MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(Deemed University)

(Declared Under Distinct Category by Ministry of Education, Government of India)

NAAC Accredited with A++ Grade

Department of Civil Engineering

Scheme of Evaluation

M. Tech. I Semester *(Environmental Engineering)* *(for batch admitted in academic session 2024-25)*

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
1.	53241101	DC	Environmental Chemistry & Microbiology	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2 Hrs
2.	53241102	DC	Solid Waste Management	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
3.	53241103	DC	Advanced Treatment Process – I (Waste Water Engineering)	20	20	30	30	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
4.	532411XX	DE	**Departmental Elective (DE-1)**	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2 Hrs
5.	53241104	SPC	Urban Water Infrastructure **(SPC-1)**	20	20	30	30	-	-	100	3	-	-	3	Face to Face	PP	2 Hrs
6.	53241105	DLC	Environmental Engineering Lab[#]	-	-	-	-	70	30	100	-	-	4	2	Experiential	SO	-
7.	53241106	SLP	**Seminar/Presentation**[$]	-	-	-	-	70	30	100	-	-	4	2	Mentoring	SO	-
8.	53241111	NEC	**Classified Novel Engaging Course (Activity Based Learning)** MS Project & Excel	-	-	-	-	-	50	50	-	1	-	1	Interactive	SO	-
Total				**100**	**100**	**150**	**150**	**140**	**110**	**750**	**13**	**03**	**08**	**20**	-	-	-

MCQ: Multiple Choice Question **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

[#] During lab, students have to perform practical/assignments/minor projects related to the courses of respective semester using recent technologies / languages / tools etc.

[$] Seminar/Presentation through SWAYAM / NPTEL (Registration in a course will be compulsory for students but assessment will be based on internal seminar presentation).

DE-1		
S. No.	**Course Code**	**Course Name**
1.	53241107	Industrial Waste Management
2.	53241108	Hazardous Waste Management
3.	53241109	Environmental Auditing & Management System
4.	53241110	Maintenance Management

Mode of Learning					Mode of Examination					Total Credits
Theory		Lab		NEC	Theory			Lab	NEC	
Face to Face	Online	Mentoring	Experiential	Interactive	PP	MCQ	OB	SO	SO	
15		2	2	1	15			4	1	20
75%		10%	10%	5%	75%			20%	5%	Credits %

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Scheme of Evaluation

M. Tech. II Semester *(Environmental Engineering)* *(for batch admitted in academic session 2024-25)*

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted								Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block		MOOCs									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation	Assignment	Exam		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional											
1.	53241201	DC	Air Pollution & Control	20	20	30	30	-	-	-	-	100	3	-	-	3	Face to Face	PP	2 Hrs
2.	53241202	DC	Advanced Treatment Process – II (Water Supply Engineering)	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
3.	53241203	DC	Environmental Impact Assessment	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
4.	532412XX	DE	**Departmental Elective* (DE-2)**	-	-	-	-	-	-	25	75	100	3	-	-	3	Online	MCQ	3 Hrs
5.	53241204	SPC	Emerging technologies for Environmental Management **(SPC-2)**	20	20	30	30	-	-	-	-	100	2	1	-	3	Face to Face	PP	2 Hrs
6.	53241205	DLC	Advanced Environmental Engineering Lab#	-	-	-	-	70	30	-	-	100	-	-	4	2	Experiential	SO	-
7.	53241206	SLP	**Seminar/Presentation$**	-	-	-	-	70	30	-	-	100	-	-	4	2	Mentoring	SO	-
8.	53241207	NEC	**Classified Novel Engaging Course (Activity Based Learning)** Fire Safety & Regulation in Building	-	-	-	-	-	50	-	-	50	-	1	-	1	Interactive	SO	-
Total				**80**	**80**	**120**	**120**	**140**	**110**	**25**	**75**	**750**	**12**	**04**	**08**	**20**	-	-	-

MCQ: Multiple Choice Question **PP:** Pen Paper **SO:** Submission + Oral **OB:** Open Book

* This course will run through SWAYAM / NPTEL /MOOC based learning platform (with credit transfer facility). The course can be related & relevant to other domain as well.

During lab, students have to perform practical/assignments/minor projects related to the courses of respective semester using recent technologies / languages / tools etc.

$ Seminar/Presentation through SWAYAM / NPTEL (Registration in a course will be compulsory for students but assessment will be based on internal seminar presentation).

DE-2* *(through SWAYAM / NPTEL /MOOC)*		
S. No.	**Course Code**	**Course Name**
1.	53241208	Plastic Waste Management

Mode of Learning					Mode of Examination					Total Credits
Theory		Lab		NEC	Theory			Lab	NEC	
Face to Face	Online	Mentoring	Experiential	Interactive	PP	MCQ	OB	SO	SO	
12	3	2	2	1	12	3		4	1	20
60%	15%	10%	10%	5%	60%	15%		20%	5%	Credits %

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Scheme of Evaluation

M. Tech. III Semester *(Environmental Engineering)* *(for batch admitted in academic session 2024-25)*

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	53242101	DLC	**Preliminary Dissertation** *(Literature Review/ Problem Foundation/ Synopsis/ survey paper, etc.)*	-	-	-	-	175	75	250	-	-	28	14	Interactive	SO	-
Total				-	-	-	-	175	75	250	-	-	28	14	-	-	-

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Department of Civil Engineering

Scheme of Evaluation

M. Tech. IV Semester *(Environmental Engineering)* *(for batch admitted in academic session 2024-25)*

S. No.	Course Code	Category Code	Course Name	Maximum Marks Allotted						Total Marks	Contact Hours per week			Total Credits	Mode of Learning	Mode of Major Evaluation	Duration of Major Evaluation
				Theory Block				Practical Block									
				Continuous Evaluation			Major Evaluation	Continuous Evaluation	Major Evaluation		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
1.	53242201	DLC	Dissertation	-	-	-	-	350	150	500	-	-	32	16	Interactive	SO	-
Total				-	-	-	-	**350**	**150**	**500**	-	-	**32**	**16**	-	-	-

Course Code: 53241101

Course Name: Environmental Chemistry & Microbiology

L	T	P	Credit
3	0	0	3

Course Objective:

To impart knowledge of environmental chemistry and microbiology, and apply these concepts in the analysis of water and wastewater.

