Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Master of Technology

SoE & Syllabus 20**25**

(Department of Civil Engineering)

M.Tech in Environmental Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

M.TECH. SCHEME OF EXAMINATION 2025

(Revised Scheme of Examination w.e.f. 2025-26 onward)

SoE No. 25ENV-101

M.Tech. in Environmental Engineering

SN	Sem	Sub. Code	Subject	T/P	Contact Hours				Credits	%Weightage		ESE Duration Hours
					L	T	P	Hrs		TA**	ESE	
I SEMESTER												
1	1	25ENV101	Energy Conversion & Environment	T	3	0	0	3	3	20	80	3
2	1	25ENV102	Water Supply & Waste Water Collection System	T	3	0	0	3	3	20	80	3
3	1	25ENV103	**Lab :** Water Supply & Waste Water Collection System	P	0	0	2	2	1	60	40	-
4	1	25ENV104	Municipal Water Treatment	T	3	0	0	3	3	20	80	3
5	1	25ENV105	**Lab :** Water & Waste Water Analysis	P	0	0	2	2	1	60	40	-
6	1	25ENV106	Municipal Solid Waste Management	T	3	0	0	3	3	20	80	3
7	1	25ENV107	Municipal Waste Water Treatment	T	3	0	0	3	3	20	80	3
8	1	25ENV108	Air Pollution Control	T	3	0	0	3	3	20	80	3
				Total	**18**	**0**	**4**	**22**	**20**			
II SEMESTER												
1	2	25ENV201	Industrial Waste Water Treatment & Reuse	T	3	0	0	3	3	20	80	3
2	2	25ENV202	Envrionmental Management	T	3	0	0	3	3	20	80	3
3	2	25ENV203	Rural Water Supply and Sanitation	T	3	0	0	3	3	20	80	3
4	2	25ENV204	Remote Sensing and GIS	T	3	0	0	3	3	20	80	3
5	2	25ENV205	**Lab :** Remote Sensing and GIS	P	0	0	2	2	1	60	40	-
6	2	25ENV206	**Lab :** Design of Sewerage Systems	P	0	0	2	2	1	60	40	-
7	2		**Professional Elective-I**	T	3	0	0	3	3	20	80	3
8	2		**Professional Elective-II**	T	3	0	0	3	3	20	80	3
				Total	**18**	**0**	**4**	**22**	**20**			

Professional Elective - I			
1	2	25ENV211	**PE I :** Hazardous Waste Management
2	2	25ENV212	**PE I :** Water Resource Management
3	2	25ENV213	**PE I :** Environmental Biotechnology
4	2	25ENV214	**PE I :** Advanced Water Treatment

Professional Elective - II			
1	2	25ENV221	**PE II :** Environmental Legislations
2	2	25ENV222	**PE II :** Applied Structure
3	2	25ENV223	**PE II :** Water Reuse and Recycling

III SEMESTER												
1	3	25ENV301	Project Phase-I	**P**	0	0	20	20	10	100	-	-
				Total	**0**	**0**	**20**	**20**	**10**			

IV SEMESTER												
1	4	25ENV401	Project Phase-II	**P**	0	0	36	36	18	60	40	-
				Total	**0**	**0**	**36**	**36**	**18**			

GRAND TOTAL	**36**	**0**	**64**	**100**	**68**			

		June, 2025	1.00	Applicable for AY 2025-26 Onwards
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

I Semester
25ENV101– Energy Conversion & Environment

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Analyze various energy conversion processes with sustainability perspectives 2. Develop competency in design of energy systems through thermochemical & biochemical process. 3. Design waste to energy & hybrid energy systems with impact assessment. 4. Evaluate energy systems economically and environmentally through life cycle assessment.

UNIT:1	**Energy Conversion and Fundamentals**	**07 Hours**
Global energy outlook, Indian energy policy and National Energy Mission, Environmental Impacts of Energy Conversion, Energy flow diagram, energy chain, Energy units & calorific values.		
UNIT:2	**Renewable Energy Sources**	**06 Hours**
Energy Conversion Methods: solar, wind, tidal, Hydro Power and geothermal with their principles and application, Energy yield calculation.		
UNIT:3	**Thermochemical Conversion of Biomass & Waste**	**07 Hours**
Combustion types and efficiency, emissions control, Gasification: Types, Energy and mass balance for a gasifier, Pyrolysis: reactor designs, Torrefaction & Hydrothermal Carbonization: Solid biofuel characterization		
UNIT:4	**Biochemical Conversion of Biomass & Waste**	**06 Hours**
Anaerobic Digestion-methane potential & digester design, Landfill Gas- Estimation of landfill gas, Compressed Biogas (CBG) , Bioethanol & Biodiesel- Substrates, processes		
UNIT:5	**Waste-to-Energy**	**07 Hours**
Energy from Green Hydrogen, Microbial Fuel Cells (MFCs), hybrid energy systems. Environmental Impact Assessment of WTE.		
UNIT:6	**Energy Economics, & Management**	**06 Hours**
Energy Economics: Life Cycle Costing (LCC), Net Present Value (NPV), Internal Rate of Return (IRR), Energy Tax		
	Total Lecture	**39 Hours**

Text Books	
1	D.O. Hall, G. W. Barnard and P.A. Moss, Biomass for Energy in the Developing Countries, Current Roles, Potentials, Problems, Prospects, Pergamon Press Ltd, 1st edition.
2	W. C. Turner, Energy Management Handbook Wiley New york 1st edition.
3	P. Meier, Energy System Analysis for Developing countries, Sringer Verlag 1st edition.
4	Dorthy J De Renzo, Energy from Bioconversion of Waste materials, Noyes data Corporation USA 1st edition.
Reference Books	
1	G.D. Rai, Non-Conventional Energy Source, Standard Publishers Distributors.
2	Fowler J. M. Energy and the Environment McGraw Hill New York 2nd edition.
3	B.H. Khan, Non-Conventional Energy Resources, 2nd Edition, McGraw Hill Companies.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/15901
2	https://www.springer.com/series/15433
3	https://www.springer.com/series/8059
4	https://link.springer.com/book/10.1007/978-3-030-76221-6

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc22_me98/preview
2	https://onlinecourses.nptel.ac.in/noc22_me104/preview
3	https://onlinecourses.nptel.ac.in/noc22_hs105/preview
4	https://onlinecourses.swayam2.ac.in/nou22_ge71/preview
5	https://onlinecourses.swayam2.ac.in/nou22_me10/preview
6	https://onlinecourses.nptel.ac.in/noc22_ch38/preview

