemistry- matrices-green computing.

UNIT VIII ENVIRONMENTAL APPLICATIONS:

Sustainable mining - Urban forestry - Green buildings - Green building practices - Approaches to green computing - Nanotechnology and Environment.

Books Recommended

1. Environmental Chemistry, a global perspective by Gary W. Vanloon & Stephen J. Duffy - Oxford University press.
2. Chemistry for environmental Engineering and science fifth edition by Clair N. Sawyer, Perry L. Mearly, Gene F. Parkin, Tata Megrahil edition.
3. Environmental Chemistry by Ajay Kumar Bhagi, G.R. Chatwal, Himalaya Publishing house.
4. Environmental Chemistry by A.K. de, 4th edition New Age International (p) Ltd., New Delhi, India, 2000.
5. Environmental chemistry by V.P. Kudesia, Pragati Prakashav, Meerut.
6. Fundamentals of Environmental chemistry, 2nd ed. CRC press, Inc., USA, 2001.

EMT-1.3 ENVIRONMENTAL MICROBIOLOGY AND BIO-TECHNOLOGY

UNIT I DIVERSITY OF MICROORGANISMS:

Prokaryotes and eukaryotes, eukaryotic and prokaryotic cell structure. General characters, beneficial and harmful effects of major groups of microorganisms, protozoa, algae, fungi, bacteria and viruses.

UNIT II MICROBIAL GROWTH AND NUTRITION:

Isolation, cultivation (aerobic and anaerobic) and preservation of micro organisms. Nutritional requirements, nutrient media (selective, differential, enriched, enrichment media) and growth conditions. Nutritional types (auto & heterotrophs; litho and organotrophs; chemo and phototrophs, oligo and copiotrophs, osmotrophs and phagotrophs; auxotrophs and prototrophs.

Microbial growth curve, exponential growth, generation time. Bacterial growth in batch and continuous cultures (chemostat and turbidostat); synchronous growth.

UNIT-III EFFECT OF ENVIRONMENT AND CONTROL OF MICROORGANISMS:

Effect of temp pH, O₂, radiant energy, osmotic pressure and desiccation on microorganisms and microbial adaptations. Control of microorganisms by physical and chemical agents, sterilization and disinfection. Physical agents – temperature, filtration, and radiation. Classes of disinfectants – phenol and phenolics – alcohol, halogens, surfactants, and heavy metals. Characteristics of an antimicrobial agent; mode of action of antimicrobial agent. Evaluation of antimicrobial agents.

UNIT IV BIOFERTILIZERS AND BIOPESTICIDES:

Use of Microbes as biofertilizer, Biological N₂ fixation, phosphate solubilization, AM fungi and crop productivity. Biopesticides Bacteria viruses & fungi and microbial products.

UNIT V BIO FUELS:

Microbial production of Methane (biogas), hydrogen, ethanol. Biodiesel & microbial fuel cells.

UNIT VI BIODEGRADATION:

Microbial degradation of biopolymers (chitin, lignin, cellulose, starch, protein). Hydrocarbons: (aliphatic and aromatic compounds) bio and xenobiotic compounds.

UNIT VII BIO-INDICATORS:

Plankton and hygrophyte community as indicators of water pollution. Diversity index in evaluation of water quality; species richness & species evenness. Determination of microbiological quality of potable and recreational waters. Indicators of air pollution.

UNIT VIII BIOSENSORS:

Microbial biosensors – definition, advantages and limitations, different components of biosensor, various transducer principles (conductometric, potentiometric, amperometric, optical,). Specific biosensors- glucose, ammonia gas, BOD, methane and mutagen sensor.

Text books:

1. Environmental Microbiology – Majer, R.M; Pepper, L; Gerba, C.P.-2009-2nd edition Academic Press.
2. Microbiology – Pelzer, K.J; Chan, E.C.S; Kreig, N.R.-2008 – 5th edition- Tata Magraw-Hill Publishing Company – New Delhi.
3. Biotechnology: the science & the business-Moses, V; Springham, D.G; Cape, R.E-1999- 2nd edition –
4. Microbial Biotechnology – Glazer, A.N; Nikaido, H-2007 – 2nd edition.
5. Biodegradation and Bioremediation – Alexander, M; - 1999 – 2nd edition – Academic Press.

