MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to R.G.P.V., Bhopal MP)

For Batch Admitted in 2022-2023

Master of Technology in Environmental Engineering (Semester – I)

Scheme of Examination

S. No.	Subject Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Periods per week			Total Credits
			Theory Slot			Practical Slot		MOOCs						
			End Sem	Mid Sem	Quiz/ Assignment	End Sem	Lab Work / Sessional	Assignment	Exam		L	T	P	
1.	530111	Environmental Chemistry & Microbiology	70	20	10	-	-	-	-	100	3	-	-	3
2.	530112	Solid & Hazardous Waste Management	70	20	10	-	-	-	-	100	3	-	-	3
3.	530113	Advanced Treatment Process – I (Waste Water Engineering)	70	20	10	-	-	-	-	100	3	-	-	3
4.		#Elective - I	70	20	10	-	-	-	-	100	3	-	-	3
5.		*Open Category Course (OC-1)	70	20	10	-	-	-	-	100	3	-	-	3
6.	530118	Environmental Engineering Lab	-	-	-	90	60	-	-	150	-	-	4	4
7.	530119	$ Self Learning / Presentation	-	-	-	-	100	-	-	100	-	-	2	2
		Total	**350**	**100**	**50**	**90**	**160**	**-**	**-**	**750**	**15**	**-**	**6**	**21**

#Elective - I

530114. Industrial Waste Management
530115. Environmental Auditing & Management System
530116. Environmental Hydraulics

*** Open Category Course (OC-1) will have to be opted from the pool of open courses (Student can opt from parent department and other department) and based on interdisciplinary aspects.**

800110. Sustainable Waste Management System.

During labs, students have to perform practical/assignments/ minor projects related to theory subjects/theoretical concepts of respective semester using recent technologies / languages / tools etc.

$Self learning / presentation through SWAYAM / NPTEL (Registration in a course will be compulsory for students bus assessment will be based on internal seminar presentation)

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For Batch Admitted in 2022-2023

Master of Technology in Environmental Engineering (Semester – II)

Scheme of Examination

S. No.	Subject Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Periods per week			Total Credits
			Theory Slot			Practical Slot		MOOCs						
			End Sem	Mid Sem	Quiz/ Assignment	End Sem	Lab Work / Sessional	Assignment	Exam		L	T	P	
1.	530211	Air Pollution & Noise Pollution	70	20	10	-	-	-	-	100	3	-	-	3
2.	530212	Advanced Treatment Process – II (Water Supply Engineering)	70	20	10	-	-	-	-	100	3	-	-	3
3.	530213	Environmental Impact Assessment & Ethics	70	20	10	-	-	-	-	100	3	-	-	3
4.		##Elective - II	-	-	-	-	-	25	75	100	3	-	-	3
5.		**Open Category Course (OC-2)	70	20	10	-	-	-	-	100	3	-	-	3
6.	530217	Advanced Environmental Engineering Lab	-	-	-	90	60	-	-	150	-	-	4	4
7.	530218	$ Self Learning / Presentation	-	-	-	-	100	-	-	100			2	2
		Total	280	80	40	90	160	25	75	750	15	-	6	21

##Elective-II (Through SWAYAM / NPTEL / MOOC based learning platform (with credit transfer facility)

530219. Biological Process Design for Waste Water Treatment

**Open Category Course (OC-2) will have to be opted from the pool of open courses (Student can opt from parent department and other department) and based on interdisciplinary aspects. This course may run through SWAYAM/NPTEL based platform (with credit transfer facility).

800209. Global Climatic Changes & Disaster Management

During labs, students have to perform practical/assignments/ minor projects related to theory subjects/theoretical concepts of respective semester using recent technologies / languages / tools etc.