I Semester
25ENV102– Water Supply & Waste Water Collection System

Course Outcomes :		
Upon successful completion of the course the students will be able to **1.**Explain components of water supply and wastewater systems. **2** Analyze flow in pipe networks using hydraulic principles and methods. **3** Design pumps, valves, and reservoirs in distribution systems. **4** Design water/wastewater distribution networks considering cost and sustainability.		
UNIT:1	**Water Supply Principle**	**07 Hours**
Analysis of Water Supply System Components of water Supply system, Water use and demand estimation Flow through pipes- Continuity principle, and energy principle, Equation for flow through pipes, Moody diagram, Maintenance of distribution System, Water hammer Analysis.		
UNIT:2	**Pipe Network Method**	**06 Hours**
Analysis of Water Distribution System Analysis of flow through pipe network through various method such as 1. Hardy cross method 2. Newton Raphson's method 3. Linear Theory method		
UNIT:3	**Pumps and Valves**	**07 Hours**
Types of Reservoirs and design parameter, Importance and design of pumps and different valves in the distribution system, Node flow analysis.		
UNIT:4	**Design of Distribution Network**	**06 Hours**
Design of Rising Main, Critical path method for design of water distribution networks and its cost analysis		
UNIT:5	**Wastewater Collection System**	**07 Hours**
Objectives, types of system and sewers, Hydraulics of sewer – flow equations, pipe and open channel flow, self-cleansing and scouring velocities through sewer. Combined, and semi-combined sewers, inverted siphon, flushing tanks.		
UNIT:6	**Design of Wastewater Collection System**	**06 Hours**
Sewer Pipe hydraulics: size and design of pipes, Manholes, street inlets, catch basins, sewer junctions, air ejectors.		
	Total Lecture	**39 Hours**

Text Books	
1	Bhave P. R. And Gupta R, Analysis of Water Distribution Networks, Narosa Publishing Co., New Delhi (2006)
2	Fair G. M., Geyer J. C. & Okun D. A., Water & Wastewater Engg. Vol.I & II, John-Willey & Sons, New York, 2015
3	Bhave P.R, Optimal design of water distribution networks, Narosa Publishing Co., New Delhi (2003

Reference Books	
1	CPHEEO, Manual on water supply and treatment, Ministry of urban development, GoI
2	CPHEEO, Manual on Sewerage and Sewage Treatment, Ministry of urban development, GoI

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/15901
2	https://link.springer.com/book/10.1007/978-3-030-76221-6

MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/courses/105/105/105105201/
2	https://www.youtube.com/watch?v=5NzMt6PErYo

I Semester
25ENV103– Lab. : Water Supply & Waste Water Collection System

Course Outcomes :
Upon successful completion of the course the students will be able to
1 Design water distribution systems using hydraulic principles and WaterGEMS software.
2 Design and analysis of pipe networks for water distribution using different methods
3. Design and analysis of water distribution system for continuous and Intermitted Systems
4 Perform cost-benefit analysis for water and sewer infrastructure projects

Following assignments in the field of

1. Water Distribution system and its design by WaterGEMS
2. Design of supply system using different parameters.
3. Analysis of water distribution
4. Cost Benefit Analysis

I Semester
25ENV104– Municipal Water Treatment

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Explain the fundamentals of conventional water treatment systems 2. Analyze the physico-chemical principles and design parameters of water treatment units. 3. Design key components of water treatment units based on water quality requirements. 4. Explain advanced water treatment methods for the effective removal of specific contaminants.

Unit:1	**Introduction of Water Treatment**	**6 Hours**
Water quality criteria and standards, Requirement of water treatment facilities, Unit operation & Unit process, Process selection. Aeration: Objective, Principles, Types of aerators, Design of aerators.		
Unit:2	**Physio-chemical treatment**	**7 Hours**
Coagulation: History, need of coagulation, Chemistry of coagulation, Various coagulants used in process, Factors affecting efficiency of coagulation process, Operation of feeders, Types of rapid mixing devices, design of flash mixer. Flocculation: Theory of flocculation, Slow mixing devices.		
Unit:3	**Sedimentation**	**6 Hours**
Principle, Stoke' law, working of ideal sedimentation tank, Types of sedimentation tank, Design and working of clariflocculator, Operational problems in sedimentation tank.		
Unit:4	**Filtration**	**7 Hours**
Theory of filtration, Types of filters, working of slow and rapid sand filter, operational difficulties, and design of rapid sand filter.		
Unit:5	**Disinfection**	**6 Hours**
Methods of disinfection, Kinetics of chemical disinfection, Chlorination, Chemistry of chlorination, Methods of chlorination.		
Unit :6	**Advanced treatment**	**7 Hours**
Other water treatment techniques: Adsorption, Defluorination, Ion Exchange, methods to remove metal ions, HRSCC, Unconventional water treatment.		
	Total Lecture	**39 Hours**

Text Books	
1	N.J. McGhee, Steel E.W., Water Supply and Sewerage, McGraw hill 1991.
2	P.N. Modi, Water Supply Engineering: v. 1,by Standard Book House, 2010

Reference Books	
1	CPHEEO, Manual on Water supply and Treatment, Govt. of India Publication

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/7.%20Water_and_Waste_Water_Engineering.pdf

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105107207

I Semester
25ENV105– Lab : Water & Waste Water Analysis

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Explain the significance of water quality standards and regulatory criteria for various water uses.
2. Perform and interpret standard physical , chemical and biological water quality tests on water samples to determine key quality parameters.
3. Analyze test results to evaluate the overall quality of water samples
4. Summarize analytical results to evaluate treatment needs, regulatory compliance, and environmental impact

Any TEN experiments of the following will be performed.

1. To determine Alkalinity of a water sample.
2. To determine Available Chlorine in given bleaching powder sample
3. To determine Total, Calcium and Magnesium hardness of given water sample.
4. To determine Dissolved Oxygen concentration in given water sample.
5. To determine Sulphates concentration in given water sample.
6. To determine Biochemical Oxygen Demand (B.O.D.) of a wastewater sample.
7. To determine Chemical Oxygen Demand (C.O.D.) of a wastewater sample.
8. To determine Maximum Probable Number (MPN) of coli form bacteria present in water sample by Multiple Tube Dilution (MTD) technique-presumptive test.
9. To determine Density of bacteria in a water sample pour plate (Standard Plate Count) method.
10. To determine concentration of Chlorides in a given water sample.
11. To determine Hydrogen ion concentration (pH) of a solution
12. To determine Turbidity of a solution using Nepheloturbidimeter.
13. To determine optimum coagulant dose by Jar test.
14. To determine effective size and co-efficient of uniformity of a given sand sample and to separate required sand from given stack of sand for required effective size and coefficient of uniformity.
15. To determine total, dissolved and suspended solids in given water sample.