Syllabus:

Unit I:

Environmental Chemistry

Basic Principles: Physical and chemical properties of water and their significance in environmental engineering- Types of chemical reactions – stoichiometric calculations – solutions – chemical equilibrium. Acid-base equilibria – alkalinity, acidity, buffers and buffer index – Chemical thermodynamics – Oxidation-Reduction – Mass transfer and transport of impurities in water and air – diffusion, dispersion – Physical and chemical interactions due to various forces, suspensions and dispersions.

Unit II:

Analysis: Basic concepts of quantitative analytical chemistry – Instrumental methods of analysis – Determination of turbidity, colour, pH, acidity, alkalinity, hardness, residual chlorine and chlorine demand, chlorides, dissolves oxygen demand, nitrogen, solids, iron and manganese, fluoride, sulphate, phosphorous and phosphate, grease, volatile acids, gas analysis – Preparation of standard solutions – Drinking water and wastewater standards – Trace organics and inorganics.

Unit III:

Environmental Microbiology

Introduction: Microorganisms – Classification, prokaryotic and eukaryotic cells, structure, characteristics, nucleic acids, DNA and RNA, Viruses, their detection and quantification – Microscopy – Measurements and isolation of Microorganism – Different Cultures – Media and Techniques of Staining and Enumeration of microorganism.

Unit IV:

Microbial metabolism and growth: Enzyme and enzyme kinetics – Metabolism – Respiration – Fermentation – Glycolysis – Kreb's cycle – Carbohydrate – Protein, lipids, significance of energetic – Chemical composition of cell and nature of organic matter used by microorganisms – Metabolic classification of microorganisms: phototroph, chemotroph, applications in environmental engineering.

Unit V:

Microbiology of water and wastewater: Distribution of microorganisms in natural water – Indicator organisms – Coliforms – Faecal coliforms – E.coli, streptococcus faecalls – Differentiation of coliforms – Significance – MPN – M.F. techniques – Microbiology of waste-water treatment processes such as activated sludge process – Trickling filter – Anaerobic processes.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of environmental chemistry & microbiology.

CO 2: Apply the concepts of environmental chemistry in environmental engineering.

CO 3: Analyze water and waste water quality parameters using the concepts of environmental chemistry.

CO 4: Apply the concepts of environmental microbiology in environmental engineering.

CO 5: Explain the concepts of energy generation in cells.

Books Recommended:

1. Maier R.M. Pepper I.L and Gerba C.P. Environmental Microbiology, Elsevier- AP, New York 2009.
2. Pelczar Jr, M.J., Chan E.C.S., Krieg R.N., and Peiczar M.F., Microbiology, Tata McGraw-Hill, New Delhi, 1996.
3. Sawyer C.N., McCarty P. L., and Parkin G.F., Chemistry for Environmental Engineers,McGraw-Hill, New Delhi, 1994.
4. Benefield, Judkins and Weand – Process Chemistry for Water and Wastewater Treatment, Prentice Hall, New Delhi, 1996.
5. Rittman B. McCarty P.L., and McCarty P., Environmental Biotechnology: Principles and Applications, McGraw-Hill, New Delhi, 2000.

Course Code: 53241102

Course Name: Solid Waste Management

L	T	P	Credit
2	1	0	3

Course Objective:

To provide broad knowledge on various aspects of planning, designing and implementation of waste management system.

Syllabus:

Unit I:

Introduction: Introduction to waste management, classification of solid waste, objective of solid waste management, Solid waste sources – Nature and characteristics (physical, chemical & biological) – Quantities and Qualities – Generation rates – Potential of disease – Nuisance and other problems, MSW rules.

Unit II:

Collection and Storage: Solid waste management – Functional elements of solid waste – on – site storage – Collection and separation – Containers and its location – Collection systems and its example – Vehicle routing – Route balance – Transfer station – Processing – Recovery and reuse.

Unit III:

Processing of Municipal Solid Waste: Conveying and compacting waste – Shredding – Types of shredders – Material separation – Types – Devices for material separation – Thermal processing of municipal solid waste – incineration, pyrolysis, gasification – Refuse Derived fuel – Biological process like composting, Vermicomposting and biomethanation.

Unit IV:

Disposal: Disposal methods – Sanitary land filling – Planning – Site selection – Landfill Process Monitoring Closure – Post closure monitoring – leachate management & control of gases in landfills, environmental monitoring of landfills.

Unit V:

Financing & PPP in Waste Management: Introduction to swachh bharat mission - current status & challenges. Introduction to Financing & Public Private Partnership (PPP) in waste management projects.

Special Waste Management: Introduction to the management of bio medical waste & e-waste

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the principles & concepts of waste management.

CO 2: Apply various techniques of handling the waste.

CO 3: Apply various techniques of processing of waste.

CO 4: Plan an effective waste disposal system.

CO 5: Plan an efficient waste management project.