References:

1. Review articles in Advanced Applied Microbiology curriculum reviews in microbiology annual review of Annual review of Microbiology, Bacteriology etc, by **Schlegel, Prescott and Madigan.**

EMT-1.4 ENVIRONMENTAL POLLUTION

UNIT I INTRODUCTION:

Classification of Pollution and Pollutants, Causes, Effects and Sources of Pollution.

UNIT II AIR POLLUTION:

Primary and Secondary Pollutants, Automobile Pollution, Industrial Pollution, Ambient Air Quality Standards, Meteorological aspects of air pollution---Temperature lapse Rates and Stability-wind velocity and turbulence-Plume behavior dispersion of air pollutants- solutions to the atmospheric dispersion equation - the Gaussian Plume Model ,Air pollution sampling and measurement-types of pollutant sampling and measurement-Ambient air sampling-collection of gaseous air pollutants-collection of particulate pollutants- stock sampling, analysis of air pollutants-sulfur dioxide- nitrogen dioxide, carbon monoxide, oxidants and ozone-hydrocarbons-particulate matter.

UNIT III WATER POLLUTION:

Point and Non-point Source of Pollution, Major Pollutants of Water, Water Quality Requirement for Different Uses, Global water crisis Issues.

UNIT IV MARINE AND NUCLEAR POLLUTION:

Misuse of International Water for Dumping of Hazardous Waste, Coastal Pollution Due to Industrial Effluents, Nuclear Power Plants, Nuclear Radiation, Disasters and Impacts, Genetical Disorders.

UNIT V LAND/SOIL POLLUTION:

Effects of urbanization on land degradation, Impact of Modern Agriculture on Soil, Effect on Environment and Life sustenance, Abatement measures.

UNIT VI NOISE AND THERMAL POLLUTION:

Sources of Noise, Effects of Noise, Industrial Noise - Occupational Health Hazards, Thermal Comforts, Heat Island Effect, Radiation Effects

UNIT VII SOLID WASTE:

Classification of Solid Waste, Factors Affecting the Solid Waste Generation, Composition and Characteristics of Solid Waste; Collection of Solid Waste: Methods of Collection, Layout of Collection Route, Door Step Collection Arrangement from Bulk Garbage Generators; Transportation of Solid Waste: Transfer Stations, Segregation of Solid Waste, Methods of Segregation.

Unit VIII E-WASTE:

Sources of generation, Effects and Control measures, Global Strategy.

Text Books:

1. Text book of Environmental Science and Technology by Dr. M. Anji Reddy, BS Publications, 2010.
2. Environmental Science- Towards a sustainable future by Richard T. Wright, PHI Learning, New Delhi 2008.

EMT-1.5 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

UNIT I: CONCEPTUAL FACTS OF EIA:

Introduction, Definition and Scope of EIA, Objectives in EIA, Basic EIA Principles, Classification of EIA: Strategic EIA (SEIA), Regional EIA, Sectoral EIA, Project Level EIA and Life Cycle Assessment, Project Cycle, Grouping of Environmental Impacts: Direct Impacts, Indirect Impacts, Cumulative Impacts and Induced Impacts. Significance of Impacts: Criteria/Methodology to Determine the Significance of the Identified Impacts.

UNIT II: BASELINE DATA ACQUISITION:

Environmental Inventory, Data Products and Sources: thematic data, topographical data, collateral data and field data. Environmental Baseline Monitoring (EBM), Preliminary Study to determine impact significance, Environmental Monitoring network Design, Monitoring Stations, Air quality data acquisition, Water Quality data acquisition, soil data, socioeconomic data and biological data acquisition. Impact on Environmental Components: Significance of Impacts, Criteria to determine the significance of the identified Impacts.