I Semester
25ENV106– Municipal Solid Waste Management

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Explain sources, characteristics, impacts, and functional elements of municipal solid waste. 2. Apply suitable methods for storage, collection, transportation, and processing of solid waste. 3. Analyze and compare biological, thermochemical, and landfill technologies for effective waste management. 4. Evaluate MSW practices with respect to rules and regulations to suggest sustainable solutions.

UNIT:1	**Solid waste Management Status**	**07 Hours**
Problems and impacts of solid waste in developing countries, Solid waste management and organization. Sources, Types, Quantity and Composition of municipal solid waste.		
UNIT:2	**Characterization of solid waste**	**06 Hours**
Functional Elements of MSW, Characteristics of solid waste–Sampling–physical, chemical, and biological Analysis.		
UNIT:3	**Storage, Collection & transportation of waste**	**07 Hours**
Storage of solid waste, Collection and segregation of waste, Transportation, Optimization of route, Tools and equipment, Transfer station, Volume reduction, Material recovery facility.		
UNIT:4	**Biological Processing of solid waste**	**07 Hours**
Composting – Process microbiology, Aerobic and anaerobic composting, anerobic digestion, Mechanical Composting. Compressed Bio Gas (CBG), Sanitary Landfill – Process, mechanism, Classification, types, site considerations, Maintenance of site. **(Contemporary issues related to topic)**		
UNIT:5	**Thermochemical Processing of solid waste**	**06 Hours**
Processing method, Incineration- Mechanism, types, and Operation, Pyrolysis, Refuse derived fuel.		
UNIT:6	**MSW Rules & regulations**	**06 Hours**
Legislation on Management and Handling of Municipal Solid Waste Management, Handling of Bio-Medical Waste **(Contemporary issues related to topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Solid waste management in developing countries – A.D. Bhide, B.B. Sudresan
2	George Techobanoglous, "Integrated Solid Waste Managementll, McGraw-Hill Publication, 1993
Reference Books	
1	Municipal Refuse Disposal – Institute of America Public Health Association, Interstate printer and publisher
2	CPHEEO manual on MSW, GoI, New Delhi

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1	https://www.springer.com/series/15901
2	https://link.springer.com/book/10.1007/978-3-030-76221-6

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105103205
2	https://archive.nptel.ac.in/courses/120/108/120108005/

I Semester
25ENV107– Municipal Waste Water Treatment

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Examine the characteristics of wastewater and compare various wastewater treatment processes. 2. Explain and apply knowledge of the functioning of different sewage treatment units. 3. Design and analyze different wastewater treatment units. 4. Illustrate methods for the treatment and disposal of biosolids.

UNIT:1	**Introduction**	**07 Hours**
General objectives of sewage treatment, sewage characteristics, Reactor types and their hydraulic characteristics, mass balance analysis, reaction order, rates and coefficients.		
UNIT:2	**Preliminary & Primary treatment**	**06 Hours**
Conventional sewage treatment flow sheet, functions of different unit processes. Physical treatment: screening, gravity separation theory, types of settling, grit removal, primary sedimentation tank and its design		
UNIT:3	**Chemical Treatment**	**07 Hours**
Chemical Treatment: chemical coagulation and precipitation, removal of phosphorus, heavy metals		
UNIT:4	**Biological treatment-I**	**06 Hours**
Biological treatment: Fundamentals, basic terminologies Activated sludge process/SBR/MBBR : process description, recent developments, process analysis, design of conventional activated sludge process unit.		
UNIT:5	**Biological treatment-II**	**07 Hours**
Denitrification, Biological phosphorous removal, Membrane Bio-Reactors		
UNIT:6	**Treatment of biosolids**	**06 Hours**
Treatment of biosolids: process flow diagram, thickening, aerobic and anaerobic digestion, conditioning, dewatering **(Contemporary issues related to topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	S.J. Arceivala, Wastewater Treatment and Disposal, Marcel Dekker,1981.
2	Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third edition McGraw – hill 1991
3	Qasim S.R. Wastewater Treatment Plant Planning, Design and Operation, Holt, Rinehart and Winston, N.Y

Reference Books	
1	N.F. Grey Activated Sludge Process, Theory and Practices, Oxford University Press

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1	https://www.springer.com/series/15901
2	https://link.springer.com/book/10.1007/978-3-030-76221-6

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc22_ce27/preview
2	https://www.digimat.in/nptel/courses/video/105105178/L23.html

I Semester
25ENV108– Air Pollution Control

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Explain the sources, classification, and impacts of air pollutants on environment. 2. Explain meteorological conditions to predict pollutant behavior. 3. Illustrate appropriate control technologies for managing emissions from major industrial and urban sources. 4. Examine indoor and ambient air quality in alignment with regulatory standards and sustainable urban planning principles.

Unit:1	**Sources And Effects of Air Pollutants**	**6 Hours**
Classification of air pollutants– Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals		
Unit:2	**Dispersion Of Pollutants**	**7 Hours**
Elements of atmosphere – Meteorological factors – Plume rise – Dispersion of pollutants – Dispersion models – Applications.		
Unit:3	**Air Pollution Control**	**6 Hours**
Principles of control equipment – Particulates control by gravitation, centrifugal method, filtration, scrubbing, electrostatic precipitation – gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries		
Unit:4	**Air Quality Management**	**7 Hours**
Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles. Air quality standards –Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality.**(Contemporary issues related to topic)**		
Unit:5	**Indoor And Ambient Air Quality**	**6 Hours**
Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, changes in indoor air quality, control of indoor air pollutants and air cleaning systems. Air pollution Index, Smoke Control.		
Unit :6	**Urban Air Pollution**	**7 Hours**
Air Pollution from vehicles; Air Pollution from Biomass burning; Air Pollution from landfills Noise pollution: Theory, sources, measurement, and methods of control of noise pollution. Odour pollution: Theory, sources, measurement and methods of control of odour pollution.**(Contemporary issues related to topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	M.N. Rao ,Air Pollution,Tata McGraw Hill, 2006
2	C. S. Rao, Air pollution control technologies

Reference Books	
1	Air Pollution, Vol. I to IX, A. C. Stern, Academic, New York, 1968

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	-----

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105107213

II Semester
25ENV201– Industrial Waste Water Treatment & Reuse

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Explain the environmental impacts of industrial wastewater, characterization methods, and regulatory standards, including sampling, toxicity testing, and statistical analysis. 2. Design preliminary and biological treatment systems for industrial wastewater. 3. Analyze advanced treatment technologies for wastewater recycle/reuse and pollution reduction. 4. Develop industry-specific treatment strategies for sectors like textiles, dairy, and tanneries based on pollutant characteristics.