$Self learning / presentation through SWAYAM / NPTEL (Registration in a course will be compulsory for students bus assessment will be based on internal seminar presentation)

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For Batch Admitted in 2022-2023

Master of Technology in Environmental Engineering (Semester – III)

Scheme of Examination

S. No.	Subject Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits
			Theory Slot			Practical Slot		MOOCs						
			End Sem.	Mid Sem.	Quiz/ Assignment	End Sem. /Practical Viva	Sessional Work/ Practical Record/ Assignment/ Quiz/ Presentation	Assignment	Exam		L	T	P	
1.	**530311**	**Dissertation Part-I (Literature Review/ Problem Foundation/ Synopsis/survey paper, etc.)**	-	-	-	150	100			250	-	-	10	10
2.	**8003XX**	***MOOC Course**	-	-	-	-	-	**25**	**75**	100	02	-	-	02
		Total	**-**	**-**	**-**	**150**	**100**	**25**	**75**	**350**	**02**	**-**	**10**	**12**

*** MOOC Course: Sustainable Engineering Concepts & Life Cycle Analysis**

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W.E.F JULY 2020

Master of Technology in Environmental Engineering (Semester – IV)

Scheme of Examination

S. No.	Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
			Theory Slot			Practical Slot						
			End Sem.	Mid Sem.	Quiz/ Assignment	End Sem. /Practical Viva	Sessional Work/ Practical Record/ Assignment/ Quiz/ Presentation		L	T	P	
1.	**530405**	**Dissertation Part-II**	-	-	-	300	200	500	-	-	14	14
		Total	**-**	**-**	**-**	**300**	**200**	**500**	**-**	**-**	**14**	**14**

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Syllabus

w.e.f. July 2020 Admitted onward batches

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
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Semester-I

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Course Code: 530111

Course Name: Environmental Chemistry & Microbiology

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To impart knowledge of environmental chemistry and its concepts.
2) To apply concepts of environmental chemistry in various analysis of water and waste water.
3) To impart knowledge of environmental microbiology and its concepts.
4) To apply concepts of environmental microbiology in various analysis of water and waste water.

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: Analyse 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.

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Course Code: 530112

Course Name: Solid and Hazardous Waste Management

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To provide broad knowledge on various aspects of planning & implementation of waste management system in a smart city/town.
2) To understand the principles applied in waste management.
3) To understand various ways to collect, treat & disposal of waste.
4) To understand various methods of energy recovery from waste.
5) To understand various aspects of hazardous waste management, E-waste management, biomedical waste management etc.

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.

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 – Design – Landfill Process – Monitoring Closure – Post closure monitoring – leachate management & control of gases in landfills, environmental monitoring of landfills. MSW rules, Introduction to swachh bharat mission and smart cities program - current status, challenges and future trend of waste management.

Unit V:

Hazardous Waste Management: Introduction to hazardous waste - Definition – Characterization and composition – TCLP test – Storage and transportation of hazardous waste – Labeling of hazardous waste – Physical, Chemical and Biological treatment of hazardous waste – Bioremediation of hazardous waste – Treatment of Bio medical – Nuclear waste and Radio – Active waste – Fly ash management and E-waste management.

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 energy recovery from waste.

CO 4: Plan an effective & efficient waste management system.

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 and Environmental 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, Noyes Data Corporation, London, 1990.
6. Michael D. Lagrega, Philip L. Buckingham, Jeffrey C. Evans. Hazardous Waste Management McGraw Hill, New York. 1994.

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Course Code: 530113

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

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To impart basic knowledge on sewerage system including estimation of sewage quantity & design of sewers.
2) To provide a broad knowledge on sewage composition & its characteristics.
3) To provide information on disposal standards of effluents & also about various methods of sewage disposal.
4) To provide broad knowledge on various techniques of sewage treatment 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 purification of 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, Tata McGraw-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.

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Course Code: 530114

Course Name: Industrial Waste Management

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To provide broad knowledge on various methods of sewage disposal, their effects on water pollution & also provide information on various disposal standards.
2) To learn the basics of sewage composition & its characteristics.
3) To provide knowledge on various waste water treatment techniques.
4) To provide broad knowledge on common effluent treatment plants, wastewater reuse, waste audit.
5) To provide information about various existing waste treatment & management techniques of various industries.

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 such as 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.

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Course Code: 530115

Course Title: Environmental Auditing & Management System

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To provide broad knowledge on various aspects of environmental management system.
2) To understand the principles of environmental auditing and complete process.
3) To apply the concepts of LCA in environmental management.
4) To understand the EMS approach and ISO.
5) To understand various 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), 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.