UNIT III: PLANNING AND MANAGEMENT OF IMPACT STUDIES:

Conceptual Approach for Environmental Impact Studies, Proposal Development, Interdisciplinary Team Formations, Team Leader Selection and Duties, General Study Management, Fiscal Control.

UNIT IV: OPERATIONAL ASPECTS OF EIA:

Screening: Application for Prior Screening for Environmental Clearance, Screening Criteria; Category A Projects, Category B Projects, Criteria for Classification of Category B1 and B2 Projects, Consistency with other Requirements and Siting Guidelines. Scoping: Identification of Appropriate Valued Environmental Components (VEC), Identification of Impacts, Information in Form 1, Structure of a Pre-feasibility Report. Public consultation: Appraisal, Decision Making, Post-clearance Monitoring Protocol.

UNIT V: METHODS FOR IMPACT IDENTIFICATION:

Background Information, Interaction-Matrix Methodologies: simple matrices, stepped matrices, development of a simple matrix, other types of matrices, summary observations on matrices, Network Methodologies: Checklist methodologies, simple checklists, descriptive Checklists, summary observations on simple and descriptive Checklists.

UNIT VI: PREDICTION OF IMPACTS (AIR AND WATER):

Air Environment: Basic information on air quality, Sources of Pollutants, effects of pollutions, Conceptual approach for addressing air environment impacts, Air quality standards, Impact Prediction, Impact significance. Water Environment: Basic Information on surface-Water Quantity and Quality, Conceptual Approach for Addressing Surface-Water-Environment Impacts, Identification of Surface-Water Quantity or Quality Impacts, Procurement of Relevant Surface-Water Quantity-Quality Standards, Impact Predictions, Assessment of Impact Significance.

UNIT VII: PREDICTION OF IMPACTS (NOISE, SOIL, BIOLOGICAL AND SCIO-ECONOMIC)::

Basic Information on Noise Key Federal Legislation and Guidelines, Conceptual Approach for Addressing Noise-Environment Impacts, Identification of Noise Impacts, Procurement of Relevant Noise Standards and/or Guidelines, Impact Prediction, Assessment of Impact Significance. Soil Environment: Human Health and Society, Biological Environment: Basic Information on Biological Systems, Conceptual Approach for Addressing Biological Impacts, Identification of Biological Impacts, Description of Existing Biological Environment Conditions, Procurement of Relevant Legislation and Regulations, Impact Prediction, Assessment of Impact Significance.

UNIT VIII: ENVIRONMENTAL MANAGEMENT PLAN (EMP):

Case Study, identification of Impacts, EMP for Air Environment: Dust Control Plan, Procedural Changes, Diesel Generator Set Emission Control Measures, Vehicle Emission Controls and Alternatives, Greenbelt Development. EMP for Noise Environment, EMP for Water Environment: Water Source Development, Minimizing Water Consumption, Domestic and Commercial Usage, Horticulture, Storm Water Management. EMP for land Environment: Construction Debris, hazardous Waste, Waste from temporary Labour settlements.

Text Books:

1. Textbook of Environmental Science & Technology by M.Anji Reddy, BS Publications, 2010
2. Technological guidance manuals of EIA. MoEF.
3. EIA by Canter
4. Man and Environment D.H.Carson 1976 Interactions Part I and III.
5. Environmental Impact Assessment, 2003, Y.Anjaneyulu, B.S Publications
6. Erickson, P.A.1979 Environmental Impact Assessment Principles and applications
7. Basic Concepts in Remote Sensing & Arial Photogrammetry Lillesand & Keifer Printice Hall Intl., 1994.
8. Renewable Energy Environment and Development, Hameswar Dayal Konark Publishers, Pvt., Ltd.
9. Environmental Impact Assessment, Canter, L.W., 1977, McGraw Hills, New York.