UNIT:1	**Introduction**	07 **Hours**
Environmental impact due to industrial water pollution, problems associated with industrial wastewater, and characterization of industrial wastewater. Sampling and analysis of wastewater, toxicity testing, statistical analysis of data, Indian standards for wastewater disposal		
UNIT:2	**Recycle and Reuse of Wastewater**	06 **Hours**
Common effluent treatment plant. Recycle and reuse of industrial waste, volume and strength reduction, concept of zero liquid discharge (ZLD)**.(Contemporary issues related to topic)**		
UNIT:3	**Primary Treatment Unit**	07 **Hours**
Screening, Equalization and proportioning of wastewater, design of equalization tank. Neutralization of wastewater, Oil and grease removal, Floatation		
UNIT:4	**Biological Treatment**	06 **Hours**
Stabilization pond, oxidation ponds. Introduction to Membrane Bioreactor (MBR), Sequencing Batch Reactor (SBR)		
UNIT:5	**Anaerobic Treatment**	07 **Hours**
Anaerobic treatment, UASB, attached growth processes		
UNIT:6	**Treatment of Industrial Wastewater**	06 **Hours**
Common Effluent Treatment Plant (CETP) using Zero Liquid Discharge (ZLD) treatment for textile and dairy industries. **(Contemporary issues related to topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third Edition McGraw Hill 1991
2	W.W. Eckenfelder, Industrial Pollution Control, McGraw Hill Int. Edition 1990
3	W.J. Weber, Physicochemical Processes for Water Quality Control, John Wiley and Sons, 1972.
4	Nemerow, N.L. Theories and Practices of Industrial Waste Treatment. New York: Addison Wisely
5	Arceivala, S.J., (1998) "Wastewater Treatment for Pollution Control ", Tata McGraw Hill

Reference Books	
1	Central pollution control board, India, comprehensive industry document series
2	World Bank Group (1998) "Pollution Prevention and Abatement Handbook – Towards Cleaner Production", World Bank and UNEP, Washington D.C

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/8059
2	https://link.springer.com/book/10.1007/978-3-030-76221-6

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105106119
2	https://nptel.ac.in/courses/105105048

II Semester
25ENV202– Environmental Management

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Analyze the interrelationship between development and the environment in national and global contexts. 2. Identify and differentiate various environmental impacts and propose appropriate preventive or reactive control strategies. 3. Apply established EIA methodologies and tools to develop environmental management plans and assess sector-specific case studies. 4. Discuss environmental audits and management systems for improving environmental performance in various sectors.

UNIT:1	**Sustainable Development**	**07 Hours**
Development and Environment, Global and Indian scenario. National Environmental Policy, Environmental organizations for planning and implementation sustainable development. Concept of carrying capacity, assimilative and supportive capacity.		
UNIT:2	**Impact Identification**	**06 Hours**
Preventive and reactive strategies for environmental pollution control, Nature of impact – primary, secondary, tertiary, short –term long-term, local and regional, reversible & irreversible impacts.		
UNIT:3	**Environmental Impact Assessment**	**07 Hours**
Environmental impact Assessment: Screening scoping, Methodologies: Adhoc, check-lists, network, matrix etc. Environmental Management plan. EIS Typical case studies (various sectors) of environmental impact assessment. MoEF questionnaire for environmental clearance, Disaster management plan.		
UNIT:4	**Environmental Audit**	**06 Hours**
Environmental Audit definition, concept of EA, types of environmental audit, audit scope, procedural aspects of conducting environmental audit, water audit, wastewater audit, health and safety audit.		
UNIT:5	**Environmental Management system**	**07 Hours**
Eco Labeling, Concept of Cleaner Technology, Life Cycle Assessment, waste minimization, ISO 14001,Green rating.		
UNIT:6	**Environmental Legislations**	**06 Hours**
Environmental Legislations and its basic concepts, -Water Act (1974, 1988), Air Act (1981), Environmental Protection Act 1986, other major environmental acts/rules. Hazardous Waste (Management and Handling) Rules, Solid Waste Management Rules, 2016, Plastic Waste, Biomedical Waste, E-Waste, and C&D Waste Rules, Coastal Regulation Zone (CRZ) Notification.		
	Total Lecture	**39 Hours**

Text Books	
1	Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House., 2009
2	W. C. Turner, Energy Management Handbook Wiley New york 1st edition.

Reference Books	
1	John Rau & Wooten, Environmental Impact Assessment, Mc Graw Hill., 4th Edition, McGraw Hill Education, 2012
2	Harry W. Gehm, Jacob I. Bregman, a handbook on pollution Control Acts, Central Pollution Control Board, New Delhi, 2015
3	R.K. Sapra, S. Bhardwaj, the New Environmental Age, Ashish Pub. House, New Delhi. 2011.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/15901
2	https://www.springer.com/series/15433
3	https://www.springer.com/series/8059
4	https://link.springer.com/book/10.1007/978-3-030-76221-6

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/114106017
2	https://onlinecourses.nptel.ac.in/noc21_hs83/preview

II Semester
25ENV203– Rural Water Supply & Sanitation

Course Outcomes :
Upon successful completion of the course the students will be able to
1.Analyze and plan rural water supply and sanitation schemes considering national policies.
2. Apply and evaluate simple, low-cost water treatment technologies for rural areas.
3. Design and analyze compact units for rural wastewater treatment and disposal systems.
4. Evaluate and propose solid waste management and strategies for rural area

