SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester I

1. AIR & NOISE POLLUTION CONTROL

Teaching Scheme
Lectures: 3 Hrs/ Week
Practical: 2 Hrs / Week

Examination Scheme
Theory Paper: 100 Marks
Term Work: 25Marks
Oral Exam 25 Marks

Course Objectives:

1. To provide the basic concepts of air pollution and its control.
2. To impart with the skill of design and operation of control devices for gaseous and particulate pollutants.

Unit1: Atmospheric Modelling and Dispersion (6)
Dispersion of Airborne Effluents, Wind Speed Correction, Wind Direction Standard Deviations, Plume Standard Deviations, Effective Stack Height, Maximum Ground-Level Concentration, Steady-State Dispersion Model (Crosswind Pollutant Concentrations), Centreline Pollutant Concentrations, Short-Term Pollutant Concentrations, Long-Term Pollutant Concentrations. Stability and Environmental Conditions

Unit 2: Carbon Sequestration (4)
Introduction, Carbon Sequestration Process Description, Development of a Carbon Sequestration Road Map, Terrestrial Sequestration, CO2 Separation and Capture, Geologic Sequestration Options, Ocean Sequestration, Chemical and Biological Fixation and Reuse

Unit 3: Desulfurization and Emissions Control (6)
Sulphur Oxides and Hydrogen Sulphide Pollution, Desulfurization Through Coal Cleaning, Desulfurization Through Vehicular Fuel Cleaning, Desulfurization Through Coal Liquefaction, Gasification, and Pyrolysis, Desulfurization Through Coal-Limestone Combustion, Hydrogen Sulphide Reduction by Emerging Technologies "Wet" Flue Gas Desulfurization Using Lime and Limestone, Emerging "Wet" Sulphur Oxide Reduction Technologies, Emerging "Dry" Sulphur Oxides Reduction Technologies

Unit 4: Control of NOx (6)
NOx Control Technologies, In-Furnace NO*x* Control, Post combustion NO*x* Control, Hybrid Control Systems, Simultaneous SO2 and NO*x* Control, Results of Recent Demonstration Plants on NO*x* Control, Future Regulation Considerations, Future Technology Developments in Multipollutant Control

Unit 5:Control of Heavy Metals & Particulate Matter in Emission Streams (6)
Principle and Theory, Reactions in the Incinerator , Control of Metal Emissions, Control Device of Heavy Metals, Control of Particulate Matter, Mechanisms, Gravity Settling Chamber , Cyclone , Electrostatic Precipitator , Quench , Fabric Filters, Vitrification , Solidification , Chemical Stabilization and Fixation , Extraction, Fluidized-Bed Metal Capture

Unit 6: Heating, Ventilation and Air Conditioning (4)
Heating, Air Ventilation and Circulation, Ventilation Requirements, Ventilation Fans, Hood and Duct Design, Air Conditioning, Design Examples, Health Concern

Unit 7: Performance and Costs of Air Pollution Control Technologies (4)
Air Emission Sources and Control , Air Pollution Control Devices Selection, Point Source VOC Controls , Point Source PM Controls, Area Source VOC and PM Controls, Pressure Drops Across Various APCDs, Energy and Cost Considerations for Minor Point Source Controls, Major Point Source Controls and Area Source

Unit 8: Noise Pollution & Control (4)
The Physics of Sound, Indoor Sound , Characteristics of Noise, Standards, Sources , Effects , Measurement , Control , Sound Out-of-Doors , Noise Reduction , Sound Isolation , Vibrations , Active Noise Control , Design Examples

Laboratory Experiments:

1. Measurement of Meteorological parameters like Wind, Pressure, Temperature and Humidity
2. Sampling and analysis of sulphur dioxide in ambient air and Stack
3. Sampling and analysis of Nitrogen dioxide in ambient air and Stack
4. Sampling and analysis of Particulate Matter (PM_{10}) in ambient air and Stack
5. Determination of $PM_{2.5}$ in ambient air Gravimetric Method
6. Sampling and analysis protocol for ozone in ambient air
7. Sampling and analysis protocol for ammonia in ambient air
8. Sampling and Analysis of Benzo(a)pyrene & other PAHs in Ambient Air
9. Sampling and analysis of Lead, Nickel and Arsenic in ambient air and Stack
10. Determination of trace elements in Particulate matter sampled through air and soil

Reference Books:

1. **Advanced Air and Noise Pollution Control, Volume 2**, Wang, Lawrence K.; Pereira, Norman C.; Hung, Yung-Tse (Eds.), 2005, XVIII, 526 p. 187 illus., ISBN 978-1-58829-359-6
2. **Atmospheric Chemistry and Physics - From Air Pollution to Climate Change - 2nd edition, Seinfeld, John H.; Pandis, Spyros N. ,** John Wiley & Sons September 2006
3. **Atmospheric Dispersion Modelling: An Introduction to Practical Applications, Rod Barratt,** Earthscan 2001,
4. **Capturing Carbon and Conserving Biodiversity - The Market Approach, Edited by Ian R. Swingland,** Earthscan May 2003
5. **Chemical Degradation Methods for Wastes and Pollutants - Environmental and Industrial Applications, Matthew A. Tarr,** Marcel Dekker August 2003
6. **Emissions of Air Pollutants - Measurements, Calculations and Uncertainties, Edited by Friedrich, Rainer; Reis, Stefan,** Springer 2004
7. **Environmental Challenges and Greenhouse Gas Control for Fossil Fuel Utilization in the 21st Century, Edited by M. Mercedes Maroto-Valer, Chunshan Song, Yee Soong,** Kluwer Academic/Plenum August 2002
8. **Fundamentals in Air Pollution - From Processes to Modelling, Bruno,** Springer 2010
9. **Fundamentals of Air Pollution (4th Edition), Daniel Vallero,** Academic Press 2008,
10. **Handbook of Air Pollution Prevention and Control, Nicholas P Cheremisinoff,** Butterworth Heinmann 2002
11. **Handbook of Chemical Technology and Pollution Control - 3rd edition, Martin B Hocking,** Academic Press 2005
12. **Heavy Metals in the Environment: Origin, Interaction and Remediation, Edited by Heike Bradl,** Academic Press March 2005
13. **Industrial Combustion Pollution and Control, Charles E. Baukal,** Marcel Dekker 2003
14. **Air Pollution Control Engineering: Basic Calculations for Particulate Collection, Second Edition**, William Licht
15. **Air Pollution Control Technology Handbook**, Karl B. Schnelle, Jr., Charles A. Brown
16. **Air pollution control: design approach,** C. David Cooper, F. C. Alley
17. **Industrial Air Pollution Control Systems**, William L. Heumann, McGraw-Hill, 1997

SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester I

2. SOLID & HAZARDOUS WASTE MANAGEMENT

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work : 25 Marks

Course Objectives:

1. To provide the necessary knowledge and concepts of solid & hazardous waste management.
2. To impart the necessary knowledge of design, operation of solid & hazardous waste collection, processing and disposal facilities.

