

Curriculum & Syllabi
of
Master of Technology
In
Environmental Engineering
(w.e.f. 2014-15)

Vision
Mission
Program Educational Objectives
Program Outcomes
Program Specific Outcomes
Overall Credit Structure
Curriculum
Syllabus



Offered By

DEPARTMENT OF CIVIL ENGINEERING
M. M. M. UNIVERSITY OF TECHNOLOGY,
GORAKHPUR-273010, UP
August 2021

M. Tech. Environmental Engineering

Vision:

To become a premier centre of learning and research in Civil Engineering, nurturing sustainable development by the year 2025.

Mission:

1. To provide the quality education in the area of Civil Engineering to transform students into graduates with high professional values.
2. To share and disseminate expertise for use in the solution of problems faced by Civil engineering industry and by society.
3. To ensure the continuous improvement in the quality of life of people in the society.
4. To conduct need based research projects giving priority to the needs of industry

Programme Educational Objectives (PEO)

PEO 1: To enrich the Graduates of the programme with the state-of-the-art knowledge of environmental engineering to achieve sustainable development

PEO 2: Graduates of the programme should be able to provide solutions to environmental engineering problems that account for economical, societal, ethical, as well as with standards both as individuals and in team environments.

PEO 3: Graduates of the programme should continue their lifelong learning to remain updated as an effective professional.

Programme Outcome (POs)

Graduates of the Environmental Engineering Programme will be able:

PO1: To acquire in-depth knowledge of environmental engineering, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.

PO2: To analyze complex environmental engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

PO3: To think laterally and originally, conceptualize and solve environmental engineering problems, evaluate a wide range of potential solutions for those problems and arrive at technically feasible and economically viable solutions after considering health and safety, cultural, societal and environmental factors in the core areas of expertise.

PO4: To extract information pertinent to environmental engineering problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually / in group(s) to the development of scientific / technological knowledge in one or more domains of environmental engineering.

PO5: To create, select, learn and apply appropriate techniques, resources, and advanced environmental modelling tools, including modelling and prediction, to complex environmental engineering activities with an understanding of the limitations.

PO6: To possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO7: To demonstrate knowledge and understanding of environmental engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently after consideration of economic and financial factors.

PO8: To communicate with the engineering community, and with society at large, regarding complex environmental engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO9: To recognize the need for and have the preparation and ability to engage in life-long learning, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO10: To acquire professional and intellectual integrity, professional ethics and code of conduct, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the society for sustainable development.

PO11: To observe and examine critically the outcomes of one's actions in addressing Environmental Engineering problems and make corrective measures subsequently and learn from mistakes without depending on external feedback.

Programme Specific Outcome (PSOs)

The students should be able to acquire the following outcomes by fulfilling the objectives (PSOs) after successful completion of the courses:

PSO1: use the application of latest and advanced equipment's in environmental engineering.

PSO2: ability of critical thinking based on in-depth knowledge in environmental engineering to obtain optimal solutions to the complex engineering problems.

PSO3: The ability to design and develop effective application-based solutions and analyzes their associated risks.

Curriculum & Syllabi

First Year, Semester I

S.N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	M	MAS-112/ MMS-606	Advanced Engineering Mathematics	3	1	0	4
2.	PC	MCE-201	Environmental Chemistry and Microbiology	3	1	0	4
3.	PC	MCE-203	Wastewater Treatment	3	1	2	5
4.	PC	MCE-000	Advances in Civil Engineering	3	1	0	4
5.	AC		Audit Subject				-
Total				12	4	2	17

First Year, Semester II

S.N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	PC	MCE-204	Air and Noise Pollution and Controls	3	1	2	5
2.	PC	MCE-205	Solid Waste Management	3	1	0	4
3.	PC	MCE-202	Water Treatment and Distribution	3	1	0	4
4.	PE1	MCE-***	Programme Elective-1	3	1	0	4
5.	AC		Audit Subject				-
Total				12	4	2	17

Second Year, Semester III

S. N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	PE2	MCE-***	Programme Elective-2	3	1	0	4
2.	PE3	MCE-***	Programme Elective-3	3	1	0	4
3.	MP	MCE-220	Minor Project	0	0	8	4
4.	D	MCE-230	Dissertation Part-I	0	0	8	4
Total				6	2	16	16

Second Year, Semester IV

S.N.	Category	Paper Code	Subject Name	L	T	P	Credits
1.	S	MCE-240	Seminar	0	0	4	2
2.	D	MCE-250	Dissertation Part-II	0	0	28	14
Total				0	0	32	16

Programme Core for M. Tech. (Environmental Engineering)

S.N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-201	Environmental Chemistry and Microbiology	-	3	1	2	5
2.	MCE-202	Water Treatment and Distribution	-	3	1	0	4
3.	MCE-203	Wastewater Treatment	-	3	1	2	5
4.	MCE-204	Air and Noise Pollution and Controls	-	3	1	2	5
5.	MCE-205	Solid Waste Management	-	3	1	0	4
6.	MCE-220	Minor Project	-	0	0	8	4
7.	MCE-230	Dissertation Part-I	-	0	0	8	4
8.	MCE-240	Seminar	-	0	0	4	2
9.	MCE-250	Dissertation Part-II	Dissertation Part-I	0	0	28	14