UNIT:1	**Introduction**	**07 Hours**
Introduction: Concept of environmental and scope of sanitation in rural areas. Magnitude of problem of water supply and sanitation, National policy.		
UNIT:2	**Planning of water supply systems**	**06 Hours**
Planning of water supply systems: Various approaches for planning of water supply systems in rural areas. Selection and development of preferred sources of water, springs, wells, Infiltration wells, radial wells, and infiltration galleries		
UNIT:3	**Collection of water**	**07 Hours**
Collection of water: Collection of raw water from surface source. Specific problems in rural water supply and treatment e.g. iron, manganese, fluorides, Low cost treatment.		
UNIT:4	**Water Treatment**	**06 Hours**
Treatment: Improvised methods and compact system of treatment of surface and ground waters such as MB settlers, slow sand filter, chlorine diffusion cartridges. Water supply through spot sources, hand pumps, open dug wells ,Rural Water supply schemes-unconventional water treatment plant < 5 MLD, Planning of distribution system in rural areas, Water supply during fairs, festivals and emergencies.		
UNIT:5	**Sanitation**	**07 Hours**
Sanitation: Treatment and disposal of wastewater/sewage various methods of collection and Disposal of night soil Onsite sanitation system and community latrines, low cost sanitation methods. (Contemporary issue related to topic)		
UNIT:6	**Rural waste management**	**06 Hours**
Rural waste management: Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, septic tank and soakage pits, Disposal of solids waste: Composting and Biogas plants. (Contemporary issue related to topic)		
	Total Lecture	**39 Hours**

Text books	
1	Wagner, E.G. and Lanoik, J.N., Water supply for Rural areas and small communities, Geneva

Reference Books	
1	Manual of water supply and treatment, 3rd Edition, CPHEEO, GOI, New Delhi
2	Low cost on site sanitation option, Hoffman and Heijno Occasional Nov.1981 Paper No.21 P.O. Box 5500 2280 HM Rijswijk, the Netherlands offices,J.C.Monkeniaan,5Rijswijk(The Haque)
3	R.K. Sapra, S. Bhardwaj, the New Environmental Age, Ashish Pub. House, New Delhi. 2011.
4	Manual of Swach Bharat Mission,

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/15433
2	https://www.springer.com/series/8059
3	https://link.springer.com/book/10.1007/978-3-030-76221-6

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105101215
2	https://jalshaktiddws.gov.in/sites/default/files/Manual_for_Operation_and_Maintenance_of_Rural_Water_Supply_Scheme.pdf

II SEMESTER
25ENV204– Remote Sensing and GIS

Course Outcomes :		
Upon successful completion of the course the students will be able to 1. Explain the fundamentals of remote sensing and GIS 2. Illustrate image processing techniques and GIS-based spatial data handling methods 3. Examine spatial data using GIS tools 4. Explain the environmental applications of RS & GIS .		
Unit:1	**Fundamentals of Remote Sensing**	**6 Hours**
Introduction & Basic Concepts of remote sensing; Electromagnetic (EM) spectrum and interaction with atmosphere and earth surface; Atmospheric windows, Types of Remote Sensing, Platforms and Sensors, Resolution of Sensors.		
Unit:2	**Remote Sensing Data Acquisition and Analysis**	**7 Hours**
Aerial Photography, Photo-interpretation keys, Satellite Remote Sensing, Digital image data formats and levels of processing- Image Processing Techniques: Pre-processing, Image enhancement, Image classification, Accuracy assessment and error matrix.		
Unit:3	**Fundamentals of GIS**	**6 Hours**
Introduction to GIS; Components of GIS; Spatial Data; Data input methods; Georeferencing and map projections ; Database Management: Attribute data models; Spatial and non-spatial data linking; Metadata and data standards		
Unit:4	**GIS Data Analysis and Modeling**	**6 Hours**
Spatial Analysis: Overlay analysis; Spatial queries and proximity analysis; Network analysis - Raster Analysis: Map algebra, reclassification, interpolation techniques; Terrain analysis; DEM/DTM concepts and applications Modeling in GIS: Suitability modeling; Hydrological modeling; Urban growth modeling and land use change detection.		
Unit:5	**Applications of Remote Sensing & GIS**	**7 Hours**
Environmental Applications: Land use and land cover mapping; Forest monitoring, biodiversity assessment; Water resources; Air and water pollution monitoring;- Urban and Regional Planning: Urban sprawl mapping; Site suitability for infrastructure; Transportation planning and utility mapping; Smart cities and sustainable urban development- Disaster Management: Early warning systems; Disaster vulnerability and risk assessment Other Applications: Agriculture; Geology; Climate studies and global change monitoring.		
Unit :6	**Recent Trends**	**7 Hours**
Advanced RS & GIS Tools: GPS, GNSS, mobile mapping; LiDAR, UAV/Drone-based remote sensing; Microwave remote sensing and SAR applications- Emerging Technologies: AI & Machine Learning in GIS/RS; Cloud-based GIS (Google Earth Engine, ArcGIS Online); Integration with IoT, Big Data, and Decision Support Systems - Case Studies: National; International **Contemporary Issues related to Topic**		
	Total Lecture	**45 Hours**

Text Books	
1	Basudeb Bhatta, Remote sensing and GIS, Oxford University Press, Third Edition 2020
2	Anji Reddy , Remote sensing and GIS, BS Publications, Third Edition 2008

Reference Books	
1	Floyd F.Sabins,Remote Sensing: Principles and Interpretation, Waveland Pr Inc; 3rd edition (5 April 2007)
2	Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman,Remote Sensing and Image Interpretation, Wiley Publication,7th Edition,2015

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-642-30061-5

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105103193
2	https://nptel.ac.in/courses/105107201
3	https://nptel.ac.in/courses/105108077
4.	https://nptel.ac.in/courses/121107009

II Semester
25ENV205– Lab. : Remote Sensing and GIS

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Demonstrate the fundamentals of image processing techniques . 2. Apply visual image interpretation and classification methods, and evaluate results using accuracy assessment techniques. 3. Utilize georeferencing, spatial data input methods, attribute data management, and database integration for efficient handling of geographic information. 4. Perform spatial and network analysis, and design professional map layouts and thematic maps for effective geospatial data presentation and decision-making.