EMT-1.6 ENVIRONMENTAL POLLUTION MONITORING LAB

Analysis of Physical and Chemical parameters of Water and Soil

Physical parameters of soil:

1. Moisture content
2. Bulk density
3. Specific gravity
4. Water holding capacity

Chemical parameters:

1. pH
2. Electrical conductivity
3. Turbidity
4. Hardness – Calcium, Magnesium and total hardness
5. Alkalinity
6. Nitrates, Nitrites and Ammonical nitrogen
7. Phosphates
8. Sulfates by Spectrophotometric & Nephelometric Method
9. Residual Chlorine
10. Dissolved Oxygen
11. Fluorides
12. Sodium
13. Potassium
14. Biological oxygen demand / organic matter
15. Chemical oxygen demand

Air Pollution Monitoring:

1. NO_x
2. SO_x
3. Particulate matter
4. Hydrocarbons

EMT-1.7 ENVIRONMENTAL MICROBIOLOGY AND BIO-TECHNOLOGY LAB

- 1) Ubiquitous nature of microorganisms.
- 2) Enumeration of algae by MPN method.
- 3) Isolation of fungi from environmental samples.
- 4) Isolation and enumeration of air-borne bacteria.
- 5) Standard plate count.
- 6) Standard coliform test.
- 7) Presence absence test.
- 8) Fecal coliform test.
- 9) 7hr FC test.
- 10) Membrane filtration test.
- 11) Enumeration of coliform bacteria by MPN method.
- 12) H₂S strip test.
- 13) Enumeration of *Bacillus cereus* in food.
- 14) Enumeration of coliform bacteria in soft drinks and fruit juices.
- 15) Isolation of *Salmonella* from meat
- 16) Kirby-Bauer test.
- 17) Determination of MIC.
- 18) Crowded plate technique for isolation of antibiotic producing microorganisms
- 19) Microbial fuel cells for bioelectricity generation.
- 20) Photo biological hydrogen production from industrial effluents.

EMT-2.1 SOLID & HAZARDOUS WASTE MANAGEMENT

UNIT I SOLID WASTE:

Definition of solid wastes – types of solid wastes – Sources - Industrial, mining, agricultural and domestic – Characteristics. Solid waste Problems - impact on environmental health – Concepts of waste reduction, recycling and reuse.

UNIT II COLLECTION, SEGREGATION AND TRANSPORT OF MUNICIPAL SOLID WASTES:

Handling and segregation of wastes at source. Collection and storage of municipal solid wastes; analysis of Collection systems. Transfer stations – labeling and handling of hazardous wastes.

UNIT III MUNICIPAL SOLID WASTE MANAGEMENT :

Solid waste processing technologies. Mechanical and thermal volume reduction. Biological and chemical techniques for energy and other resource recovery: composting, vermicomposting, termigradation, fermentation. Incineration of solid wastes. Disposal in landfills: site selection, design, and operation of sanitary landfills; Leachate and landfill gas management; landfill closure and post-closure environmental monitoring; landfill remediation. Regulatory aspects of municipal solid waste management.

UNIT IV HAZARDOUS WASTES:

Hazardous waste definition. Physical and biological routes of transport of hazardous substances – sources and characterization categories and control. Sampling and analysis of hazardous wastes – analytical approach for hazardous waste characterization – proximate analysis – survey analysis – directed analysis – analytical methods.

UNIT V HAZARDOUS WASTES MANAGEMENT:

Sources and characteristics: handling, collection, storage and transport, TSDF concept. Hazardous waste treatment technologies - Physical, chemical and thermal treatment of hazardous waste: solidification, chemical fixation, encapsulation, pyrolysis and incineration. Hazardous waste land fills - Site selections, design and operation. HW reduction, recycling and reuse, Regulatory aspects of HWM.

UNIT VI BIOMEDICAL WASTE MANAGEMENT:

Biomedical waste: Definition, sources, classification, collection, segregation Treatment and disposal.

UNIT VII RADIOACTIVE WASTE MANAGEMENT:

Radioactive waste: Definition, Sources, Low level and high level radioactive wastes and their management, Radiation standard by ICRP and AERB

UNIT VIII E-WASTE MANAGEMENT:

Waste characteristics, generation, collection, transport and disposal.