Programme Electives (PE1)

S. No.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-151	Environmental Quality Management	-	3	1	2	5
2.	MCE-152	Earth and Environment	-	3	1	0	4
3.	MCE-153	Principles of Remote Sensing	-	3	1	2	4
4.	MCE-256	Environmental Sanitation and	-	3	1	0	4

Programme Electives (PE2)

S.N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-156	Environmental Impact Assessment and Management	-	3	1	0	4
2.	MCE-167	Geographic Information System Techniques	-	3	1	0	4
3.	MCE-261	Ground Water Management	-	3	1	0	4
4.	MCE-259	Rural Environmental Technology	-	3	1	0	4
5.	MCE-262	Building Environment and Services	-	3	1	0	4

Programme Electives (PE3)

S.N.	Paper Code	Subject	Prerequisite Subjects	L	T	P	Credits
1.	MCE-162	Non-conventional Sources of Energy	-	3	1	0	4
2.	MCE-268	Industrial Wastewater Treatment	-	3	1	0	4
3.	MCE-267	Hazardous Waste Management	-	3	1	0	4
4.	MCE-169	Disaster Management	-	3	1	0	4

Audit Courses for M. Tech. (Environmental Engineering)

S. No.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
1.	MAS-105	Applied Probability and Statistics	-	3	1	0	4
2.	MBA-109	Research Methodology	-	3	1	0	4
3.	MAS-109	Foreign Language-French	-	2	1	0	3
4.	MAS-110	Foreign Language-German	-	2	1	0	3
5.	BCS-68	Neural Network and Fuzzy System	-	3	1	0	4

Besides above elective, the students may be offered other elective subject to prior approval from competent authority.

SYLLABI

MMS 606 ADVANCED ENGINEERING MATHEMATICS

Course category	: Basic Sciences & Maths (BSM)
Pre-requisites	: NIL
Contact hours/week	: Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	: 4
Course Assessment methods	: Continuous assessment through tutorials, assignments, quizzes, One Minor and One Major Theory Examination.
Course Outcomes	: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course

1. To find out the dimension of vector spaces
2. To describe the differences between finite-difference and finite-element methods for solving PDEs;
3. To solve Elliptical (Laplace/Poisson) PDEs using finite differences;
4. To solve functional using Euler method.

Topics Covered

UNIT-I

Vector spaces and Linear transformation: Vector spaces, subspaces, Linear dependence, Basis 9 and Dimension, Linear transformations, Kernel & images, matrix representation of linear transformation, change of basis, Eigen values and Eigen vectors of linear operators, diagonalization.

UNIT-II

Numerical Techniques: Solution of algebraic and transcendental equations using bisection, Regula 9 Falsi and Newton Raphson's method, Numerical solution to linear system, LU factoring decomposition, Cholesky method, Gauss Seidal method, Numerical eigen value problem, Jacobi, Givens method

UNIT-III

Calculus of Variation: Functionals, Euler's equation and its generalization. One and several 9 independent variables. Initial value problems. Weierstrass's sufficiency condition for weak and strong minima and maxima

UNIT-IV

Numerical Solution of Partial Differential Equations: Classification of partial differential 9 equations of the second order. Laplace equations and its solution by Liebmann's process. Poisson equation. Solution of Parabolic, Elliptic and Hyperbolic Equations. Applications to Engineering.

Textbooks

1. K. Hoffman, R Kunze, Linear Algebra, Prentice Hall of India, 1971.
2. I. M. Gelfrand, S. V. Fomin, Calculus of Variation, Dover Publications.
3. M. D. Raisinghania, Advanced Differential Equations, Schand Publishers.
4. P. Kandasamy, K.Thilagavathy & K.Gunavathy, Numerical Methods, S. Chand Publ.

MCE-201 ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY 5Credits (3-1-2)

Course Category	:	Departmental Core (DC)
Pre-requisite Subjects	:	
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.
Course Objectives	:	The purpose behind this course is to make the students familiar with the concepts of chemistry and microbiology involved in the environment.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Understand basic concepts from General Chemistry and Colloidal Chemistry.
2. Understand Environmental Biochemistry and its applications.
3. Perform physico-chemical and biological examination of water and wastewater.
4. Discuss thermodynamics of microbiological systems.
5. Define mass and energy balance of microbial processes.
6. Explain aerobic and anaerobic microbial growth.

UNIT-I	9
Introduction, basic Concept from General Chemistry, Colloidal Chemistry.	
UNIT-II	9
Environmental Biochemistry, Physico-Chemical and Biological examination of Water and Wastewater.	
UNIT-III	9
Thermodynamic of Microbiological systems.	
UNIT-IV	9
Mass and energy Balance of Microbial Process, Aerobic and Anaerobic Microbial growth.	