Text Books:

1. Text Book of Solid Wastes Management, Iqbal H. Khan and Naved Ahsan, CBS Publishers,1st edition 2012
2. Integrated Solid Waste Management, Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, McGraw Hill Yew York, 1993

Reference Books:

1. Environmental Engineering, Rowe, Peavy & Tchobanogolous, Tata McGraw Hill Publications,2017
2. CPHEEO, Manual on Municipal Solid Waste management, Central Public Health andEnvironmental Engineering organization, Government of India, New Delhi, 2016
3. Solid Waste Engineering, Vesilind P.A., Worrel H. W. and Reinhard, Thomson Learning Inc, 2003
4. Charles A. Wentz, Hazardous Waste Management, McGraw Hill, New York. 1995.
5. David Rimbers, Municipal Solid Waste Management: Pollution Technologies Review, NoyesData Corporation, London, 1990.
6. Michael D. Lagrega, Philip L. Buckingham, Jeffrey C. Evans. Hazardous Waste ManagementMcGraw Hill, New York. 1994.

Course Code: 53241103

Course Name: Advanced Treatment Process – I (Waste Water Engineering)

L	T	P	Credit
2	1	0	3

Course Objective:

To impart knowledge on sewerage systems, sewage composition and characteristics, effluent disposal standards, and various sewage treatment techniques, including advanced processes.

Syllabus:

Unit I:

Estimation of sewage flow, fluctuations in flow, estimation of storm water quantity, self-cleansing velocity, systems of sewerage, design of sanitary sewer & storm water sewer, sewer materials, sewer appurtenances, construction & maintenance of sewer lines, sewage characteristics.

Unit II:

Conventional municipal waste water treatment flow sheet, functions of different unit process, unit operations, treatment requirements. Preliminary treatment: screening, grit removal, design of screen, grit chamber. Primary Treatment: principles of sedimentation, design of sedimentation tanks and skimming tanks. Biological Treatment: principles & objectives of biological treatment, types of biological treatment, fundamentals of process kinetics, kinetics of biological growth, reactors – classification, selection, aspects of reactor design.

Unit III:

Attached & suspended growth biological treatment system, design of activated sludge process, trickling filters, oxidation ponds, septic tanks, imhoff tanks, rotating biological contactors, aerated lagoon, oxidation ditch, anaerobic treatment – UASB process, anaerobic filters, anaerobic digester, anaerobic lagoons.

Unit IV:

Advanced waste water treatment: requirement of tertiary treatment, disinfection, nitrogen removal, phosphorus removal, adsorption, removal of dissolved inorganic substances using various filtration techniques like R.O., ultra-filtration etc, electrodialysis. Recent techniques of waste water treatment – MBBR, MBR, SBR, constructed wetlands.

Unit V:

Sludge treatment: sources of sludge, sludge quantity & quality, sludge thickening and digestion, various methods of sludge treatment, sludge drying beds, sludge disposal.

Sewage disposal: stream & effluent standards for various purposes, dilution methods, natural purificationof stream, oxygen sag curve & its analysis, disposal of sewage on land, methods of sewage farming.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of waste water engineering & treatment.

CO 2: Determine the requirements of safe disposal of sewage.

CO 3: Apply various techniques for treatment of sewage.

CO 4: Apply various techniques of sludge treatment and disposal.

CO 5: Design sewage system for safe disposal of sewage**.**

Text Books:

1. Sewage Disposal & Air Pollution Engineering, S. K. Garg, Khanna Publishers, 2016
2. Metcalf & Eddy, Inc. Wastewater Engineering, Treatment and Reuse. 3rd Edition, TataMcGraw-Hill, New Delhi, 2003.

Reference Books:

1. Waste Water Engineering, B.C. Punmia, Laxmi Publication.
2. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, New Delhi
3. Wastewater Treatment Plant, Planning Design & Operation, S.R. Qasim, CRC Press, 1998
4. CPHEEO, Manual on Sewerage and Sewage Treatment, Ministry of Urban Development, Central Public Health and Environmental Engineering organization, Government of India, New Delhi, 2013.

Course Code: 53241104

Course Name: Urban Water Infrastructure

L	T	P	Credit
3	0	0	3

Course Objective:

To impart an extensive understanding of how urbanization affects hydrology and the water cycle, as well as strategies for managing storm water and flooding, collecting rainwater, and designing and optimizing urban water systems using hydraulic and hydrological modelling techniques. The course emphasizes practical applications, design methodologies, and the integration of advanced modeling software like SWMM and SMADA to promote sustainable water infrastructure solutions in urban environments.

Syllabus:

Unit-I:

Urbanisation and its effects on water-cycle, Urban water cycle, effect of urbanization on hydrology, significance of short duration intense rain fall and runoff, estimation of surface runoff, TOC and its estimation, factors affecting surface runoff, separate and combined system, IDF curves, urban drainage system, peak flow estimation, NRCS curve number approach, appurtenances, data requirements, interaction between urban drainage and solid waste

Unit-II:

Storm water drainage structures , source control, design of storm water network, good storm water management practices ,detention and retention facilities, pumping constructed wet land, swales, conservation of water bodies and natural wet lands, waste water and storm water reuse, receiving water quality standards

Unit-III:

Flood mitigation: Flood routing, reservoir routing (various methods), design flood, envelope curve, empirical and rational formulae, frequency analysis, probability plotting, Gumbles method, Rational flood frequency analysis, urban infra structures for flood relief.

Unit-IV:

Rain water harvesting: Importance, types of rain water harvesting system, soil and geological strata characteristics affecting design of harvesting system, design of storage, settlement tank, recharge structures and design, provision of CPHEEO/CPWD manual on rain water harvesting, case studies, design of rain water harvesting system, sizing of infiltration and percolation basin.

Unit-V:

General principles of hydrological modelling, rational and empirical approach, time area method, unit hydrograph method, physically based distributed method, hydraulic modelling, model calibration and validation, probabilities models, expert systems, use of model SWMM, SMADA.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Identify the basic elements of urban hydrology and their effect on flood, water pollution, water scarcity and catchment.

CO2: Analyze flood and its character and pattern.

CO3: Design suitable storm water disposal facilities.