Unit 1: Legislation (6)

Municipal solid waste rules, hazardous waste rules, biomedical waste handling rules, fly ash rules, recycled plastics usage rules, batteries rules.

Unit 2: Sources & Characterization of MSW (5)

Sources, composition, generation rates, collection of waste; separation, transfer and transport of waste; treatment and disposal options. characterization of waste,

Unit 3: MSW Processing (7)

Chemical treatment processes for MSW, composting and vermi-composting; anaerobic biodegradation of municipal solid waste: waste to energy options, other methods; bioremediation - fundamentals.

Unit 4: Operation & Management of Landfill Sites (6)

Sanitary landfill site selection, Landfill site design, operation, maintenance and precautions, leachate and its control, control of contamination of ground water.

Unit 5: Sources ,Characterization, Risk & Effects of Hazardous Waste (8)

Sources, characterization of waste, compatibility and flammability of chemicals, fate and transport of chemicals, health effects. Defining risk and environmental risk, methods of risk assessment, case studies., measures, health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.

Unit 6: Hazardous Waste Treatment & Disposal (8)

Chemical treatment processes for Hazardous Waste (combustion, stabilization and solidification of hazardous wastes); physico-chemical processes for hazardous wastes (soil vapor extraction, air stripping, chemical oxidation), Concept of incinerator, ground water contamination and remediation. Landfill site selection, Operation monitoring. Rehabilitation, Closure & end-use.

Term Work:

1. Analysis of Solid Waste- Physical properties.
2. Design of refuse collection & disposal system for medium size town/ part of a city
3. Assignments based on above topics.

References:

1. Vesilind P.A., Worrell W. and Reinhart D.R., "Solid Waste Engineering", Thomson Books.
2. Bhide A.D. and Sundaresan B.B., "Solid Waste Management, Collection, Processing and Disposal", Nagpur.
3. Tchobanoglous G., Theisen H. and Vigil S.A., "Integrated Solid Waste Management", McGraw-Hill International editions.
4. "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, Government of India.
5. Management and Handling Rules for: municipal solid waste, biomedical waste, hazardous waste and radioactive wastes, Government of India Publications.
6. Solid Waste Management Hand Book – Pavoni
7. Composting – Gottas

SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester I

3. PHYSICO- CHEMICAL PROCESSES FOR WATER & WASTEWATER TREATMENT

Teaching Scheme
Lectures: 3 Hrs/ Week
Practical: 2 Hrs / Week

Examination Scheme
Theory Paper: 100 Marks
Term Work : 25 Marks
Oral Exam: 25 Marks

Course Objectives:

1. To provide the necessary knowledge and concepts of physical, and chemical processes used for water and wastewater treatment.
2. To provide the necessary knowledge of design and operation of water and wastewater treatment plant.

Unit 1: Reactors & Reaction Kinetics **(2)**
Types of reactions, reaction kinetics, Configurations of ideal and non-ideal reactors.

Unit 2: Aeration **(4)**
Principles of aeration, Gas-liquid mass transfer, two film theory, Aeration in water and wastewater treatment, Types of aerator, Design of aeration systems

Unit 3: Coagulation, Flocculation & Settling **(8)**
Coagulation processes, stability of colloids and destabilization, coagulants Flocculation theory, Orthokinetic and perikinetic, Design of slow and rapid mixers. Sedimentation, particle settling theory, types of settling and related theory, clarifiers, high rate clarification, design of clarifiers, Design of grit chamber.

Unit 4: Filteration **(6)**
Introduction to depth filtration, filtration processes, principal mechanisms of filtration, filter hydraulics, backwash hydraulics, Rate control patterns and methods, design and operation of rapid sand and dual media filters

Unit 5 : Membrane Processes **(6)**
Membrane Filtration: Terminology, Process Classification, Membrane configuration, Specific membrane problems such as fouling and its control, application of membranes, Electrodialysis: Theory, Disposal of concentrate waste streams.

Unit 6 : Adsorption **(4)**
Adsorption processes, causes and types of adsorption, influencing factors, adsorption equilibria and development of adsorption isotherms, activated carbon adsorption kinetics, analysis and design of GAC and PAC contactors.

Unit 7 : Ion exchange **(3)**
Ion exchange, exchange materials, exchange capacity, ion exchange chemistry & reactions, applications for hardness & TDS removal, design of ion exchange softener.

Unit 8: Disinfection **(7)**

Disinfection, modes of disinfection, mechanisms, factors influencing, ideal disinfectant, chemistry of chlorination, Disinfection with ozone: chemistry, modeling, estimation of ozone dosage. UV disinfection: system components, modeling, Estimation of UV dose Corrosion processes, electrochemical nature of corrosion, types of corrosion, methods of corrosion control.

List of Practicals:

1. Physico-Chemical analysis of water:
    a. Turbidity
    b. Solids: Dissolved, suspended, total, volatile, fixed
    c. Alkalinity
    d. Dissolved oxygen
    e. Hardness
    f. Residual chlorine
    g. Nitrate
2. Optimum coagulant dose by jar test
3. Bacteriological quality through most probable number
4. Studies using settling column

Reference Books:

1. "Theory and Practice of Water and Wastewater Treatment", Droste, Ronald L., John Wiley & Sons Publication, 1997, 1st Edition.
2. "Environmental Engineering", Peavy, Rowe and Technologies.
3. "Physico-Chemical Processes of Water Purification", Weber.
4. "Wastewater Engineering Treatment and Reuse", Metcalf And Eddy, Tata McGraw Hill Publication, 1979, 2nd Edition.

SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester I

ELECTIVE – I: INDUSTRIAL HEALTH AND SAFETY AUDITING

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work: 25 Marks

Course Objectives:

1. Interpret and apply legislative requirements, industry standards, and best practices in a variety of workplaces.
2. Collect, manage, and interpret information and data to identify trends and issues in the workplace.
3. Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards.
4. Design, support, and evaluate health and safety programs and implement procedures using project management principles and processes appropriate to the task.

Unit 1. Introduction to Audit Systems (4)

Purpose and Overview of Audit Systems, Scope and Background, Intended Audience, Period Of Applicability, Organization Of The Document

Unit 2. Technical Audits and Related Assessments (10)

General Characteristics Of Technical Audits And Assessments, Self-Assessments Versus Independent Audits And Assessments, Role Of Technical Audits And Assessments, Necessity Of Technical Audit Or Assessment, Authority To Audit Or Assess, Attributes Of Auditors, Education And Training , Independence And Objectivity, Experience , Personal Attributes Of Auditors , Management Of Audit Programs, Audit Costs, Budget, Cost Considerations

Unit 3. Steps In The General Technical Audit And Assessment Process (10)

Planning , Decision To Conduct An Audit, Selection Of Audit Type , Selection Of Audit Team , Planning Meeting , Confidentiality And Dissemination Of Audit Results, Review Of Project Documents , Contact With Auditee , Audit Plan And Other Preparation , Audit Questionnaire , Audit Checklist , Performance Of The Audit, Audit Protocol , Opening Meeting , Audit Activities , Observation Of Work , Interviews, Document Review , Objective Evidence Compilation , Closing Meeting , Evaluation, Identification Of Finding, Evaluation Of Finding , Documentation , Draft Finding Report , Final Report , Corrective Action , Closeout

Unit 4. Types of Technical Audits **(6)**
Introduction to Audit Types, Readiness Reviews, Technical Systems Audits, Surveillance, Performance Evaluations

Unit 5. Related Technical Assessments **(4)**
Introduction to Assessment Types, Audits Of Data Quality, Data Quality Assessments

Unit 6. Guidance for Auditee **(6)**
Preaudits Participation, Audit Readiness, Audit Participation, Opening Meeting, Audit Activities, Closing Meeting, Draft Findings Report Review, Confidentiality and Dissemination of Audit Results

Term work: At least one assignment on above each unit.