Book Recommended

1. Hazardous waste management Charles A. Wentz. Second edition 1995. McGraw Hill International.
2. Integrated solid waste management George Tchobanoglous, Hilary Theisen & Samuel A. Vigil.
3. Criteria for hazardous waste landfills – CPCB guidelines 2000.
4. Hazardous waste management by Prof. Anjaneyulu.
5. Environmental Sciences by Daniel B. Botkin and Edward A. Keller, Wiley student, 6th edition- 2009.
6. Standard handbook of Hazardous waste treatment and disposal by Harry M. Freeman, McGraw Hill 1997.
7. Management of Solid waste in developing countries by FrankFlintoff , WHO regional publications 1976.

EMT-2.2 REMOTE SENSING AND GIS

UNIT I REMOTE SENSING – BASIC PRINCIPLES:

Introduction, Electromagnetic Remote Sensing Process, Physics of Radiant Energy: Nature of Electromagnetic Radiation, Electromagnetic Spectrum. Energy Source and its Characteristics, Atmospheric Interactions with Electromagnetic Radiation: Atmospheric Properties, Absorption Ozone, Atmospheric Effects on Spectral Response Patterns. Energy Interactions with Earth's Surface Materials: Spectral Reflectance Curves. Cosine Law.

UNIT II REMOTE SENSING PLATFORMS AND SENSORS:

Introduction, Satellite System Parameters . Sensor Parameters, Imaging Sensor Systems. Earth Resources Satellites. Meteorological Satellites . Satellites Carrying Microwave Sensors . OCEANSAT-1 (IRS-P4), IKONOS Satellites Series, Latest Trends in Remote Sensing Platforms and sensors.

UNIT III VISUAL IMAGE INTERPRETATION AND DIGITAL IMAGE PROCESSING:

Introduction, Types of Pictorial Data Products, Image interpretation strategy, Process of Image Interpretation, Interpretation of Aerial Photo, Basic elements of Image Interpretation, Application of Aerial Photo Interpretation, Interpretation of Satellite Imagery, Key Elements of Visual Image Interpretation, Concept of Converging Evidence. Basic Character of Digital Image, Preprocessing, Image Registration, Image Enhancement Techniques, Image Classification. Image classification and GIS.

UNIT IV FUNDAMENTALS OF GIS:

Introduction, Roots of GIS, Overview of Information System, The Four Ms, Contribution Disciplines, GIS Definitions and Terminology, GIS Queries, GIS Architecture, Theoretical Models of GIS. Theoretical Framework for GIS, GIS Categories, Levels/Scales of Measurement.

UNIT V SPATIAL DATA MODELING:

Introduction, Stages of GIS Data Modelling, Graphic Representation of Spatial Data . Raster GIS Models . Vector GIS Models . Comparison of Raster and Vector Models.

UNIT VI GIS DATA MANAGEMENT:

Introduction, Data Base Management Systems . GIS Data File Management . Database Models . Storage of GIS Data . Object Based Data Models . Temporal Topology, Organisational Strategy of DBMS in GIS.

UNIT VII DATA INPUT AND EDITING:

Introduction, The Data Stream a. Data Input Methods . GPS for GIS Data Capture . Data Editing

UNIT VIII DATA QUALITY ISSUES:

Introduction, Components of Data Quality, Accuracy . Precision and Resolution . Consistency, Completeness, Sources of Error in GIS, Modelling Errors . Error Evaluation by Graphical Methods.

Text Books:

1. Remote Sensing and Image Interpretation by T.M.Lillesand and R.W.Kiefer, John Wiley, Third Edition.
2. Fundamental of Geographic Information Systems –Demers 1995 Edition.
3. Textbook of Remote Sensing and GIS, M.Anji Reddy, B.S.Publications

EMT-2.3 TECHNOLOGICAL SOLUTIONS FOR POLLUTION CONTROL

UNIT I SEWAGE TREATMENT AND DISPOSAL:

Self purification of streams- BOD and its important- treatment methods- primary, secondary and tertiary levels- disinfections of treated sewage effluent- septic tank design- effluent disposal methods- disposal on land, sewage sickness- disposal by dilution- design of biological treatment units- sludge characteristics, unit operations in sludge disposal, conventional and high rate digesters- disposal of sludge- gas utilization.