CO4: Plan strategy to control and mitigate the flood and to propose suitable flood relief infrastructure.

Reference Books:

1. Storm water Hydrology & Drainage, Stepheon D, Elseiver Publication
2. Storm water management, Wanielista . MP & Yousef, John Wiley & Sons
3. Storm water detention for drainage, water quality and CSO management, Stahre Peter, Prentice Hall
4. Manual on drainage in urban areas, UNESCO Press

Course Code: 53241107

Course Name: Industrial Waste Management

L	T	P	Credit
3	0	0	3

Course Objective:

To provide a comprehensive understanding of sewage disposal methods, wastewater treatment techniques, effluent treatment plants, wastewater reuse, waste audits, and industry-specific waste management techniques.

Syllabus:

Unit-I:

Effects of wastes on streams and sewage treatment plant, natural purification of streams, oxygen sag curve, allowable organic load on streams, classification of stream, stream standards and effluent standards requirement of water for different purposes.

Unit-II:

Sampling of waste waters, Grab, Composite and Integrated samples, analysis of waste water, Biochemical Oxygen Demand, Chemical Oxygen Demand and pH value of waste water, Toxicity of waste by Bioassay method.

Pre-treatment of Wastes: Volume and strength reduction, source reduction of wastes, salvage of materials, recovery of by products, reuse of waste water.

Unit-III:

Equalization, Neutralization, Removal of suspended solids, removal of inorganic and organic dissolved solids, sludge treatment & disposal, Advance methods of treatment such as Adsorption, Reverse Osmosis, Ion Exchange Process, Electro Dialysis, etc.

Unit-IV:

Industrial Waste water and environmental impacts, Industrial waste survey, Industrial and common effluent treatment plants, zero effluent discharge systems, Waste management approach, Waste Audit – Evaluation of pollution prevention options.

Unit-V:

Brief study of industrial processes and treatment methods of waste water from common industries suchas Textile, Dairy, Paper and pulp, Tannery, Distillery, petrochemicals, pharmaceuticals, fertilizers, cement & food processing.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain basic concepts of industrial waste management.

CO2: Evaluate the effects of industrial waste on streams as per the standards.

CO3: Determine the requirements for safe disposal of sewage.

CO4: Apply suitable techniques for reduction & treatment of industrial waste & sludge.

CO5: Explain waste management techniques of different industries.

Text Books:

1. Industrial Waste Water Treatment – A.D. Patwardhan, PHI, Delhi

2. Waste Water Engg. – Treatment Disposal & Reuse – Metcalf & Eddy – Tata Mc Graw Hill, New Delhi

3. Industrial Water Pollution Control – W.W. Eckenfelder, McGraw Hill, 1999.

Reference Books:

1. Wastewater Treatment – M.N. Rao & Dutta, Oxford & IBH Publishing House, New Delhi.

2. Waste Water Treatment – Arceivala – Tata Mc Graw Hill, New Delhi, 2006.

3. Industrial Waste Water Management hand book – N.S. Azad, Tata Mc Graw Hill, New Delhi

4. Pollution Control in Process Industries – Mahajan, Tata McGraw Hill, Delhi, 1984

5. Liquid Waste of Industries – Theories, Practice and Treatment – N.L. Nemerow, Wesley Publishing Co.

Course Code: 53241108

Course Name: Hazardous Waste Management

L	T	P	Credit
3	0	0	3

Course Objective:

To make students aware about various sources, types and classification of hazardous waste to plan its environmental safe management & disposal in accordance with prevailing management rules. The course will appraise students regarding various waste treatment techniques and disposal method being used in modern days.

Syllabus:

Unit I: Definition, identification, characterization, classification, sources, Environmental significance, waste minimization, waste exchange, recycling, health implications, fate & transport of chemicals, waste tracking system, transport of contaminants.

Unit II: Treatment Technologies: Biological, Chemical, Physico- chemical treatment, incineration, stabilization, solidification, disinfection, irradiation, waste exchange, soil vapour extraction, air stripping, chemical oxidation, disposal of hazards waste, remediation.

Unit III: Biomedical, Plastic & Electro plating Industry Waste: Sources, characterization, measurement, Generation, Storage, Collection, treatment and disposal.

Unit IV: Electronic, Nuclear, Power Plant & Petrochemical Industry Waste: Sources, characterization, Measurement, Generation, storage, Collection, Treatment and disposal

Unit V: Hazardous Waste Laws & Regulations: Relevant Regulations, (management and handling), biomedical waste management and rules, flyash management rules, recycled plastic uses rules, batteries disposal and management rules, risk defining, risk assessment, ground water remediation. Case studies

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Classify and characterize various types of hazardous waste

CO2: Identify suitable technology for treatment of hazardous waste

CO3: Apply various treatment and disposal techniques in managing hazardous waste

CO4: Plan hazardous waste management system ad per prevailing rules & regulations

Reference Books:

1. Industrial Water Pollution Control – W.W. Eckenfelder, McGraw Hill.
2. Treatment & Disposal of Industrial Waste, Besselviere E & Schwartz, McGraw Hill
3. Integrated Solid Waste Management: Engineering Principles and Management Issues, Tchobanoglous, Theisen & Vidil, McGraw Hill
4. Solid Waste Engineering, Worrel & Vesilind, Cengage Learning
5. CPHEEO Manual for Solid Waste Management

Course Code: 53241109/51241110

Course Title: Environmental Auditing & Management System

L	T	P	Credit
3	0	0	3

Course Objective:

To provide broad knowledge on environmental management systems, including principles of environmental auditing, the application of LCA, EMS approaches and ISO standards, and concepts of social accountability.