Reference Books:

1. Safety, Health, and Environmental Auditing: A Practical Guide, Simon Watson Pain, Published: April 26, 2010 by CRC Press - 230 Pages
2. The Management System Auditor's Handbook, Joe Kausek, 432 Pages, 2006
3. Guidance on Technical Audits and Related Assessments for Environmental Data Operations, EPA QA/G-7, US Environment Protection Agency, Washington, DC 20460

SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester I

ELECTIVE - I : OPTIMIZATION TECHNIQUES

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work: 25 Marks

Course Objectives:

1. To provide necessary knowledge of numerical tools required for analyzing and solving problems in the field of environmental engineering.
2. To provide pre-requisite statistical knowledge to the students for analyzing the data/results.

Unit 1: Introduction (4)

Introduction: Birth of O. R., Methodology, Scope and Limitations, Types of O.R. Models, Applications, Use of computers in O. R., Optimization problem statement, Classification of optimization problems.

Classical Optimization Theory: Unconstrained optimization, constrained optimization with equality and inequality, Method of Lagrange multipliers, Kuhn-Tucker conditions

Unit 2: Linear Programming (6)

Linear Programming: Construction of LP model, Simplex method, Big M and two phase methods, Transportation and Assignment problems, Duality and sensitivity analysis

Unit 3: Non-linear Programming (6)

Non-linear Programming: Unconstrained optimization techniques, Classification of methods, steepest ascent, Newton method, constrained optimization, Separable and quadratic programming.

Unit 4: Dynamic Programming (5)

Dynamic Programming: Multistage decision process, recursive relationships, Principle of optimality, Computational procedure in DP, DP applications, Problem of dimensionality.

Unit 5: Numerical differentiation and Numerical integration (7)

Numerical differentiation and Numerical integration: Numerical solution of ordinary differential equation, Systems of ordinary differential equations, Runge – Kutta Method, Trapezoidal rule, Simpson's rule, Gauss – Siedel method, Jacobian method

Unit 6: Network Modeling (6)

Network Modeling: Fundamentals of CPM / PERT networks; CPM – construction of networks, critical path, forward and backward pass, floats & their significance, crashing for minimum cost and optimum and minimum duration, resource allocation and leveling. PERT – Time Estimates, Construction of Networks, Probability of completing projects by given date.

Unit 7: Genetic Algorithm (6)

Genetic Algorithm, Neural Networks and Fuzzy Systems: Introduction, Representation of decision variables, Objective function and constraints, GA operators, neural network based optimization, Optimization of fuzzy systems.

Term work: At least one assignment on above each unit.

Reference Books:

1. Introduction to O.R., 6/e (with floppy disk) – Hamdy A. Taha, (PHI)
2. Quantitative Techniques in Management, 2/e - N.D. Vora. (TMH)
3. Introduction to O.R., 7/e (with CD) – Hillier & Lieberman (TMH)
4. Operations Research – Hira & Gupta.
5. Operations Research – J.K. Sharma. (Mac Millan)
6. Operations Research – S.D. Sharma
7. Optimization in Operation Research – Ronald L. Rardin (Pearson education)
8 Genetic algorithm – Goldberg

SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester I

ELECTIVE – I: Project Management

Teaching Scheme
Lectures: 3 Hrs/ Week
Tutorial: 1 Hr / Week

Examination Scheme
Theory Paper: 100 Marks
Term Work: 25 Marks

Course Objectives:

1. To provide necessary knowledge of project management, planning and implementation
2. To provide necessary knowledge of project quality concept, risk management and global projects and challenges.

SECTION - I

1 Introduction to project management, necessity, project lifecycle, key stake holders, management process groups and their responsibilities, concepts of project initiation **(3)**

2 Project planning, scope, work breakdown structure, scheduling, PM planning software, cost estimating and planning, responsibility matrix, resource allocation and leveling/smoothening, Risk planning, procurement plans, communication and quality planning **(6)**

3 Project implementation, developing project team, team structure, leadership styles, relationship building, negotiating conflict, motivation and ethics. Project closure and post project analysis **(8)**

SECTION - II

4 Project quality concepts, planning and assuring project quality, quality audit, SWOT analysis, quality control tools **(6)**

5 Risk management, identification, analysis, prioritizing, tools and techniques for acceptance, avoidance and mitigation and documentation **(8)**

6 Global Project management, preparation, planning challenges, politics, culture and law, pitfall avoidance, control and closure, Computerized project management **(9)**

Term work : At least one assignment on above each unit.

Reference Books:

1. "Practical Project Management", R. G. Ghattas and Sandra.
2. "Planning, Performing and Controlling", Angus Robert and Norman Gundersen.
3. "Project Principles and Applications", Moder and Phillips.
4. "Project Management with CPM, PERT and Precedence Diagrams", VN.
5. "Engineering Management", Stoner. PHI
6. "A Text book of Management", A.S.Deshpande.
7. "Essentials of Management", Koontz, Dounell and Weigrick. TMH
8 "Management and Organization", Kast and Rosinweig. TMH
9 "Quantitative Techniques in Management - Vol. I", L.C. Jhamb. Eurasia.

SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester I

Elective - II : Energy Management

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work : 25Marks

Course Objective:

1. To study the basics of energy conservation methods, energy auditing and its benefits.
2. To provide the students with the concepts of energy management and energy economics.

SECTION - I

Unit 1: Sources of Energy (10)

Sources of Energy**:** Energy Scenario – Principles and Imperatives of Energy Conservation – Various Sources – Alternative – non conventional energy sources – Alternative energy sources-wind-Solar energy – Energy Consumption Pattern – Resource Availability – Role of Energy Managers in Industries.

Unit 2: Energy Auditing (10)

Energy Auditing: Energy Audit – Purpose, Methodology with respect of Process Industries – Power Plants, Boilers etc, - Characteristic Method Employed in Certain Energy Intensive Industries – Various Energy" Conservation Measures in Steam System – Losses in Boiler, Methodology of Upgrading Boiler Performance; Energy Conservation in Pumps, Fans, Aerators Compressors, Air conditioning and refrigeration systems, Function, Necessity

SECTION - II

Unit 3: Energy Conservation (12)

Energy Conservation: Total Energy Systems – Concept of total Energy – Advantages & Limitations – Total Energy System & Application – Potential & Economics of total Energy systems, water heat recovery.