Module 1
Familiarization with image processing – Image data loading, visual understanding of image and identification of objects, image histogram and layer information, Image registration and analysis. Image enhancement techniques- linear and non-linear contrast enhancement, details band composition, edge enhancement, high pass and low pass filtering.
Module 2
Visual image interpretation- identification of features on image (Physical features, urban features, forest and agricultural landuse), true color and FCC, Interpretation of thermal and Radar images. Image classification- supervised and unsupervised classification with maximum likelihood, minimum distance to mean technique. Accuracy assessment of image- understanding error matrix, overall and mapping accuracy, kappa coefficient, ground truth.
Module 3
Georeferencing application- Coordinates system, datum conversion/map projection use and types with special reference to UTM and WGS. Spatial data input- scanning, Heads-up/on screen digitization, creating new features, selecting features, editing features, understanding and use of topology, linear and area measurement, linking of attributes data with geographic features. Attribute data input- Use of MS Office, excel and access, data updating, queries of table in GIS software (union, intersection, join, relate), creation of graphs.
Module 4
Spatial analysis- Query (location and attribute), geoprocessing tools and wizard. Spatial searching (buffer analysis). Network analysis- utility of network, network model creation, shortest path analysis. Map design and presentation- Map layout presentation with scale, index, north line, coordinate etc., thematic maps, export map with different formats.

II Semester
25ENV206– Lab. : Design of Sewerage Systems

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Demonstrate the fundamentals of SewerGEMS software. 2. Apply modelling techniques for gravity and pressure flow systems. 3. Perform extended period simulations by assigning loading patterns, setting up diversions, defining controls, and comparing scenarios using built-in tools. 4. Integrate geospatial and engineering data to design and present sewer networks with automated pipe sizing and engineering profiles.

Module 1
Introduction to SewerGEMS :Graphical User Interface , Switch solvers within SewerGEMS, Duplicate, edit and rename FlexTables , Use the Sanitary Load Control Center to apply unit loads to manholes ,Setup extreme flows to apply peaking factors to unit loads , Create and edit new scenarios, calculation options, and profiles ,Use the Unit Sanitary (Dry Weather) Loads manager to import unit loads , Apply color coding and annotation to models
Module 2
Gravity and Pressure :Open an existing (preloaded) model, Draw pressure elements, Enter pump characteristics, Determine system head curves , Model wet wells
Module 3
Extended Period Simulations :Enter pattern loading data and assign patterns to manholes , Set up diversions in a sewer model ,Enter pump definitions and inflow hydrographs ,Understand how to set up and use controls in a model ,Use the Scenario Comparison tool to easily compare any two scenarios in SewerGEMS ,Switch between SewerGEMS solvers and compare calculated results
Module 4
Geospatial Data Tools :Build a sewer model from shapefiles using ModelBuilder ,Import node elevations using TRex , Import loading data using LoadBuilder ,Import a shapefile as a background image
Module 5
Designing a New System Use a Background file (dxf) to draw a network to scale ,Set design constraints and apply SewerGEMS automated design to size pipes www.ifsacademy.org ,Create and view engineering profiles

II Semester
25ENV211– PE-I : Hazardous Waste Management

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Describe and classify hazardous waste, and sources with respect to their effects on human health. 2. Apply and compare hazardous waste treatment technologies. 3. Evaluate waste minimization strategies, solidification/stabilization techniques, and site selection methodologies for effective hazardous waste management. 4. Interpret and explain national and international legislation and frameworks related to hazardous waste handling.

UNIT:1	**Introduction**	**07 Hours**
Definition of hazardous waste, U.S.E.P.A. classification, global scenario, episodes.		
UNIT:2	**Source of hazardous waste**	**06 Hours**
Source of hazardous waste, effect of Hazardous waste on human health, Sampling and analytical procedures, Overview of treatment and disposal method – waste minimization.		
UNIT:3	**Treatment of Hazardous Waste-I**	**07 Hours**
Physicochemical method and biological method, Thermal Processes. In-situ methods for Decontamination of hazardous waste sites.		
UNIT:4	**Treatment of Hazardous Waste-II**	**06 Hours**
Solidification/stabilization and innovation techniques. Common hazardous waste treatment Storage and disposal facility (CHWTSDF).		
UNIT:5	**Disposal**	**07 Hours**
Secure landfill**.** Site selection methodology for establishing treatment and disposal methods and EIRA methodology.		
UNIT:6	**Legislations**	**06 Hours**
Legislation on Management &Handling rules based on Hazardous Waste Management. Hazardous waste (management and handling) rules, 1989 and Indian Scenario. Transboundary movement rules. **(Contemporary issues related to topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Charles A. Wentz; " Hazardous Waste Management ", McGraw-Hill Publication, 1995
2	W. C. Turner, Energy Management Handbook Wiley New york 1st edition.

Reference Books

1	The safe disposal of hazardous waste. Vol. I, II, & III Bat stone, Smith, Wilson, Joint study Sponsored by the world bank, the WHO, & UN Environmental Program UNEP,
2	The World Bank Freeman H.M. standard Handbook of Hazardous Waste Treatment and Disposal, 1989

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/15901
2	https://www.springer.com/series/15433
3	https://www.springer.com/series/8059

MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/content/storage2/courses/105106056/Introduction.pdf
2	https://onlinecourses.swayam2.ac.in/cec20_ge34/preview

II Semester
25ENV212– PE-I : Water Resource Management

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Understand water resources planning 2. Understand water policies and the application of remote sensing. 3. Understand different methods of conservation and recharging of water resources 4. Understand inter-basin transfer and EIA of water Resource development projects

UNIT:1	**Introduction**	**07 Hours**
Introduction: water resources planning, multi–objective planning role in national development		
UNIT:2	**Hydrology**	**06 Hours**
Basic concepts of hydrology and hydrogeology, River monitoring, gauging silting, silt load		
UNIT:3	**Water Resources Planning**	**07 Hours**
National water policy. Water resources planning and processes. Management of water bodies. Application of remote sensing Techniques. Integrated approach – carrying capacity based planning.		
UNIT:4	**Water resources conservation:**	**06 Hours**
Quantity aspects, surface and ground water development, Rain water harvesting, ground water recharge, conjunctive use of ground and surface water.**(Contemporary issues related to topic)**		
UNIT:5	**Water resources development**	**07 Hours**
Coastal areas. Basic concepts of economics, welfare economics. Inter basin transfer of water.**(Contemporary issues related to topic)**		
UNIT:6	**Case Studies on Water Conservation**	**06 Hours**
EIA of water Resource development projects. Case study related to water conservation and resources Development.**(Contemporary issues related to topic)**		
	Total Lecture Hours	**39 Hours**

Text books	
1	Linsey, R. K. &Franzini, J.B. water resources Engineering. New Delhi : McGraw Hill
2	Grigg N.S. Water Resources planning McGraw Hill Book company

Reference Books	
1	Neil S. Grigg, Water resource management – principles, regulations, and cases New Delhi: McGraw Hill

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/15901
2	https://www.springer.com/series/15433
3	https://www.springer.com/series/8059

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105108081
2	https://nptel.ac.in/courses/105108130

II Semester
25ENV213– PE-I : Environmental Biotechnology

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Understand the fundamental concept of microbial biochemistry and biotechnology
2. Understand the Relationship between cell signaling and gene transcription.