Syllabus:

Unit I: Concepts of Environmental Audit, objectives of audit, types of audit, features of effective auditing, audit criteria, elements of audit process, planning and organizing audits, pre-visit data collection, audit protocol, onsite audit, data sampling, inspection, evaluation and presentation, exit interview, audit report, action plan, management of audits, waste management contractor audits, environmental statement.

Unit II: Environmental audit in Industrial projects, case studies of environmental audits, Life cycle assessment approach (LCA), life cycle costing, eco labeling, stages in LCA of product, procedures for LCA, applications of LCA, sustainable approach towards environment management, green building & green energy concepts and management.

Unit III: Environmental Management Systems Approach (EMS): Introduction, principles & elements of successful environmental management, basic concepts of EMS approach, ISO principles, essential elements of an EMS & ISO 14001, benefits of an environmental management system, creating an EMS in line with ISO 14000.

Unit IV: Environmental Management Planning, EMS development and implementation project and plan, measurement and evaluations required for an EMS, environmental management reviews and improvements, legal and regulatory concerns, Integrating ISO 9000 & ISO14000, EMAS.

Unit V: Social Accountability: requirements, social accountability (SA) 8000 certification, elements of social management system, social policy, planning, implementation, business benefits, corporate social responsibility (CSR), and different models.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Illustrate the process of environmental auditing.

CO2: Demonstrate the environmental audit process in industry and other projects.

CO3: Explain the concepts of environmental management system approach through ISO guidelines.

CO4: Apply various environment management methodologies like LCA, social accountability.

CO5: Develop EMS in organizations and improve the existing EMS system.

Text Books:

1) A. K. Shrivastava, Environmental Auditing, APH Publishing, 2003.
2) T.V. Ramachandra, Vijay Kulkarni, Environmental Management, TERI Press, 2009
3) Richard Welford, Corporate Environmental Management, Universities Press (India), 1996
4) Christopher Sheldon, Environmental Management Systems, Routledge Edition, 2006
5) Mitlon P Dentch, ISO 14001:2015 Implementation Handbook, ASQ, 2017

Reference Books:

1) R. D. Tripathi, An Introduction to Environmental Audit, Alfa Publication.
2) Vasanthakumar, N.Bhat, Total Quality Environmental Management : An ISO 14000 Approach, Praeger publishers, 1998
3) Alan S. Morris, ISO 14000, Environmental Management Standards, Wiley International, 2003.
4) Syed Imtiaz Haider, Environmental Management System ISO 14001:2004, CRC Press, 2010
5) Deborah Leipziger, Social Accountability SA8000, Viva Books Private Limited, 2010
6) B Banerjee, Corporate Environmental Management, PHI Publications, 2009.

Course Code: 53241105

Course Name: Environmental Engineering Lab

L	T	P	Credit
0	0	4	2

Course Objective:

To acquire knowledge of sampling techniques and develop skills to determine the physical, chemical, and biological characteristics of water.

Syllabus:

Introduction to Sampling Procedure, Types of Sampling, Collection of Samples & Preservation of Sample.

List of Experiments:

1. Determination of pH of water sample.
2. Determination of Turbidity of water sample.
3. Determination of Total Solids (Suspended & Dissolved Solids) of water sample.
4. Determination of Acidity of water sample.
5. Determination of Total Alkalinity of water sample.
6. Determination of Total Hardness, Calcium Hardness, Magnesium Hardness of water sample.
7. Determination of Chloride of water sample.
8. Determination of Sulphate of water sample.
9. Determination of Residual Chlorine of water sample.
10. Determination of DO in water sample.
11. Determination of Optimum Dosage of Coagulants using Jar Test.
12. Determination of MPN of water sample.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Follow sampling procedure & other guidelines for sampling & analysis of water samples.

CO 2: Check various water quality parameters.

CO 3: Develop skills to analyze and interpret the experimental data for identifying potential causes of water contamination.

Reference Books:

1. Water Supply Engineering, S.K. Garg, Khanna Publishers, New Delhi, 2017.
2. BIS 3025 Methods of Sampling & Test for Water & Waste Water, BIS 1622.
3. APHA Standard Methods for Examination of Water & Waste water, 2012.

Course Code: 53241106

Course Name: Seminar / Presentation

L	T	P	Credit
0	0	4	2

Course Objective:

To enhance students' understanding of Environmental Engineering by encouraging the study of diverse literature, fostering lifelong learning, and developing the soft skills necessary for effective presentation.

Syllabus:

Any relevant topic related to Environmental Engineering from within or beyond the syllabus through Swayam / NPTEL/MOOC.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Analyze contemporary issues in Environmental Engineering & its allied areas.

CO 2: Demonstrate good oral communication skills.

CO 3: Develop poster and power point presentations for effective communication.

Course Title: MS Project and Excel

Course Objective:

Understand the fundamentals of project management and the role of MS Project and Excel.

Course Modules:

Module 1: Introduction to Project Management

- Overview of Project Management principles
- The role of software in project management
- Introduction to MS Project and Excel
- Setting up a new project
- Defining project scope and goals
- Work breakdown structure (WBS)
- Task creation and management
- Setting up milestones

Module 2: Resource and Cost Management in MS Project

- Resource allocation and leveling
- Estimating project costs
- Budgeting in MS Project
- Tracking and managing costs
- Creating a project schedule
- Gantt charts and network diagrams
- Critical Path Method (CPM)
- Handling project delays and rescheduling

Module 3: Tracking and Managing Projects with MS Project

- Baselines and project tracking
- Monitoring progress and performance
- Earned Value Management (EVM)
- Reporting and exporting project data
- Excel basics: Functions, formulas, and data formatting
- Creating project timelines and Gantt charts in Excel
- Budget tracking and cost analysis using Excel

Module 4: Advanced Excel Techniques for Data Analysis

- Pivot tables and pivot charts
- Advanced formulas and functions (e.g., VLOOKUP, HLOOKUP, INDEX-MATCH)
- Data validation and conditional formatting
- Data visualization: Creating charts and graphs

Module 5: Integration of MS Project and Excel

- Exporting data from MS Project to Excel
- Creating dynamic dashboards in Excel for project reporting
- Customizing reports and charts using Excel

Course Materials:

- Textbook: "Microsoft Project 2019 Step by Step" by Carl Chatfield and Timothy Johnson
- Additional readings: Selected articles and case studies
- Software: MS Project, Excel

Course Outcomes:

CO1: Master project management principles and apply them using MS Project and Excel.