UNIT II WATER TREATMENT:

Methods of water purification, primary treatment- sedimentation- flotation, secondary (biological) treatment- design and principles in biological treatment facilities- activated sludge process- trickling filters – low cost waste treatment systems and their design, tertiary treatment.

UNIT III ADVANCED WASTE WATER TREATMENT & BIO-REACTORS FOR WASTE WATER TREATMENT:

Introduction, removal suspended solids- removal of dissolved solids- Ammonia removal- phosphorus removal- chemical oxidation- recovery of materials from process effluents.

Up Flow Anaerobic Sludge Blanket (UASB), Two-stage, Aerobic UNI Tank System (TSU-System, Route Zone Treatment, Submerged Aerobic Fixed Film (SAFF) Reactor, Fluidized Aerobic Bio – Reactor (FAB).

UNIT IV AIR POLLUTION CONTROL TECHNOLOGIES:

Sources- correction methods- -particulate emission control- gravitational settling chambers-cyclone separators- fabric filters-electrostatic precipitators-wet scrubbers- -control of gaseous emissions-adsorption by solids-absorption by liquids-combustion, condensation – control of SO₂ emission – desulphurization of flue gases – dry methods – wet scrubbing methods. Control of nitrogen oxides- modification of operating conditions- modification of design conditions- effluent gas treatment methods-carbon monoxide control-control of hydrocarbons-mobile sources.

UNIT V SOIL POLLUTION, PHYTOREMEDIATION AND BIOREMEDIATION TECHNOLOGIES:

Impact of modern agriculture on soil, degradation of soil, Control of soil pollution, Phytoextraction, Phytostabilization, Phytostimulation, Phytotransformation, Rhizofiltration, Constructed Wetlands, Bioremediation Technologies: Bioaugmentation, Biostimulation, Bioreactors, Land-based Treatments, Fungal Remediation.

UNIT VI SOLID AND HAZARD WASTE TREATMENT:

Sources and generation of solid waste – characterization, chemical composition and classification- dumping of garbage- commercial, Industrial, Agriculture, Mining and Power Plant discharges- Disposal methods- Composting, Incineration and others- biomedical waste management. HWT Technologies, Physical Treatment Methods, Chemical Treatment Methods, Stabilization and Fixation Systems.

UNIT VII NOISE CONTROL AND GREENBELT DEVELOPMENT:

Standard Methods of Noise Control; Greenbelt Development: Advantage of Green Belt Development, Design of Green Belt, Rain Water Harvesting:

UNIT VIII REMOTE SENSING AND GIS:

Geospatial Requirements, Spatial Decision Support System (SDSS), GIS in EIA

Text Books:

1. Text book of Environmental Science and Technology by Dr. M. Anji Reddy, BS Publications, 2010.
2. Bioremediation by Baker K H and Herson DS. Mc Graw Hill, Inc, New Delhi.
3. Biodegradation and Bioremediation, Martin Alexander, Academic press.
4. Waste water engineering, treatment and reuse by Metcalf & Eddy, fifth edition, Tata Mcgraw Hill.
5. Air Pollution, H.C.V. Rao, 1990, Mcgraw Hill Co.
6. Environmental Pollution control technologies, C.S. Rao, Wiley estern Ltd, 1993.
7. Air Pollution, M.N. Rao, Mcgraw Hill 1993.

EMT-2.4 OCCUPATIONAL HEALTH & SAFETY

UNIT I INTRODUCTION TO SAFETY PHILOSOPHY:

Sequence of Accident Occurrence, Occupational Injuries-Effects of Industrial Accidents, Analysis of Accidents, Injury Data, Accident Investigations & Reporting, Accident Costing

UNIT II SAFETY & HEALTH MANAGEMENT:

Employer & Employee Responsibilities, Record-keeping & Reporting Requirements, Safety Organization, Responsibilities of Safety Officer, Supervisors, Safety committees.