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Course Code: 530116

Course Name: Environmental Hydraulics

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To understand the concepts of fluid mechanics and apply them in pipe flow calculations.
2) To understand the principles of open channel flow and apply them in sewer system design.
3) To apply concepts of hydrology in estimation of storm water and its design.
4) To understand concepts of ground water hydraulics.
5) To understand concepts of pollutant transfer and estimation of pollution load in water bodies.

Syllabus:

Unit I:

Introduction to concepts of fluid flow – continuity equation, energy principle, momentum principle, frictional head loss, flow through pipes, major and minor energy losses in pipes, hydraulic gradient and total energy line, flow through pipe in series, parallel, equivalent pipe, water hammer pressure, design of water distribution pipe network using hardy cross method and equivalent pipe method.

Unit II:

Open channel flow and its classifications, critical flow computations, sub critical flow, super critical flow, uniform flow, gradually varied flow, most efficient/economical sections in channel, specific energy, hydraulic jump, hydraulic elements of sewer & design of sewers.

Unit III:

Introduction to Hydrology, Hydrological cycle, Precipitation measurement and analysis of data, runoff and its estimation, hydrograph – unit hydrograph, s-curve hydrograph, synthetic hydrograph, rational method, estimation of storm water quantity and design of storm water sewers.

Unit IV:

Ground water estimation & well hydraulics – confined & unconfined aquifers, governing equations for yield of well (Thiem's & Dupuit's), well loss & specific capacity, ground water recharge. Transport & transformation of contaminants in groundwater: processes, governing equations, and initial and boundary conditions, solution of simple cases.

Pumps and their classification, pump performance curves, selection of pumps, head, power & efficiency of pumps, economical diameter of rising main, pumping station and their designs.

Unit V:

Introduction to Pollutant transport process in surface water, standards for pollutant disposal in surface water, factors affecting pollutant transport and mixing in river – dilution, dispersion, oxidation, reduction etc., zone of pollution in river, mixing mechanism in river, sag curve, streeter phelps equation. Introduction to various software's for design of pipe networks & sewer lines.

Course Outcomes:

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

CO 1: Apply fluid mechanics principles in analysis and design of pipe flow.

CO 2: Apply principles of hydraulics for design of sewer lines.

CO 3: Apply principles of surface water hydrology for design of storm water sewer.

CO 4: Estimate groundwater quantity and pollution load on groundwater and surface water.

CO 5: Apply the principles of hydraulics in design of pumping stations and estimation of pollution load on rivers.

Text Books:

1. Sewage Disposal & Air Pollution Engineering, S. K. Garg, Khanna Publishers, 2016
2. Water Supply Engineering, S.K. Garg, Khanna Publishers, 2016
3. Hydraulics & Fluid Mechanics, P.N. Modi & S.M. Seth, Standard Publishers, 2017

Reference Books:

1. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, New Delhi
2. CPHEEO, Manual on Sewerage and Sewage Treatment, Ministry of Urban Development, Central Public Health and Environmental Engineering organization, Government of India, New Delhi, 2013.
3. CPHEEO, Manual on Water Supply and Treatment, Ministry of Urban Development, Central Public Health and Environmental Engineering organization, Government of India, New Delhi, 1999.
4. Fluid Mechanics, A.K. Jain, Khanna Publishers, 2004.

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Course Code: 800110

Course Name: Sustainable Waste Management System

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To develop an understanding about the concepts of sustainability & sustainable development.

2) To understand the concepts of water conservation techniques.

3) To understand the concepts of wetlands & other natural wastewater treatment system.

4) To provide knowledge on various low cost sanitation methods & other sustainable waste management techniques.

5) To provide an insight into sustainable design of buildings.

Syllabus:

Unit I:

Introduction: Concept of sustainability in water and waste management, sustainable development, guidelines and strategies for implementing sustainable development, Pollution prevention & Cleaner production in achieving sustainability, Environmental indices - Bio remediation.