Potential Areas for Conservation in Various Industries – Energy Management Opportunities in Electrical Heating, Lighting System, Cable Selection – Energy Efficient Motors – Factors Involved in Determination of Motor Efficiency.

Unit 4: Energy Economics (08)

Energy Economics**:** Importance of Energy Management, Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Life Cycle Costing, Carbon Credit.

Applications: Case studies on Sugar Industry, Thermal Power Plant; Petrochemical Industries, Educational Institutions.

Term work: At least six Assignments on above units

References Books:

1. Trivedi, P R, Jolka K R, Energy Management, Commonwealth Publication, New Delhi, 1997.
2. Witte, Larry C, Industrial Energy Management & Utilization, Hemisphere Publishers, Washington, 1988
3. CB Smith, Energy Management Principles, Pergamon Press, New York, 3rd Edition, 2004.
4. Hamies, Energy Auditing and Conservation; Methods, Measurements, Management & Case Study, Hemisphere, Washington, 1980.

SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester I

Elective - II : OPERATION AND MAINTENANCE OF TREATMENT PLANTS

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work: 25Marks

Course Objective:

1. To study the importance of good Operation & Maintenance and use of operation manuals.
2. To study operation and maintenance of water, wastewater treatment systems and air pollution control devices.

SECTION - I

Unit 1 **(5)**

Introduction: Need of O and M, Strategy for Good Operation and Maintenance, Limitations of O & M Strategy, Improvement O&M, Corrective and Preventive maintenance, Data: Detailed plans, Drawings, Operation manuals.

Unit 2 **(8)**

a) O & M of Water Supply System: Intakes: Problems; O & M; Record Keeping Safety, Pumps, Transmission Pipes: Problems; O & M

b) O & M of WTP: O & M of conventional units: Cascade Aerator; Flash Mixer; Clariflocculator; Filters; Chlorination, O & M of Iron Removal Plant, O & M of advanced units: Reverse Osmosis Unit; Demineralization Unit, Instrumentation & Scada Systems

Unit 3 **(7)**

O & M of Water distribution system: Problems; O & M, pipe breaks, failure observations and leakages, leak detection & control, O and M of Appurtenances, ESRs & MBRs, Management in Times of Water Shortage, System Surveillance, Monitoring System Performance, Water Meters, Flow Meters, Water Audit, Energy Audit, Public Awareness & Customer Relation

SECTION – II

Unit 4 **(6)**

a) O & M of Wastewater facilities: Sewer & Sewer Appurtenances, Planning for Sewer Maintenance, Necessity & Types of Inspection, Cleaning and rehabilitation, Hazards & Safety in sewer inspection/cleaning, Emergency Maintenance

b) O and M of Wastewater Treatment Plant: conventional units viz Screens, Grit Chamber, Primary Clarifier, Bioreactor, Secondary Clarifier, Chlorination, Pressure Filters, Sludge Drying Beds & advanced units viz Ion Exchange Plant, Reverse Osmosis Plant, Belt Press, Centrifuge, Filter Press.

Unit 5 **(5)**

O & M of Air Pollution Control Facilities: Particulate Matter Control equipments, Gravity Settling Chambers, Cyclones, Wet Cyclones, Inertial Separators, Bag Filters, Scrubbers, Electrostatic Precipitator, Gaseous Control Devices, Incinerators.

Unit 6 **(3)**

O and M Planning & Scheduling: Organizational Structure, Work Planning, Preparation and Scheduling, Cost Estimates, Total Productive Maintenance, Total Quality Management, Annual Shutdown Maintenance.

Term work:

a) Visit to Treatment plants, industries & preparation of report.
b) Case study of Water / Waste water Treatment plant & assignments based on above units /facilities.
c) Study of organizational structure of O & M in Municipal Corporation/ Industries.

References:

1. O & M of Water Treatment Plant –Charles R Cox
2. Wastewater Engineering- Metcalf & Eddy
3. CPHEEO Manual on Water Supply and Treatment
4. CPHEEO Manual on Sewerage and Sewage Treatment
5. Air Pollution- M N Rao, H V N Rao
6. Industrial Air Pollution Control Systems – Neumann

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M.E. (Environmental Engineering) Semester I

ELECTIVE – II : GREEN BUILDING

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper:100 Marks
Tutorial: 1 Hr / Week	Term Work: 25Marks

Course Objectives :

a) To study various parameters of climate and provisions to be made for obtaining comfort conditions in building.
b) To train the students to adopt techniques of reduction of various natural resources used in building.
c) To study various methods of improving indoor air quality in buildings.
d) To study various rating systems for Green Buildings.

SECTION - I

Unit 1: Sustainable Site Selection (10)

Sustainable Site Selection, Orientation, Building envelop, Building plan layout, Design of Doors and windows, Natural ventilation, Solar energy, Use of solar energy for water heating, Solar concentrators, Solar photovoltaic panels, Direct and indirect lighting, comparison of various lighting devices- electric tubes, incandescent lamps, CFL and LED lamps, Indirect lighting devices -Light Tubes, Fibre optic, Fresnel lense, Thermal Transmittance of Building

Unit 2: Bioclimatic Design of Building (05)

Components of Bioclimatic Design, Thermal Transmittance , Role & Designing of various Building Elements in Achieving thermal Performance, Concept of Embodied Energy, Embodied energy of various common building materials, Thermal properties of building components, Thermal storage, emissivity, reflectivity, Selection of materials and surface treatment for, Ventilation & lightening, Positioning of openings, Day lighting , Active and Passive Architecture, Hybrid system of active and passive refrigeration and air conditioning. Energy audit of building, Designing of various Passive Systems,

Unit 3: Green Rating of building (**05)**

Various rating systems LEED criteria, USGBS, CIII-Godrej Green rating, GRIHA, ASHRAE, CDM and Carbon trading, Environmental clearance of buildings.

SECTION - II

Unit 4: Water Efficiency (**06)**

Water Efficient Landscaping –Rain water harvesting, potable water and borewell recharging methods, Minimisation of water use, Dual flush, waterless urinals, smart controlled water taps, Segregation and treatment of wastewater, Various treatment technologies like septic tank, Anaerobic filter, CWTS, biogas plants advanced treatment options like carbon bed, reverse osmosis, electrodialysis, ion exchange, recycling of treated wastewater for different non potable purpose, Domestic solid waste – Segregation, earthworm composting other options.

Unit 5: Indoor Environmental Quality (**07)**

Low- VOC Emitting Materials - Adhesives & Sealants, Paints & Coatings, Carpet Systems, Composite Wood & Agro-fiber Products like coconut, jute, bamboo and their use as interiors

Unit 6: Recycling of Building materials (**07)**

Recycling of Building materials, Existing Walls, Floors & Roof, and Interior Non-Structural Elements. Construction Waste Management, Materials Reuse, Recycled Content,, Use of fly ash, foundry sand and other inert solid wastes in buildings Life cycle analysis, Construction phase, operation phase, demolition, Impact on environment and land use.

Term Work:

Term work consists of

1. Green and energy audit of one building
2. Suggested modifications for improving green rating and energy conservation in building studied.
3. Assignments based on all above units.