UNIT:1	**Introduction**	**07 Hours**
Basic concept of microbial biochemistry-carbohydrates, proteins, fats, and nucleic acids.		
UNIT:2	**Biological Decomposition**	**06 Hours**
Basic concept of biodegradation, biotransformation, biobenification, bio restoration / bioreclammation, microbial interaction, Environmental monitoring-signification of monitory bacterial viral and protozoan pathogens		
UNIT:3	**Monitoring Techniques**	**07 Hours**
Technique of monitoring-standard methods of monitoring viral bacterial and protozoan pathogens, Advance techniques-gene probes biosensor, immunoassay.		
UNIT:4	**Genetic**	**06 Hours**
Basic concept of genetic engineering-chromosomal DNA, plasmid DNA transformation, mutation recombinant DNA techniques		
UNIT:5	**Biotransformations**	**07 Hours**
Transudation conjugation, protoplast fusion, Biotransformation of biomass/organic waste into value added chemicals, energy, fertilizers, and single cell protein		
UNIT:6	**Application of Biotechnology**	**06 Hours**
Aerobic and anaerobic waste treatment processes-microorganisms involved, and biochemical changes of different pollutants present in liquid and solid waste, reactor technology.**(Contemporary issues related to topic)**		
	Total Lecture Hours	**39 Hours**

Text books	
1	C.S. Forster and D.A. John Wase, Environmental Biotechnology, Ellis Harwood, 1987
2	Trehan K. Biotechnology, New Delhi, Willey Eastern Ltd.1990

Reference Books	
1	Forster C.F.N Biotechnology and Wastewater Treatment, Cambridge 1992
2	N.F. Grey, Biology of Wastewater Treatment Oxford University Press ,2009

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/15733

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/102105088
2	https://archive.nptel.ac.in/content/syllabus_pdf/102105088.pdf

II Semester
25ENV214– PE-I : Advanced Water Treatment

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Explain the principles and significance of advanced water treatment and water quality requirements. 2. Apply appropriate treatment methods for purification and softening of water. 3. Analyze techniques for removal of specific contaminants and improvement of water quality. 4. Evaluate and suggest suitable water treatment and control measures for safe and sustainable use.

UNIT:1	**Introduction**	**07 Hours**
Significance of Advanced water treatment, water quality requirement and specific treatment for industries.		
UNIT:2	**Hardness and TDS Removal**	**06 Hours**
Softening of water, Boiler feed water, lime soda process, ion exchange process, Membrane filtration.		
UNIT:3	**Desalination**	**07 Hours**
Desalination: Theory of desalination, various methods of Desalination- Distillation, Electro dialysis, Freezing, Demineralization, Solar evaporation. Membrane filtration process.		
UNIT:4	**Adsorption**	**06 Hours**
Adsorption: Theory, Granular and powder activated carbon, Performance, and Reactivation. Materials and Reactions, Kinetics, Applications.		
UNIT:5	**Other Methods**	**07 Hours**
Fluoride Removal, Arsenic Removal, Fe and Mn removal, Taste, odor and colour removal.		
UNIT:6	**Miscellaneous methods**	**06 Hours**
Algae control, Corrosion control, Water treatment for Swimming Pool.		
	Total Lecture	**39 Hours**

Text books	
1	N.J. McGhee, Steel E.W., Water Supply and Sewerage, McGraw hill 1991
2	Fair Geyer & Okun, Water and Waste Water Engineering, Vol I and II, John Wiley & Sons 1st

Reference Books	
1	Nordel, E, Water Treatment for Industrial and Other Uses, Reinhold Publishing Corporation, N.Y.
2	CPHEEO, Manual on Water supply and Treatment, Govt. of India Publication.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/15733

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/105105178
2	https://www.youtube.com/watch?v=hZIMFBuP8zc

II Semester
25ENV221– PE-II : Environmental Legislations

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Interpret the provisions and applicability of environmental laws, policies, and regulations. 2. Analyze the processes of environmental clearance, EIA, and public participation in decision-making. 3. Evaluate the effectiveness of environmental enforcement mechanisms, audits, and legal frameworks. 4. Propose improvements to environmental governance and legal compliance based on real-world case studies.

UNIT:1	**Introduction to Environmental Law and Governance**	**07 Hours**
Concept, scope, and importance of environmental law, History and evolution of environmental legislation in India International environmental law and treaties: Stockholm (1972), Rio (1992), Kyoto Protocol & Paris Agreement (2015), Role of judiciary, & National Green Tribunal (NGT)		
UNIT:2	**Indian Constitutional Provisions and Institutional Framework**	**06 Hours**
Article 48A and 51A(g), Right to Life and Environmental Protection (Article 21), Ministry of Environment, Forest and Climate Change (MoEF&CC), Central and State Pollution Control Boards (CPCB, SPCBs) – roles and power, Role of ULBs and panchayats, E-Governance and online compliance tools.		
UNIT:3	**Major Environmental Acts and Rules**	**07 Hours**
The Environment (Protection) Act, 1986, Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, Hazardous Waste (Management and Handling) Rules, Solid Waste Management Rules, 2016, Plastic Waste, Biomedical Waste, E-Waste, and C&D Waste Rules, Coastal Regulation Zone (CRZ) Notification		
UNIT:4	**Environmental Clearance, EIA, and Public Participation**	**06 Hours**
Environmental Impact Assessment (EIA) Notification 2006 & amendments, Process of environmental clearance (screening, scoping, appraisal), Role of public hearing and stakeholder consultation, Post-clearance monitoring and compliance, Case studies of major infrastructure/industrial projects		
UNIT:5	**Environmental Audits, Standards & Enforcement Mechanisms**	**07 Hours**
Environmental audit: objectives, procedure, and reporting, CPCB guidelines on effluent and emission standards, Consent to Establish (CTE) and Consent to Operate (CTO), Role of ISO 14001 and Environmental Management Systems (EMS), Role of Environmental Courts and NGT in enforcement Contemporary Issues.		
UNIT:6	**Global Frameworks, Sustainability, and Emerging Legal Issues**	**06 Hours**
UN Sustainable Development Goals (SDGs) and climate action, UNFCCC, Environmental, Social, Governance and Corporate Environmental Responsibility, Carbon tax and Carbon credit, Emerging issues: Climate litigation, environmental crimes, and environmental refugees.		
	Total Lecture	**39 Hours**