Unit II:

Water Conservation: Rainwater Harvesting – Roof water harvesting – Technology – Quality – Health issues – Groundwater recharge – Techniques – Case studies – Wastewater reuse and reclamation.

Unit III:

Natural Wastewater Treatment Systems: Centralized Vs decentralized – Natural and constructed wetlands – Different types – Mechanisms – Performance – Design – Case studies – Land treatment systems.

Unit IV:

Low-Cost Sanitation: Dry sanitation methods – Pit latrines – VIP latrines – Aquaprivy – Septic tank.

Organic Solid Waste Management Techniques: Composting/ Vermicomposting – Biogas technology – Plasma technology

Unit V:

Green Design: Green buildings - benefits and challenges; public policies and market-driven initiatives; Effective green specifications; Energy efficient design; Passive solar design; Green power; Green materials and Leadership in Energy and Environmental Design (LEED)

Course Outcomes:

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

CO1: Illustrate the concepts of sustainability & sustainable development.

CO2: Apply various methodologies of water conservation in field.

CO3: Apply various natural methodologies of wastewater treatment like wetlands.

CO4: Apply various low cost sanitation & other waste management techniques.

CO5: Plan for sustainable and green design of buildings.

Reference Books:

1. Cites R.W., Middlebrooks E.J., Reed S.C., Natural wastewater Treatment Systems, CRC Taylor and Francis, 2006.
2. Cairncross S., Feachem R. Environmental Health Engineering in the Tropics; John Wiley & Sons 1993.
3. Bajwa, G.S. Practical Handbook on Public Health Engineering, Deep Publishers, Simla, 2003.
4. White, I.D. Mottershed, D.N and Harrison, S.L., Environmental Systems – An Introductory Text, Chapman Hall, London, 1994.
5. Martin, A.M., Biological Degradation of Wastes, Elsevier Appl. Science, New York, 1991.
6. Mili Majumdar, Energy Efficient Buildings in India, TERI

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Course Code: 530118

Course Name: Environmental Engineering Lab

L	T	P	Credit
0	0	4	4

Course Objectives:

1) To acquire knowledge of various types of sampling, its procedure including its preservation.
2) To acquire skills to determine various physical, chemical & biological characteristics of water.

Syllabus:

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

List of Experiments:

1. Determination of physical characteristics of water sample (pH, Turbidity, Total Solids (Suspended & Dissolved Solids), Electrical Conductivity)
2. Determination of Acidity & Total Alkalinity of water sample.
3. Determination of Total Hardness, Calcium Hardness, Magnesium Hardness of water sample.
4. Determination of Chloride of water sample.
5. Determination of Sulphate of water sample.
6. Determination of Available Chlorine in bleaching powder & Residual Chlorine of water sample.
7. Determination of Nitrate & Phosphate of water sample.
8. Determination of Optimum Dosage of Coagulants using Jar Test.
9. Determination of MPN of water sample.
10. Application of Plate Count Method for bacterial growth.
11. Study on Gram Staining Technique.

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: Improve the water quality by suggesting suitable corrective measures.

CO 4: Train others on various ways of improving the quality of water.

Reference Books:

1. Water Supply Engineering, S.K. Garg, Khanna Publishers, New Delhi, 2017.
2. Sawyer C.N., McCarty P. L., and Parkin G.F., Chemistry for Environmental Engineers, McGraw-Hill, New Delhi, 1994.

3. BIS 3025 Methods of Sampling & Test for Water & Waste Water, BIS 1622.
4. APHA Standard Methods for Examination of Water & Waste water, 2012.

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Course Code: 530119

Course Name: Self Learning / Presentation

L	T	P	Credit
0	0	2	2

Course Objectives:

1) To encourage students to read, study & understand different topics of Environmental Engineering published in articles, literatures.
2) To help in presenting different topics of Environmental Engineering and related subjects to supplement theoretical knowledge gained in class.
3) To make student acquire good oral & written communication skills.
4) To promote the habit of lifelong learning.
5) To prepare students develop adequate soft skills to be able to present their topic effectively to listeners.

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 through literature survey.

CO 2: Distinguish state of art & relevance of the topic in national & international arena.

CO 3: Demonstrate good oral & written communication skills.