References:

1. Handbook of Energy Conscious building, IIT Mumbai Publication
2. Building Planning & Design, Y.S.Sane
3. Building Planning & Design, Shaha Kale
4. Lead Manual
5. GRIHA Manual

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M.E. (Environmental Engineering) Semester I

SEMINAR I

Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs / Week	Term Work: 25 Marks

Seminar-I shall be delivered on one of the advanced topics chosen in consultation with the guide after compiling the information from the latest literature and also internet. The concepts must be clearly understood and presented by the student. All modern methods of presentation should be used by the student. A hard copy of the report (25 to 30 pages A4 size, 12 fonts, Times New Roman, single spacing both side printed, preferably in IEEE format) should be submitted to the Department Post Graduate Committee (DPGC) before delivering the seminar. A PDF copy of the report in soft form must be submitted to the guide along with other details if any

SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester II

1. INDUSTRIAL WASTE TREATMENT

Teaching Scheme
Lectures: 3 Hrs/ Week
Tutorial: 1 Hr / Week

Examination Scheme
Theory Paper: 100 Marks
Term Work : 25Marks
Oral Exam: 25 Marks

Course Objectives:

1. To enable students to identify, characterize and develop alternative treatment options for industrial waste
2. To study the manufacturing process, water requirement, wastewater generation and conventional and novel techniques for treatment of industrial waste
3. To train students to identify and design specific treatment required for removal of hazardous and toxic pollutants from industrial wastes
4. To understand benefits and techniques of waste minimization in industries

SECTION – I

Unit 1 : Classification of Industries (8)

a. Agro based industries- Sugar, Distillery, Dairy, Pulp and paper mill, Textile
b. Chemical Industries –Pharmaceutical, Petroleum & Refining, Fertilizer, Tanning,
c. Engineering Industries- Steel, Electroplating, Foundries, sponge iron unit, alumina/aluminum manufacturing unit, copper smelter,
d. Thermal Power Plants Manufacturing processes, Water usage, Effluent Sources, Quantities and characteristics

Unit 2 : Waste Minimization Techniques (8)

Waste Audit**,** Volume reduction, Strength reduction, Neutralization, Proportioning, Equalization, Reuse and recycling concepts.

Unit 3 : Treatment of industrial waste (8)

Alternative treatment options for all above industries – Theory and design problems

a. Conventional treatment options- Physical, Biological & chemical methods,
b. Advanced treatment technologies- Membrane processes- Reverse osmosis, Ultra filtration, micro filtration - Process classification, Membrane configurations, Membrane fouling and its control,
c. chemical oxidation,
d. Electrodialysis: Theory, Area and power requirement, Disposal of concentrate waste streams.
e. Gas Stripping**:** analysis, design of stripping towers.

Unit 4 : Utilization and disposal of industrial waste (2)
Effluent Standards prescribed by MOEF/ Pollution Control Board

Unit 5 : Environmental Legislations with respect to industries (8)
Application for consent, Procedure for water cess, Procedure for environmental clearance, compliance w.r.t various sections of water act, Air act and EPA. Case studies of various environmental issues

Unit 6 : Common Effluent Treatment Plant (4)
Concept, Objectives, Methodology, Cost benefit analysis, Design, Operation and maintenance.

Unit 7 : (3)
Planning and management of industrial wastes (solid, liquid and gaseous) from small scale industries.

Term work:

1. Assignments based on above topics
2. Industrial visit report for any two industries

Text Books:

1. W .W. Eckenfelder Jr., "Industrial Water Pollution Control", McGraw-Hill Book Company, New Delhi, 2000.
2. "Theories and Practices of Industrial Waste Treatment", Nelson Nemerow, Wiley Publication Company, 1971, 1st Edition.
3. "Wastewater Engineering Treatment and Reuse", Metcalf And Eddy, Tata McGraw Hill Publication, 1979, 2nd Edition.
4. "Hazardous Waste Management", Wentz. C.A., McGraw Hill 1989, 1st Edition

Reference Books:

1. MOEF standards Guide for Treatment and Disposal of Waste from Various Industries".
2. H.M.Freeman, "Industrial Pollution Prevention Hand Book", McGraw-Hill Inc., New Delhi,
3. "Pollution Prevention: Fundamental & Practice", Bishop, P.L.,McGraw-Hill, 2000.
4. "Industrial Pollution Prevention", T.T.Shen, Springer, 1999.
5. "Industrial Wastewater Systems Hand book", R.L.Stephenson and J.B.Blackburn, Jr., Lewis Publisher, New Yark, 1998

SHIVAJI UNIVERSITY, KOLHAPUR

M.E. (Environmental Engineering) Semester II

2. BIOLOGICAL WASTEWATER TREATMENT

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Practical: 2 Hr / Week	Term Work : 25Marks
	Oral Exam 25 Marks

Course Objectives:

a) To provide students the necessary knowledge, concepts and recent trends of biological processes used for wastewater treatment.
b) To impart students with the skill of design and operation of secondary wastewater treatment units.

SECTION - I

Unit 1: Objectives and fundamentals of biological treatment **(4)**

Objectives and fundamentals of biological treatment, types of biological treatment processes, Microbial growth kinetics

Unit 2: Modeling suspended growth treatment processes **(9)**

Modeling suspended growth treatment processes Activated Sludge Process (ASP): Configurations and variations, Cyclic ASP, Process design and operating parameters, Operational problems, Evaluation of Biokinetic Parameters. Biological nitrification and denitrification. Design and operation of aerated lagoon, oxidation ditch, and facultative waste stabilization pond, Membrane bioreactor.

Unit 3: Modeling attached growth treatment processes **(6)**

Modeling substrate removal in attached growth treatment processes. Process, design considerations and operational problems for attached Growth aerobic biological treatment systems: Trickling filters and Rotating biological contactors. Secondary clarification

SECTION - II

Unit 4: Anaerobic processes **(7)**

Anaerobic processes, Process fundamentals, Growth kinetics, General design considerations, Types of anaerobic reactors. Process, design and operation of anaerobic lagoon, anaerobic filter and Upflow anaerobic sludge blanket systems

Unit 5: Sludge treatment and disposal **(6)**

Sludge treatment and disposal – characteristics, thickening, Sludge Digestion (anaerobic and aerobic), and disposal, Types of anaerobic digester and their selection, Design and operation of digesters. Stream and Effluent standards. Wastewater reclamation and reuse, Application of treated waste water on land for irrigation, Effect of dissolved solids

Unit 6: Wetland and aquatic treatment systems **(8)**

Wetland and aquatic treatment systems: Types, application, Treatment kinetics and effluent variability in constructed wetlands and aquatic systems, Free water surface and subsurface constructed wetlands, Floating plants (water hyacinths and duckweed), Combination systems, Design procedures for constructed wetlands, Management of constructed wetlands and aquatic systems

List of Practical:

1. Grab and composite sampling of wastewater

2. Analysis of wastewater for the following quality parameters:

    a) pH
    b) Alkalinity and Acidity
    c) Suspended solids, dissolved solids, volatile and fixed solids
    d) Organic matter in terms of Biochemical Oxygen Demand (Titrimetric and manometric sensor system)
    e) Organic matter in terms of Chemical Oxygen Demand
    f) Volatile acids
    g) Nitrogen and Phosphorous
    h) Heavy metals

Reference Books:

1. “Theory and Practice of Water and Wastewater Treatment”, Droste, Ronald L., John Wiley & Sons Publication, 1997, 1st Edition.
2. “Environmental Engineering”, Peavy, Rowe and Technologous MGH.
3. “Wastewater Engineering Treatment and Reuse”, Metcalf And Eddy, Tata McGraw Hill Publication, 1979, 2nd Edition.
4. “Environmental Engineering”, Sincero. A.P. And Sincero. G.A., Prentice Hall of India Private Limited, 1996, 1st Edition.
5. “Wastewater Treatment for Pollution Control and Reuse”, Arceivala S.J. and Asolekar, Tata McGraw Hill Publication, 2002, 2nd Edition.