CO2: Develop comprehensive project plans, including scope, timelines, and resources.

CO3: Effectively manage project costs and resources using MS Project tools.

CO4: Utilize advanced Excel techniques for data analysis and project reporting.

CO5: Integrate MS Project and Excel to enhance project tracking and performance monitoring.

Course Title: Optimization Using MATLAB Toolbox

Syllabus

1. **Introduction to Optimization:**
   - Basic concepts and definitions
   - Types of optimization problems (linear, nonlinear, integer, etc.)
2. **MATLAB Optimization Toolbox Overview:**
   - Introduction to the toolbox and its capabilities
   - Setting up the MATLAB environment
3. **Linear Programming (LP):**
   - Formulating LP problems
   - Solving LP problems using linprog
4. **Nonlinear Programming (NLP):**
   - Unconstrained optimization (using fminunc)
   - Constrained optimization (using fmincon)
5. **Quadratic Programming (QP):**
   - Formulating and solving QP problems using quadprog
6. **Mixed-Integer Linear Programming (MILP):**
   - Solving MILP problems using intlinprog
7. **Least Squares Problems:**
   - Linear and nonlinear least squares (using lsqnonlin and lsqcurvefit)
8. **Multi-objective Optimization:**
   - Formulating and solving multi-objective problems (using fgoalattain and fminimax)
9. **Genetic Algorithm:**
10. **Project Work:**
    - Hands-on projects to apply optimization techniques to real-world problems

Course Code: 53241201

Course Name: Air Pollution & Control

L	T	P	Credit
3	0	0	3

Course Objective:

To impart a comprehensive knowledge on the sources and effects of air pollution, air quality standards, and monitoring techniques, as well as to equip students with the skills to understand and apply control measures to reduce air as well as noise pollution.

Syllabus:

Unit I Introduction:

Definition of Air Pollution, Sources and classification of air pollutants – Man made – Natural sources – Type of air pollutants – Pollution due to automobiles, Units of measurements of pollutants, Air quality criteria - emission standards – National ambient air quality standards – Air pollution indices – Air quality management in India, Air pollution survey, Air pollution from major industrial operations, Air pollution in Indian cities, Major Air pollution episodes, Air Act.

Unit II Effects of Air Pollution:

Analysis of air pollutants – Chemical, Instrumental and biological methods, Air pollution and its effects on human beings, plants and animals – Economic effects of air pollution – Effect of air pollution on meteorological conditions – Changes on the Meso scale, Micro scale and Macro scale, Global Warming, Acid Rain, Ozone Layer Depletion, Indoor Air Pollution & Occupational Diseases.

Unit III Sampling, Meteorology and Air Quality Modeling:

Sampling and measurement of particulate and gaseous pollutants – Ambient air sampling – Stack sampling. Environmental factors – Meteorology – temperature lapse rate and stability – Adiabatic lapse rate – Wind Rose – Inversion – Wind velocity and turbulence – Plume behavior – Dispersion of air pollutants- Air Quality Modeling.

Unit IV Air Pollution Control Measures:

Control – Source correction methods – Control equipments – Particulate control methods – Bag house filter – Settling chamber – cyclone separators – inertial devices – Electrostatic precipitator – scrubbers – Control of gaseous emissions – Absorption – Absorption equipments – adsorption and combustion devices (Theory and working of equipments only), odour and its control, stack monitoring kit, auto exhaust analyser.

Unit V Noise Pollution & its Control:

Sources of noise – Units and Measurements of Noise – Noise Standards, Noise rating system, Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non - auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person – Control of other types of Noise Sound Absorbent, Sound level meter.

Course Outcomes:

CO 1: Explain the concepts of air & noise pollution.
CO 2: Illustrate the effects of air pollution on environment.
CO 3: Apply various techniques to measure air & noise pollution.
CO 4: Solve air and noise pollution problems by devising solutions to the identified problems
CO 5: Apply various techniques used in reducing the environmental pollution.

Text Books:

1. Air pollution & Control, M. N. Rao & H. V. N Rao, Tata McGraw Hill Publications., 2017
2. Air Pollution and Control Technologies, Dr. Y. Anjaneyulu, Allied publishers Pvt. Ltd., 2002.

Reference Books:

1. Sewage Disposal & Air Pollution Engineering, S.K. Garg, Khanna Publishers, 31st edition, 2008
2. Environmental Pollution Control Engineering, C. S. Rao, New Age Intl Pub., 3rd edition, 2018
3. Environmental Engineering, Rowe, Peavy & Tchobanogolous, Tata McGraw Hill Publication, 2017

Course Code: 53241202

Course Name: Advance Treatment Process – II (Water Supply Engineering)

L	T	P	Credit
2	1	0	3

Course Objective:

To provide in-depth knowledge of planning, designing, operating, and maintaining water distribution and treatment system, including the determination of water quality parameters and application of advanced water treatment techniques for urban water supply systems.

Syllabus:

Unit I:

Water supply, Components of distribution system, Principles and design of distribution system, Equivalent pipe method, Hardy Cross and Section method, Electrical network analogy method, Construction and maintenance of distribution system, Corrosion and methods of control, Computer applications in distribution network analysis.