CO 4: Develop poster and power point presentations for effective communication.

CO 5: Display lifelong learning.

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Semester-II

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Course Code: 530211

Course Name: Air Pollution & Noise Pollution

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To provide a broad knowledge on various sources & effects of air pollution.

2) To understand the techniques to control air pollution and apply them.

3) To provide knowledge on air quality standards, monitoring of air quality.

4) To provide a basic knowledge on sources, effects of noise pollution & also how to reduce the 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:

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

CO 1: Explain the concepts of air & noise pollution.

CO 2: Illustrate the effects of air & noise 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

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Course Code: 530212

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

L	T	P	Credit
3	0	0	3

Courses Objectives:

1) To understand the concepts of planning a distribution system & subsequently design the water distribution system.
2) To understand the operation & maintenance of water supply systems.
3) To determine the water quality parameters and also have knowledge on various standards of water quality.
4) To understand the concepts of various water treatment techniques.
5) To be able to plan & design water treatment plant for a city.

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.

Courses 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)

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Course Code: 530213

Course Title: Environmental Impact Assessment & Ethics

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To develop an understanding about the requirements of environment impact assessment in modern day.

2) To provide a broad knowledge on the process of environmental impact assessment.

3) To provide a broad knowledge on various methods used in impact assessment.

4) To provide a practical knowledge on how to carry out environmental impact assessment process through various case studies.

5) To provide an insight into various existing environmental laws 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, EIS, Life Cycle Assessment, Risk Assessment.

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, Objective of Ethics, Importance of Ethics, Code of Ethics, Environmental ethics in India, Environmental Audit: Introduction, Necessity, Types, and Process of audit.

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. & laws used in EIA studies.

CO3: Analyse impacts on various components of environment.

CO4: Apply various laws & ethical practices in environmental management.

CO5: Plan for mitigation of impact & accordingly monitor the mitigation measures through environmental audit.

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.

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Course Code: 800209

Course Name: Global Climatic Changes & Disaster Management

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To understand the effects of climate change.
2) To get knowledge of various protocols & policies on global climate changes.
3) To understand various natural disasters.
4) To understand various techniques of disaster monitoring.
5) To plan for management of disasters and emergency situations.

Syllabus:

Unit-I

Climate, weather and Climate Change; Overview of Earth's Atmosphere; Layers of Atmosphere; Greenhouse Gases, Aerosols, Impact of CO_2 increase on climate change, Temperature, Radiation and Variation; Heat- Balance of Earth Atmosphere System; Temporal Variation of Air temperature; Hydrologic cycle; Climate Variability like Floods, Droughts, Drought Indicators, Heat waves, Climate Extremes.

Recent Climate Change impact at local and global scale, Ecological Impacts of Climate change: Anthropogenic activities and climate change, Rising of sea level and consequences, Impact on biodiversity and extinction of endemic species, Changing of food chain, Agricultural shifts. Impact of climate change on health.

Unit-II

Policy and Legislative issues in Climate Change: The UNFCCC, The Montreal Protocol, From Kyoto to Copenhagen, Towards COP21, ICMR, ICAR & IARI.

Introduction to Climate Modeling (GCM and RCM Models) IPCC Scenarios, difference between climate change and climate variability Carbon trading and clean development mechanism, Role of countries and citizens in containing in global warming. The Role of Technology Roadmaps and Roundtables,

Unit-III

Overview of disaster, major natural disasters – flood, tropical cyclone, droughts, landslides, heat waves, earthquakes, fire hazards, tsunami, etc. – Factors for disaster – climatic change and global sea rise, erosion, environmental degradation, large dams and earthquakes, road building and landslides, Chemical and Biological weapons – case studies.

Unit-IV

Techniques of monitoring and design against the disasters, Management issues related to Disaster, Mitigation through capacity building, legislative responsibilities of disaster management; Disaster mapping, assessment, pre-disaster risk and vulnerability reduction, post disaster recovery and rehabilitation; disaster related infrastructure development. Disaster management plan, national crisis management committee, state crisis management group.