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M.E. (Environmental Engineering) Semester II

3. ENVIRONMENT IMPACT ASSESSMENT AND LEGISLATION

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial : 1 Hr / Week	Term Work : 25 Marks

Course Objective

a) To study fundamentals and scope of Environment Impact Assessment.
b) To study the scope of environmental laws and various legal procedures in India for environment.

SECTION – I

Unit 1: Fundamentals of Environmental Impact Assessment, Scope & Contents (6)
Environmental Impact Assessment – Definition, Objectives, Types – Rapid and Comprehensive EIA, EIS, FONSI. Step-by-step procedure for conducting EIA and Limitations of EIA, Prevention of Significant Deterioration (PSD) Programme. Frame work of Impact assessment, scope and contents of EIA, methodologies and techniques of EIA.

Unit 2: Value functions of EIA, EMP & Case Studies (7)
Attributes, Standards and Value functions. Public participation in EIA. Environmental Management Plan (EMP) and Disaster Management Plan (DMP).
EIA Case Studies –Thermal Power Plant, Mining, Fertilizer, Construction Projects, Air port, Water and Wastewater Treatment Plants.

Unit 3: History of Environmental policy (8)
Environmental Policy : Pre & Post Independence Period; From Stockholm to Johannesburg Declaration (Rio) and Role of Government – Five year Plans – Forest Policy – Conservation strategy – Water Policy; Conservation of Natural Resources and its Management; Constitution and Environment: Right to Environment – Constitutional provisions on Environment and its Protection – Role of Judiciary on Environmental issues – Evolving of new Principles – Polluter pays principle – Precautionary principle – Public trust doctrine.

SECTION - II

Unit 4: International Law and Environmental Protection (7)
International Law and Environmental Protection: International conventions in the development of Environmental Laws and its Policy - From Stockholm to recent

conventions (Special Emphasis on Major conventions & Protocols) - Control on Marine Pollution; Common Law aspects of Environmental Protection; Remedies under other Laws (I.P.C., Cr.P.C, C.P.C.) - Riparian rights and prior-appropriation.

Unit 5: Indian Environmental Laws (8)

Prevention and Control of Pollution: Pollution of Water, Sources, Legal Control, The Water (P & CP)Act, 1974 - Pollution of Air, The Air (P & CP) Act, 1981 – Noise Rules, Noise Pollution and its control, Noise Pollution control order - Disposal of Waste, Hazardous Wastes (Management Handling & Transboundry) Act, 2008. Laws on waste, disposal and its control - Trans-boundary Pollution hazards & Regulation; Bio Medical Waste (Management & Handling) Rules, 1998 as amended. Biological Diversity and Legal Order: Bio-diversity and Legal regulation - Utilization of flora and fauna - Experimentation on animals - Legal and Ethical issues - Genetic Engineering - Wildlife Protection Act, 1972 - Forest Conservation Act, 1980 - Prevention of Cruelty against animals - Problems in Legal regulation of medicinal plants - The plant varieties Act - Wetland Conservation. Municipal Solid Waste (Management & Handling), Rules, 2000.

Unit 6: Environment Protection Act (4)

Environment Protection Act, 1986 including, Environment Protection Rules, Coastal Zone Regulation, ECO-Mark, Environment Impact Assessment, Environmental Audit, Public Participation in Environmental decision making, Environment information, public hearing, Regulation on Bio-Medical Waste.

Term work:

1. Assignments based on above all units.
2. Study of EIA report prepared

Reference Books:

1. Canter L., (1995), “Environmental Impact Assessment”, McGraw Hill.
2. Jain R.K., Urban L.V., Stacey G.S., (1977), “Environmental Impact Analysis – A New Dimension in Decision Making", Van Nostrand Reinhold Co.
3. Clark B.C. Bisett and Tomlinson P, (1985), “Perspective on Environmental Impact Assessment”, Allied Publishers.
4. Rau and Wooten, (1981), “Environmental Impact Assessment Handbook”. McGraw Hill
5. Simon Ball Stuart Bell - Environmental Law.
6. Sanjay Upadhyay and Videh Upadhyay - Handbook on Environmental Laws.
7. S. Shantha Kumar- Introduction to Environmental Law.
8. Relevant Bare Acts/Notifications.

Prescribed Books:

1. Armin Rosencranz - Environmental Law and Its Policy in India.
2. P. Leelakrishnan - Environmental Law in India /Cases.
3. Lal’s commentaries on Water and Air Pollution laws along with Environment (Protection) Act and Rules, 1986.

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M.E. (Environmental Engineering) Semester II

Elective - III: REMOTE SENSING AND GIS

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work : 25Marks

Course Objective:

a) To understand the principles, applications, trends, and pertinent issues of geographical information systems and sciences, including remote sensing (RS), Photogrammetry and cartography.
b) To develop applications of environmental remote sensing and GIS which can directly enhance service delivery on land use management, ground water management/prospects, agriculture, forestry, food and water security, disaster management, etc.

SECTION - I

Unit 1: Concepts of remote sensing (6)

Concepts of remote sensing; Energy sources and Radiation principles, spectral characteristics of earth's surface and of atmosphere. Sensors and their characteristics; Radiometers, cameras, multi-spectral scanners and microwave systems. Aerial and satellite platforms.

Unit 2 : Remote sensing imagery (6)

Optical, infrared and microwave imagery, Analysis of imagery, Visual and machine interpretation of imagery, Ground truth data, Digital image processing.

Unit 3 : Application of remote sensing (7)

Application of remote sensing – Land use and Land cover mapping, biodiversity, forestry and agriculture, soil erosion, water resources, wetland mapping, Wild life ecology, Environmental assessment, Environmental management, Urban and regional planning, Monitoring natural disasters.

SECTION - II

Unit 4 : Fundamentals of GIS **(4)**

Fundamentals of GIS: Definition, Components, spatial data, thematic characteristics, rasters and vectors, databases and database management.

Unit 5: Data input and Editing **(8)**

Data input and Editing: Data stream, data encoding, map digitization and conversion, data analysis, network and surface analysis in GIS, analytical modelling, forms of GIS output, decision support systems, GIS project design and management.