Unit II:

Quality of water: Factors affecting water quality in various sources, Protection of water quality, Classification of natural water with reference to the best use, Bacteriological quality of water, Effect on health, Standards of water for various uses, Water quality index, Minimal National Standards (MINAS), their significance in relation to Industrial pollution control.

Unit III:

Preliminary Treatment and Sedimentation: Degree of treatment required, various operation and flow sheet, Preliminary treatment methods such as screening, coagulation, perikinetic and orthokinetic, flocculation, Coagulants and coagulants aids, Polyelectrolyte, Sedimentation, Class I and Class II clarification, Column settling test, zone and compression settling, Design of sedimentation tank – various types and their working, Tube settlers and their design.

Unit IV:

Filtration and Disinfection: Slow and rapid sand filters, Theory of filtration, Design, Operation, Performance and evaluation of filters, Pressure filter, Multi-media filter, Diatomaceous earth filter, Disinfection of water kinetics, Amount of chemicals required for disinfection, Free and combined chlorine, Fixed end disinfector.

Unit V:

Non – Conventional treatment units: Water softening, Methods of softening, Application of Membrane process, Reverse osmosis, Electro-dialysis, Various practices, Removal of fluorides, iron and manganese, Taste and odour removal, Industrial water conditioning, Langliear saturation index, Management of water treatment plant residues, Design of complete treatment scheme.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of water distribution systems including its operation & maintenance.

CO 2: Design a water distribution scheme for an area / city.

CO 3: Evaluate the water quality of an area / city with the help of available standards & guidelines.

CO 4: Explain the concepts of various water treatment techniques.

CO 5: Design a water treatment scheme for an area / city.

Text Books:

1. Water Supply Engg., S. K. Garg, Khanna Publishers New Delhi, 2017

2. Environmental Engineering, Peavy, Rowe & Tchobanoglous, McGraw Hill Publication, 2017

Reference Books:

1. Water Supply & Sanitary Engg., G.S. Birdie, Dhanpat Rai Publishing Company, 2014

2. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, 6th edition, 2008

3. Manual of Water Supply and Treatment by CPHEEO, GOI, 2009

4. Water Supply Engg., B. C. Punmia, Laxmi Publication (P) Ltd. New Delhi, 2016

5. Water Supply & Sanitary Engineering by S.K. Husain (Oxford & IBH Publishing Co. New Delhi, India)

Course Code: 53241203

Course Name: Environmental Impact Assessment

L	T	P	Credit
2	1	0	3

Course Objective:

To develop a comprehensive understanding of the need for environmental impact assessment (EIA), its processes, and methods, alongside practical knowledge of conducting EIA through case studies, while gaining insights into environmental laws and regulations in India.

Syllabus:

Unit I: Environment and its components, Concept of Ecological imbalances, Carrying capacity and Sustainable development, EIA: Definitions, Necessity of EIA, Historical Evolution of EIA: Indian EIA rules 1994 & 2006, Environmental clearance process, Procedure for carrying out EIA in India, Post project monitoring, EIA documentation, EMP, Risk Assessment, Environmental Audit: Introduction, Necessity, Types, and Process of audit.

Unit II Environmental Impact Assessment Methodologies: Characteristics of EIA Methods, Ad- hoc method, Checklist, Matrices, Networks, Overlays, Environmental Quality Index, Predictive Models, Comparative study of EIA Methodologies.

Unit III Prediction and assessment of impact on water & air environment: Basic information of air & water quality, Data requirements for impact assessment, Existing standards for air & water quality (surface & subsurface), Identification of impacts, Prediction & assessment of impacts, Mitigation measures. Case Studies - Environmental Impacts of Road, Rail, Dam and thermal power projects or any other major projects on water & air environment.

Unit IV Prediction and assessment of impact on cultural & socio-economic environment: Basic information on cultural resources like archaeological, historical structures, Cultural system, Basic information of socio-economic environment, Description of existing socio-economic environment, Identification of impacts, Prediction & assessment of impacts, Mitigation measures, R & R study.

Unit V: Environmental Legislations: List of prevalent environmental acts in India, Brief about provisions in Water Act 1974, Air Act 1981, EPA 1986, International Environmental Laws & Protocols like Montreal Protocol, Rio Earth Summit, Kyoto Protocol.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Illustrate the concepts of EIA.

CO2: Apply various methodologies for carrying out EIA.

CO3: Analyse impacts on various components of environment.

CO4: Plan for mitigation of impact & accordingly monitor the mitigation measures.

CO5: Apply various environmental legislations for managing the environment.

Text Books:

1) Y. Anjaneyulu & Valli Manickam, Environmental Impact Assessment Methodologies, B S Publishers.

2) R. R. Barthwal, Environmental Impact Assessment, New Age International Publishers.

Reference Books:

1) L.W. Canter, Environmental Impact Assessment, Mc Graw Hill International Publishers International Edition.

2) O. V. Nandimath, Handbook of Environmental Decision Making in India: An EIA Model, Oxford University Press.

3) Ministry of Environment and forest, Government of India Environmental Impact Assessment Notification, New Delhi, 2006.

Course Code: 53241204

Course Name: Emerging Technologies for Environmental Management

L	T	P	Credit
3	0	0	3

Course Objective:

To provide in-depth knowledge of advanced technologies and strategies for addressing global environmental issues, managing emerging contaminants, mitigating climate change, controlling pollution, and facilitating environmental technology transfer for sustainable development.

Syllabus:

Unit-I Global Environmental Issues and Frameworks:

Overview of micro and macro environmental issues: urbanization, industrialization, resource depletion. Global environmental challenges like climate change, trans boundary pollution. Resource sharing issues: water, energy and land issues. Role of global organizations and policy frameworks in environmental governance. Case study on international collaboration and conflict resolution in environmental management

Unit-II Emerging Contaminants and Advanced Waste Management Technologies:

Introduction to emerging contaminants: micro plastics, PFAS, pharmaceuticals, and nanomaterial's, detection and monitoring of emerging contaminants. Advanced waste management technologies: pyrolysis, gasification, anaerobic digestion, and resource recovery. Case study on successful application of emerging waste management technologies.

