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		L	T	P				
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional									
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.	NECXXXXX	NEC	**Classified Novel Engaging Course (Activity Based Learning)**	-	-	-	-	-	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.	NECXXXXX	NEC	**Classified Novel Engaging Course (Activity Based Learning)**	-	-	-	-	-	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.		
2.		
3.		

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 %

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								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
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	-	-	-

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								
				Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment		Lab Work & Sessional			L	T	P				
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.