Unit 6 : GIS applications **(8)**

GIS applications: Forestry, Bio-diversity, Environment, Soil resource management, Hydrological modelling, Public utilities (water distribution, sewerage, solid waste management).

Term Work:

A) Assignments based on above units
B) Practicals based on :
   a) GPS Survey and Use of MAPSEND software
   b) Visual Interpretation of imagery and aerial photographs
   c) Digital Interpretation of imagery and aerial photographs
   d) Image Processing on IDRISI and CARTALINX
   e) Preparation of Thematic maps

References:

1. Remote Sensing and Image Interpretation – Lilles and Kiefer.
2. Introduction to the physics and techniques of Remote Sensing – Elachi.
3. Geographical Information System Vol. I and II– Longley.
4. An Introduction to GIS – Ian Haywood.

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M.E. (Environmental Engineering) Semester II

Elective: III - WATERSHED MANAGEMENT

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work : 25Marks

Course Objectives:

1. To provide knowledge about concept, necessicity & scope of watershed Management
2. To provide thorough knowledge of general, scientific &engineering approaches regarding proper planning & utilization of water using different technologies.
3. To enhance student skill for conservation & utilization of natural resources such as land, water and air for sustainable development
4. To inculcate in students professional and multi disciplinary approach for success in various branches of civil & environmental engineering.

SECTION - I

Unit 1:

a) Introduction to Watershed Management (3)

Concept of watershed, Introduction to watershed management, Watershed management policies and decision making, Place in environment, Global effects, Status in India, Historical background

b) Sustainable Watershed Management Practices (6)

Sustainable integrated watershed management, Natural resources management, agricultural practices, Integrated farming, Soil erosion and conservation, Reclamation of saline soils

Watershed Management Practices in different Regions, Short term and long term strategic planning

Unit 2: Integrated Approach of Watershed Management (5)

Introduction, Integrated water resources management, conjunctive use of water resources, rainwater harvesting; roof catchment system, Groundwater - potential & harvesting, well construction

Unit 3: Socio – Economic Aspect of Watershed Management (5)

Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Role of NGOs and International agencies

SECTION – II

Unit 4:

a) Modeling of Watershed (5)

Standard modeling approaches and classifications, Concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall- runoff process, subsurface flows and groundwater flow

b) Management of Water Quality (5)

Water quality and pollution, Types and sources of pollution**,** Water quality modeling, Environmental guidelines for water quality

Unit 5: Storm Water, Flood and Drought Management (6)

Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, Drought assessment and classification, drought analysis techniques, drought mitigation planning

Unit 6: Advanced Techniques in Watershed Management (4)

Applications of Geographical Information System (GIS) and Remote Sensing in Watershed Management

Term work:

A journal consisting of the following -

1. Preparing model management plan for one watershed in nearby area.
2. Field visit to an ideally managed watershed area & its report.
3. Plan & prepare budget for watershed.
4. To find economical viability of the watershed management plan.

References:

1. Murty, J.V.S. “Watershed Management”, New Age Intl., New Delhi 1998
2. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994
3. Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995
4. Vir Singh, Raj , Watershed Planning and Management, Yash Publishing House, Bikaner, 2000
5. Hydrology & Soil Conservation Engineering - Ghansham Das , Prentice Hall of India
6. Manual of Soil & Water Conservation Practices - Gurumal Singh, Oxford & IBH Publishing Company
7. Soil & Water Conservation Engineering - R. Suresh, Standard Publishers

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M.E. (Environmental Engineering) Semester II

Elective: III - ENVIRONMENTAL MODELLING AND SIMULATION

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work: 25 Marks

Course Objectives:

a) To impart knowledge of modeling and simulation(M&S) methodologies considering both practical and theoretical aspects.
b) To understand a wide range of M&S concepts that will lead students to develop their own M&S applications

SECTION – I

Unit 1: Fundamentals & Mathematical model of physical systems (9)

Fundamentals: Mass balance principle, Reaction kinetics (types of reaction, rate and order of reaction, Effect of temperature), Analysis of experimental data, Determination of rate constants

Mathematical model of physical systems- Hydraulic models of natural systems (Types of reactors), CFSTR, PFR Models, Ideal flow models, Mass balance applications

Unit 2: Modeling Water quality in Environment (5)

Modeling Water quality in Environment: Transport phenomena, Advection, diffusion, dispersion, Dispersion and mixing in streams, Air/water interface, Gas transfer (agitated and stagnant), pH modeling.

Unit 3 : Surface water quality modeling (6)

Surface water quality modeling-, Water quality in rivers & streams, Point and non-point sources, BOD model, Point source Streeter –Phelp equation, Nitrogenous BOD modeling, Sediment oxygen demand, Stream quality modeling using QUAL2E

SECTION – II

Unit 4 : Water quality of lakes & reservoirs (8)

Water quality of lakes & reservoirs- Hydraulic behavior, Effect of physical processes on Water quality, Modeling of lakes & reservoirs, 1D model, Vertical modeling, Ecological modeling, Significance, Eutrophication in flowing water.

Unit 5 : Subsurface water quality modeling (4)

Subsurface water quality modeling: Transport of non reactive & reactive contaminant in Ground water, Gaussian plume model

Unit 6 : Microbe / Substrate modeling and pH modeling (8)

Microbe / Substrate modeling: bacteria growth, substrate utilization, Microbial kinetics, batch and CSTR, toxicant modeling in flowing water.

pH modeling, Toxics substance model in CSTR, Bio-concentration and Bioaccumulation model.

Term Work:

A journal consisting of the following -

1. Assignments on each of the units
2. Study and application of QUAL2E model

Reference Books:

1. Surface water quality modeling - Steven Chopra, McGraw hill
2. Water quality modeling; modification - Tchobanoglous (Addision & Wesley Edward Schroedar)
3. Environmental Engineering - Sincero and Sincero
4. USEPA: www.epa.gov.in QUAL2E model
5. Metcalf & Eddy. Waste Water Engg. Treatment & Disposal, Tata McGraw - Hill Pub.

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M.E. (Environmental Engineering) Semester II

Elective: III - ENVIRONMENTAL MANAGEMENT SYSTEMS

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work : 25Marks

Course Objective:

a) To study various elements of Environmental Management System with reference to ISO 14001:2004.
b) To understand evaluation of environmental performance of an organization to meet the requirements of Environmental Management System.

SECTION - I

Unit 1: Introduction to ISO 14001 (2)

Definitions, Purpose, Scope, ISO 14001 family, Deming's PDCA Cycle, General requirements, EMS Elements.

Unit 2 : General Requirements and Planning (9)

Environmental policy, Compliance, Continual improvement, Pollution prevention Planning, Aspects, Aspects Procedure, Aspects list, Significant determination information, Significant aspects/impacts list, Legal and other requirements, Listings of applicable legal and other requirements, Appropriate instructions for compliance, Permits, manifests, Objectives and targets, Minutes/notes of objectives and target development, List of objectives and targets, Related action plans.