Text Books	
1	Shyam Divan and Armin Roseneranz "Environmental law and policy in India "Oxford University Press, New Delhi, 2001.
2	Greger I. Megregor, "Environmental law and enforcement", Lewis Publishers, London1994.
3	Constitution of India [Referred articles from part-III, part-IV and part-IV A]
4	Pares Distn. Environmental Laws in India (Deep, Lated edn.)
5	Handbook of environmental management and technology: Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.

Reference Books	
1	CPCB, "Pollution Control acts, Rules and Notifications issued there under "Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997.
2	The ISO 14000 Handbook: Joseph Cascio.
3	ISO 14004: Environmental management systems: General guidelines on principles, systems and supporting techniques (ISO 14004:1996 (E)).
4	ISO 14001: Environmental management systems: Specification with guidance for use (ISO 14001:1996b(E) (International organization for standardization-Switzerland)

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	/www.springer.com/series/5921
2	/www.springer.com/series/15053
3	https://www.springer.com/series/5921/books?page=5
4	https://link.springer.com/book/10.1007/978-981-10-6952-9
5	https://link.springer.com/book/10.1007/978-981-10-3761-0

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc22_lw02/preview
2	https://onlinecourses.swayam2.ac.in/aic19_ge05/preview
3	https://onlinecourses.nptel.ac.in/noc22_hs126/preview
4	https://onlinecourses.nptel.ac.in/noc22_mm36/preview
5	https://onlinecourses.swayam2.ac.in/nou22_bt06/preview

II Semester
25ENV222– PE-II : Applied Structures

Course Outcomes:
Upon successful completion of the course, the students will be able to 1. Design various pipes and associated structures. 2. Analyze different loads conditions applicable to different environmental structures 3. Design important water collection and conveyance appurtenances . 4. Explain the importance of durability of water supply structures

UNIT:1	**Introduction**	**07 Hours**
Basic Concept of Structural design of water supply and water collection system		
UNIT:2	**Design of pipes**	**06 Hours**
Design of pipes such an R.C.C. prestressed mild steel asbestos cement, cast iron etc.		
UNIT:3	**Estimation of loads**	**07 Hours**
Estimation of loads such as gravity earth forces, superimposed loads, moving loads, etc. On rigid and flexible conduits under various types of field conditions.		
UNIT:4	**Design of appurtenances**	**06 Hours**
Design of pipe supports, beddings, shallow and deep manholes, inverted siphons and other appurtenances etc.		
UNIT:5	**Design of tanks**	**07 Hours**
Design of tanks and prestressed structures for water such as circular and intake tank.		
UNIT:6	**Durability**	**06 Hours**
Study of Durability criteria for environmental structures **(Contemporary issues related to topic)**		
	Total Lecture	**39 Hours**

Text Books	
1	Jai Krishna & Jain O.P. plain & reinforced concrete, Vol. II, Roorkee: New Chand & Bros, 1980

Reference Books	
1	N. Krishna Raju, advanced concrete structures, Tata McGraw Hill 1995

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/5921
2	https://www.springer.com/series/15053

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc22_lw02/preview
2	https://onlinecourses.swayam2.ac.in/aic19_ge05/preview

II Semester
25ENV223– PE-II : Water Reuse and Recycling

Course Outcomes:
Upon successful completion of the course, the students will be able to 1. Understand the concept of sustainable water resources management as a foundation for water reclamation and reuse 2. Understand the various technologies and systems available for reclaimed water 3. Understand the Water reuse applications including agricultural uses, landscape irrigation, industrial uses, environmental and recreational uses, groundwater recharge.

UNIT:1	**Introduction**	**07 Hours**
Hydrological cycle, Water Reuse Past and Current Practices, water Reuse Application.		
UNIT:2	Environmental Issues	**06 Hours**
Environmental Issues in water Reuse, Water Reclamation criteria in national and international scenario.		
UNIT:3	Water reuses	**07 Hours**
Water reuses treatment methods and technologies.		
UNIT:4	Reclamation of water	**06 Hours**
Storage of reclaimed water, water quality discharge requirements, Problems involved in storage system and its Management		
UNIT:5	Water reuse regulation	**07 Hours**
Water reuse regulation and guidelines, Health and risk management assessment in water reuse application.		
UNIT:6	Water reuse application	**06 Hours**
Water reuses application in agriculture, industrial, urban, groundwater recharge.		
	Total Lecture	**39 Hours**

Text Books	
1	John, P. D., M. Cox, and P. S. Berger (1999) —Health and Aesthetic Aspects of Water Quality,‖ in Water Quality & Treatment, A Handbook of Community Water Supplies, American Water Works Association, McGraw-Hill, Inc., New York

Reference Books	
1	T. Asano, Water Reclamation and Reuse, Water Quality Management Library 10, CRC Press, Boca Raton, FL

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	https://www.springer.com/series/5921
2	https://www.springer.com/series/15053

MOOCs Links and additional reading, learning, video material	
1	https://www.digimat.in/nptel/courses/video/105105178/L01.html
2	https://onlinecourses.swayam2.ac.in/aic19_ge05/preview

III Semester
25ENV301–Project Phase-I

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Illustrate a sound technical knowledge of their selected project topic.
2. Write problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team.
4. Express effectively about the solution of the problem to enhance writing and communication skill.

The group of students will continue to work for the project allotted previously as per thrust area and will submit a project report (thesis) based on their studies. Evaluation will be done continuously, and viva voce conducted at the end of the semester.

IV Semester

25ENV401– Project Phase-II

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Illustrate a sound technical knowledge of their selected project topic.
2. Write problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team.
4. Express effectively about the solution of the problem to enhance writing and communication skill.

The group of students will continue to work for the project allotted previously as per thrust area and will submit a project report (thesis) based on their studies. Evaluation will be done continuously, and viva voce conducted at the end of the semester.