Unit-V

Water supply preparedness and protection, emergency water supply strategy, rural and urban emergencies. Assessment of damage. Emergency water supply schemes – Sources, quality, treatment, storage and distribution, operation and maintenance. Sanitation – Human waste and health, strategy for excreta disposal in emergencies, techniques for excreta disposal, disposal of wastewater, management of refuse.

Courses Outcomes:

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

CO 1: Explain the basic concepts of climate change, the causes of climate change and its effect on environment.

CO 2: Determine the important climate variables and the predictions of the changes in the climate system.

CO 3: Analyse policy issues and mitigation strategies in response to climate change and other disasters.

CO 4: Design an emergency water supply and sewage system.

Reference Books:

6. Climate Change and India – Vulnerability Assessment and Adaptation; Edited by P. R. Shukla, Subodh K. Sharma, N. H. Ravindranath, Amit Garg, Sumana Bhattacharya, Universities Press, 2003
7. Global Warming – The Complete Briefing, third edition; John Honghton, Cambridge University Press, 2004,
8. Climate Change- Causes Effects and Solutions; John T. Hardy, Wiley
9. Alexander D, Principles of emergency planning and management, Oxford University Press, 2002.
10. Hallow G. and Bullock J. Introduction to Emergency Management: Elsevier, 2002.
11. Anil Markandya, Climate Change and Sustainable Development: Prospects for Developing Countries, Routledge, 2002.
12. Jepma, C.J., and Munasinghe, M., Climate Change Policy - Facts, Issues and Analysis, Cambridge University Press, 1998.
13. R.B. Singh, Disaster Management, Rawat Publication, New Delhi, 2000
14. H.K. Gupta, Disaster Management, University's Press, India, 2003
15. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management, IIPA, New Delhi, 2001

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Course Code: 530217

Course Name: Advanced Environmental Engineering Lab

L	T	P	Credit
0	0	4	4

Course Objectives:

1) To acquire knowledge of sampling of air samples, solid waste samples & waste water samples.
2) To acquire skills to determine various characteristics of waste water.
3) To acquire skills to determine various characteristics of solid waste.
4) To acquires skills to determine various air pollutants.
5) To acquire skills to determine 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 Nitrates in waste water sample.
7. Determination of Oil & Grease in waste water sample.
8. Determination of Heavy Metals in waste water sample.
9. Analysis of solid waste sample (Proximate & Elemental).
10. Determination of calorific value of solid waste sample.
11. Determination of SPM, SO_x & NO_x in air using RSPM/HVS.
12. Monitoring of ambient & traffic noise levels using noise level meters.
13. Study of Stack Monitoring Kit.
14. 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 waste water, air &

solid waste samples.

CO 2: Check various waste water quality parameters.

CO 3: Analyze various solid waste characteristics.

CO 4: Analyze the level of pollutants in air.

CO 5: Analyze noise levels in an area / city.

Reference Books:

1. BIS 3025: Methods of Sampling & Test for Water & Waste Water.
2. BIS 10158, 9234, 9235: Analysis of Solid Wastes.
3. BIS 5182: Measurement of Air Pollution.
4. APHA Standard Methods for Examination of Water & Waste water, 2012.
5. Sawyer C.N., McCarty P. L., and Parkin G.F., Chemistry for Environmental Engineers, McGraw-Hill, New Delhi, 1994.
6. Water Supply Engineering, S.K. Garg, Khanna Publishers, New Delhi, 2017.

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Course Code: 530218

Course Name: Self Learning / Presentation

L	T	P	Credit
0	0	2	2

Course Objectives:

1) To encourage students to read, study & understand different topics of Environmental Engineering published in articles, literatures.
2) To help in presenting different topics of Environmental Engineering and related subjects to supplement theoretical knowledge gained in class.
3) To make student acquire good oral & written communication skills.
4) To promote the habit of lifelong learning.
5) To prepare students develop adequate soft skills to be able to present their topic effectively to listeners.

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 through literature survey.

CO 2: Distinguish state of art & relevance of the topic in national & international arena.

CO 3: Demonstrate good oral & written communication skills.

CO 4: Develop poster and power point presentations for effective communication.

CO 5: Display lifelong learning.