UNIT III RISK MANAGEMENT:

Definitions of Hazards, Risks, Evolution of Methodical Analysis, System safety Analysis techniques, Performance measurement, Operational Reviews - Internal & External.

UNIT IV WORK PRACTICES IN INDUSTRIES:

Hazards in Chemical Operations, Material Handling Hazards, Lifting Machinery & Pressure Vessels, Material Safety Data Sheets, Classification of Chemicals, Hazardous Chemicals, Storage Practices, Radiation Safety, Petroleum Storage Requirements, Pesticide Safety.

UNIT V INDIAN STATUTES:

Central Acts, Factory's Act, AP Factory Rules, Construction Safety Regulations, Petroleum Rules 2002, Electrical Act & Rules.

UNIT VI FIRE SAFETY:

Basic Elements, Causes, Industrial Fires, Explosions, Effect On Environment, Property & Human Loss, Prevention Techniques, Building Design, Fire Protection Systems, Contingency Plan, Emergency Preparedness, Evacuation.

UNIT VII INDUSTRIAL BEST PRACTICES:

In Electrical, Mechanical, Fire, Machine Guarding, Personal Protective Equipment, Occupational Health, Ergonomics Ambulance, Noise Abatement Methods, Management Of Contractors.

UNIT VIII OCCUPATIONAL SAFETY & MANAGEMENT STANDARDS:

Indian Standards, OHSAS 18001 Standard and its Elements, CE Certificate, Social Accountability Standards, System Implementation, Benefits.

Text Books:

1. Industrial safety and health, David L. Goetsch, Macmillan Publishing Company, 1993.
2. Handbook of environmental health and safety, Vol I & II, Herman Kooren, Michael Bisesi, Jaico Publishing House, 1999.

EMT-2.5 COMPUTER APPLICATION AND MODELLING

UNIT I COMPUTER BASICS:

Problem solving using computers- flowcharts-algorithms-CPU-Input and output units- .computer memory- Basic concepts of Object oriented Languages

UNIT II BASICS OF C++:

Basic structure of C++ programming- tokens-keywords-data types: basic data types- derived data types-user defined data types- constants-variables-arrays-one, two and multi dimensional arrays-structure-union-enumerated data types.

UNIT III OPERATORS:

Arithmetic operators- relational operators-increment and decrement operators-bit wise operators-arithmetic expression-precedence of operators-Evaluation of expression- type compatibility-expression and implicit conversion-manipulators-

UNIT IV FUNCTIONS:

Control structures: decision making and branching-decision making and looping- Function declaration and definition- argument passing-return values.

UNIT V OBJECT FUNCTIONS:

Class and objects-member functions- array of objects-object as a argument- function overloading- friend function-operator overloading-this pointer-static data member- static member function

UNIT VI CONSTRUCTORS, DESTRUCTORS AND INHERITANCE:

Constructors: default constructor-parameterized-copy constructor-dynamic constructor-destructors-Inheritance-single inheritance-multiple inheritance-multilevel inheritance-pointers virtual functions and polymorphism

UNIT VII AIR AND WATER QUALITY MODELING:

UNIT VIII OTHER ENVIRONMENTAL MODELS:

Text books :

- 1) Object Oriented Programming with C++ by E. Balagurusawmy

EMT-2.6 REMOTE SENSING AND GIS LAB

1. Study of toposheet and base map preparation;
2. Description of satellite and sensor details of the imagery used for thematic mapping;
3. Land use / land cover map preparation;
4. Field visits for finalization of land use / land cover map and soil map;
5. Scanning / digitization of maps;
6. Digital image display; image enhancement;
7. Image registration
 - a. Ground Control points from toposheets (GCP)
 - b. Geo referencing
8. Image classifications for land use / land cover using ERDAS, PCI Geomatica and ENVI.
9. Digital Mapping: GIS Software, ARC GIS and Geo-Server.

EMT-2.7 ENVIRONMENTAL MODELLING LAB

Air pollution modeling, water pollution modeling and ecological modeling lab.

Softwares like ISCST3, Mod Flow, TWQM, Geopack, WQAM, etc.