Unit-III Innovative Strategies for pollution control:

Innovative strategies for managing waste, Integration of circular economy principles in waste management. Water and soil remediation technologies: bioremediation, electrocoagulation, and permeable reactive barriers. AI-driven monitoring systems and predictive modeling. Role of non-conventional technologies in pollution control.

Unit-IV Climate Change Adaptation and Mitigation Technologies:

Understanding climate change: impacts, vulnerabilities, and mitigation strategies. Adaptation techniques: resilient infrastructure, sustainable urban design, and nature-based solutions. Carbon capture and storage (CCS), carbon farming. Emission trading mechanisms: carbon markets, carbon credits, and blockchain applications. Case studiy on climate change adaptation in urban and rural settings

Unit-V Environmental Technology Transfer and Future Trends:

Concept of environmental technology transfer: barriers, facilitators, and mechanisms. Policy and financial frameworks for technology transfer. Integration of environmental technologies into policy and planning. Role of innovation hubs, incubators, and international collaborations. Emerging trends: green technologies, bio-inspired designs, AI, IoT, and big data analytics in environmental management.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Analyze global environmental issues, resource-sharing conflicts, and the role of international frameworks in promoting environmental governance and sustainable solutions.

CO2: Apply advanced waste management technologies for the effective treatment of contaminants and resource recovery.

CO3: Develop innovative strategies for pollution control by integrating circular economy principles and employing AI-driven monitoring systems and predictive models.

CO4: Apply climate change mitigation and adaptation technologies including carbon management, resilient infrastructure, and emission trading mechanisms.

CO5: Demonstrate understanding of environmental technology transfer processes, policy frameworks, and emerging trends to facilitate the adoption of sustainable environmental management practices.

Reference Books:

1. Environmental Science: A Global Concern, William Cunningham & Mary Cunningham, McGraw Hill Publications.
2. Emerging Contaminants in the Environment: Challenges and Sustainable Practices, Hemen Sarma, Delfina C. Dominguez, Wen-Yee Lee, Elsevier Publications.
3. Environmental Pollution & Control, Vesilind, Peirce and Weiner, Elsevier Publications.
4. Climate Change Mitigation and adaptation Strategies, Murali, Sambath, Sudarshan, COSMOS Scientific Publications.
5. Environmental Sustainability: Role of Green Technologies, Thanagvel & Sridevi, Springer publications.

Course Code: 53241205

Course Name: Advanced Environmental Engineering Lab

L	T	P	Credit
0	0	4	2

Course Objective:

To provide knowledge and skills in sampling and analyzing air, solid waste, and wastewater samples, including the determination of various characteristics of wastewater, solid waste, air pollutants, and noise levels.

Syllabus:

1. Introduction to waste water sampling procedure.
2. Introduction to air sampling procedure.
3. Introduction to solid waste sampling procedure.

List of Experiments:

1. Determination of Solids (TS, TSS, VSS, FS) in waste water sample.
2. Determination of settling velocity of suspended solids in waste water sample.
3. Determination of D.O. in waste water sample.
4. Determination of B.O.D. in waste water sample.
5. Determination of C.O.D. in waste water sample.
6. Determination of Oil & Grease in waste water sample.
7. Analysis of solid waste sample (Proximate & Elemental).
8. Determination of calorific value of solid waste sample.
9. Determination of SPM, SO_x & NO_x in air using RSPM/HVS.
10. Monitoring of ambient & traffic noise levels using noise level meters.
11. Study of Stack Monitoring Kit.
12. Characterization of wastes from different industries.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Follow sampling procedure & other guidelines for sampling & analysis of water samples, air & waste samples.

CO 2: Check various water quality parameters.

CO 3: Analyze various solid waste characteristics.

CO 4: Analyze the level of pollutants in air and noise in an area/city.

Reference Books:

1. BIS 10158, 9234, 9235: Analysis of Solid Wastes.
2. BIS 5182: Measurement of Air Pollution.
3. APHA Standard Methods for Examination of Water & Waste water, 2012.
4. Sawyer C.N., McCarty P. L., and Parkin G.F., Chemistry for Environmental Engineers, McGraw-Hill, New Delhi, 1994.
5. Water Supply Engineering, S.K. Garg, Khanna Publishers, New Delhi, 2017.

Course Code: 53241206

Course Name: Seminar / Presentation

L	T	P	Credit
0	0	4	2

Course Objective:

To enhance students' understanding of Environmental Engineering by encouraging the study of diverse literature, fostering lifelong learning, and developing the soft skills necessary for effective presentation.

Syllabus:

Any relevant topic related to Environmental Engineering from within or beyond the syllabus through Swayam / NPTEL/MOOC.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Analyze contemporary issues in Environmental Engineering & its allied areas.

CO 2: Demonstrate good oral communication skills.

CO 3: Develop poster and power point presentations for effective communication.

Course Title: Fire Safety & regulation in Building

Course Objective:

Understanding of Fire Hazards, Identify various fire protection systems and implement fire safety regulation

Course Content:

- Fire alarm system and their types
- Fire suppression agents
- Types of water distribution system
- System readiness
- Building fire hazards
- Fire safety in buildings: basic principles
- Fire safety management
- Codes and regulations

Course Outcomes:

CO1: Explain the working of fire alarm system, suppression system, and portable fire extinguishers.

CO2: Identify various types of water storage devices, type of pipe material and different valves used in water supply system

CO3: Apply fire safety principles, management and regulation in building