Unit 3: Implementation and Operation (9)

Structure & Responsibility, Job descriptions, Organizational charts, Training, Training needs listings/matrix, Manuals, course materials, Sign-in sheets, Test records, certificate copies,Communications, Specific work instructions, Records of communication and correspondence, Document control, Documents, procedures, and manuals, Operational control, Critical operations/aspects listing/matrix, Specific work instructions, Emergency plans and protocols, Practice and drill results, Environmental issues and instructions within other work instructions, Contractor policies, work orders,

Supplier requirements, Emergency response, Emergency plans and protocols, Practice and drill results.

SECTION – II

Unit 4: Checking and Corrective Action **(8)**

Monitoring and measurement, - Objectives and target action plans, Function-specific procedures and work instructions, Records of monitoring and measurement data collected, including calibration records, Nonconformance and corrective/preventive action, Corrective action reports, Evidence of discussion and follow-up (meeting notes, etc.), Records, Control of records.

Unit 5: EMS Auditing **(8)**

EMS audit, Specific audit procedures, checklists, forms, schedule, EMS audit notes and working documents, EMS audit reports.

Unit 6: Management Review **(4)**

Meeting agendas and attendance, Meeting minutes and action items, Evidence of follow-up actions, reports.

Term work:

Case study of at least one large scale industrial unit covering eighteen article of EMS manual

Reference Books:

ISO 14001 Standard Manual

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M.E. (Environmental Engineering) Semester II

Elective: IV - DISASTER PLANNING AND RISK ANALYSIS

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper:100 Marks
Tutorial : 1 Hr / Week	Term Work: 25 Marks

Course Objective:

a) Identify the objectives and scope of the disaster plan
b) Indicate an understanding of issues of formulating policies for disaster preparedness & risk analysis

SECTION - I

Unit 1: Fundamentals of Disaster (4)

Disaster - Definition, types, Classification, hazards and its types, Difference between natural disasters and manmade disasters

Unit 2 : Natural disasters (8)

Natural disasters – Causes of occurrence, consequences, Impact on human health, animal health, socioeconomic impacts, and impact on environment, major events of the past and recent , pattern of occurrence in India and world of following Natural disasters - Earthquakes, Floods, Tsunami, Landslide, Cyclones, Volcanoes, Drought and Pest infestation

Unit 3 Disaster Management for Natural disasters (8)

Disaster Management, Definition and Purposes, Planning and Control of Various Natural Disasters, Various Mitigative & Preventive Measures, Disaster Management Planning in India at Central level, State level, District & Local level, Application of Remote Sensing and GIS for Disaster Management

SECTION - II

Unit 4 : Manmade Disasters (7)

Manmade Disasters, types and causes of occurrences, Industrial Disasters and their impacts, Environmental disasters, definition and causes of occurrence and their Impacts

Unit 5: Disaster Management for Manmade Disaster (7)

Disaster Management for Manmade Disaster, Identification and control of hazards, Risk Analysis – Definition, Various Techniques of Risk Analysis for Industries- HAZOP, HAZAN, FMEA, Fault Tree Analysis, Event Tree Analysis

Unit 6: Risk Analysis for Environmental Disasters (5)

Risk Analysis for Environmental Disasters, Dose- Response Relationship, Control of Environmental Risk, Case studies

Term Work:

A journal consisting of

1. Assignments based on above units.
2. A visit report on any Major Risk Industry.

References :

1. Disaster Management - B.Narayan, APH Publishing Corporation
2. Industrial Disaster Management - Chakrabarty U.K., Asian company, new Delhi
3. Risk Assessment- An Environmental Perspective - Peter K.Lagoy, Jaico Publishing House, Mumbai
4. Industrial Occupational Safety, Health and Hygiene - A.H. Hommadi, Indian Bibliographies Bureau, New Delhi
5. Pesticides, Man and Biosphere - O.P.Shukla, APH Publishing Corporation, New Delhi
6. Websites of Government of India

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M.E. (Environmental Engineering) Semester II

Elective: IV - ENVIRONMENTAL GEO-TECHNOLOGY

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ Week	Theory Paper: 100 Marks
Tutorial: 1 Hr / Week	Term Work: 25 Marks

Course Objective:

a) To understand the principles of Environmental Geo-technology.

b) To understand soil- contaminant interaction, contaminant transport and remediation in soil strata.

SECTION – I

Unit 1: Soil- Pollutant Interaction (6)

Soil- Pollutant Interaction: Introduction to geo environmental engineering – environmental cycle – sources, production and classification of waste – causes of soil pollution – factors governing soil-pollutant interaction- Physico-chemical behavior and modeling -failures of foundations due to pollutants

Unit 2: Characterization, Stabilization and Disposal (7)

Characterization, Stabilization and Disposal: Safe disposal of waste – site selection for landfills – characterization of land fill sites – waste characterization –stability of landfills – current practice of waste disposal- passive contaminant system - Hazardous waste control and storage system – mechanism of stabilization - solidification of wastes – micro and macro encapsulation – absorption, adsorption, precipitation- detoxification —- organic and inorganic stabilization

Unit 3: Transport of Contaminants (7)

Transport of Contaminants: Contaminant transport in sub surface – advection – diffusion – dispersion – governing equations – contaminant transformation – sorption – biodegradation – ion exchange – precipitation –hydrological consideration in land fill design – ground water pollution – bearing capacity of compacted fills – pollution of aquifers by mixing of liquid waste – protecting aquifers.

SECTION - II

Unit 4: Detection and Testing Methods (5)

Detection and Testing Methods: Methodology- review of current soil testing concepts – Proposed approach for characterization and identification of contaminated ground soil for engineering purposes

Unit 5: Remediation of Contaminated Soils (8)

Remediation of Contaminated Soils: Rational approach to evaluate and remediate contaminated sites – monitored natural attenuation – exsitu and insitu remediation – solidification, bio – remediation, incineration, soil washing, electro kinetics, soil heating, verification, bio venting –

Unit 6: Ground water remediation (7)

Ground water remediation – pump and treat, air sparging, reactive well- application of geo synthetics in solid waste management – rigid or flexible liners.

Term work:

1. Assignments based on above unit
2. Report on field visit to contaminated site

References:

1. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
2. Daniel, B.E., Geotechnical practice for waste disposal, Chapman and Hall, London, 1993.
3. Fang, H.Y. Introduction to environmental Geotechnology, CRC press New York, 1997.
4. Lagrega, M.d., Bukingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill,Inc. Singapore, 1994.

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M.E. (Environmental Engineering) Semester II

SEMINAR II

Teaching Scheme	**Examination Scheme**
Practical: 2 Hr / Week	Term Work: 25 Marks

Seminar - II shall be delivered preferably on the topic of dissertation or at least the area of dissertation. The concepts must be clearly understood and presented by the student. All modern methods of presentation should be used by the student. A hard copy of the report (25 to 30 pages A4 size, 12 fonts, Times New Roman, single spacing both side printed, well formatted preferably in IEEE format) should be submitted to the DPGC before delivering the seminar. A PDF copy of the report in soft form must be submitted to the guide along with other details if any.