MCE-202 WATERTREATMENT AND DISTRIBUTION 4 Credits(3-1-0)

Course Category:	Departmental Core (DC)
Pre-requisite Subjects:	Environmental Engineering-I(BCE-26) Environmental Engineering-II (BCE-32)
Contact hours/week:	Lecture: 3, Tutorial : 1 , Practical: 0
Number of Credits:	4
Course Assessment Methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.
Course Objectives:	Student should be able to make technology choice to deal with water quality issues, operate and maintain working treatment systems and do troubleshooting of the problems in these systems. The student will be able to apply the knowledge gained from the subject in EIA studies for water component and water pollution control strategies.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. The students will understand to select or construct appropriate treatment schemes to remove certain pollutants present in water or wastewater.

2. The students may learn to design a water or wastewater treatment component.
3. The students can understand the balance chemical reactions and use balanced reactions to determine the distribution of species at equilibrium.
4. Develop a mass balance expression for contaminants under different case scenarios and design a simple system to meet desired needs.
5. The students can learn how to characterize source water, for physical and chemical treatment of drinking water.
6. The students can learn how to characterize wastewater, physical, chemical and microbiological treatment of wastewater.
7. The students can understand selected contemporary global water and wastewater issues such as water shortage, wastewater reuse and emerging contaminants.
8. The students will learn the water demand, sources of water and intake structures.
9. The students can understand the transmission of water.

UNIT-I	9
Introduction and Sources of Water, Population Forecasting and Water Requirement.	
UNIT-II	9
Physical, Chemical and biological Water Quality Parameters.	
UNIT-III	9
Solid Separation, Settling Operation, Coagulation, Softening, Filtration, Disinfection, Desalination, Dissolved Solids Removal, Adsorption and Ion Exchange, Electrolysis, Osmosis.	
UNIT-IV	9
Special Treatment, Pumping and Distribution Systems.	

Book & References:

1. Water Work Engineering- S. R. Qasim, E. M. Motley and Guang Zhu (Prentice Hall of India, NewDelhi)
2. Water Supply Engineering-S.K. Garg (Khanna Publication, New Delhi)

MCE-203	WASTEWATER TREATMENT	5Credits(3-1-2)
----------------	-----------------------------	------------------------

Course Category:	Departmental Core (DC)
Pre-requisite Subjects:	Environmental Engineering-I(BCE-26) Environmental Engineering-II (BCE-32)
Contact hours/week :	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits :	5

Course Assessment Methods : **Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.**

Course Objectives: To learn principles of different levels of wastewater treatment viz., primary, secondary, and tertiary levels.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Knowledge of design and operational concepts of different wastewater treatment units.
2. An outlook on treatment and disposal of sludge from wastewater treatment units. By product recovery.
3. The students can learn how to characterize wastewater, physical, chemical and microbiological treatment of wastewater.
4. The students can understand selected contemporary global water and wastewater issues such as water shortage, wastewater reuse and emerging contaminants.

UNIT-I	9
Overview of Wastewater Engineering, Terminology in Wastewater Treatment.	

UNIT-II **9**

Wastewater Flow rates, Wastewater Characteristics, Water Born Disease.

UNIT-III **9**

Physical and Chemical Unit Operations, Biological Unit Processes including Kinetics of Biological growth, Sludge Thickening, Digestion, Disposal and Nutrient removal, Self-Purification of Streams.

UNIT-IV **9**

Advanced Treatment Processes, Wastewater Collection, Disposal and Reuse, Introduction to generation of Industrial Wastewater.

EXPERIMENTS

1. To estimate the hardness of the given water sample.
2. To estimate the Ph and turbidity of the given water sample.
3. To estimate the acidity of the given water sample.
4. To estimate the alkalinity of the given water sample.
5. To estimate the chloride concentration of the given water sample.
6. To estimate the total solids and total dissolved solids of the given water sample.
7. To determine the MPN count of total coliforms in the given water sample.
8. To determine BOD of given waste water sample.
9. To determine the COD of the given waste water sample.

Book & References:

1. Environmental Engineering-Peavey, Rowe and Technologies (McGraw Hill Co. Ltd.)
2. Wastewater Engineering-Metcalf and Eddy (McGraw Hill Co. Ltd.)
3. Sewage Disposal and Air Pollution Engineering (Environmental Engineering), Vol.-II- S.K. Garg (Khanna Publication, New Delhi)

MCE-204	AIR AND NOISE POLLUTION AND CONTROL	5 Credits (3-1-2)
----------------	--	--------------------------

Course Category : Departmental Core (DC)

Pre-requisite Subjects :

Contact hours/week : Lecture : 3, Tutorial : 1 , Practical: 2

Number of Credits : 4

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.

Course Objectives:

1. Understanding of basic concepts of air pollution.
2. Study of air pollution episodes. Reasoning of the entire episode, identification of the parameters, conditions, mechanisms. Study of sampling types and methods for ambient air and stack.
3. Study of macro and micro meteorology for understanding the dispersion of pollutants.
4. Simple and complex modelling for point source, line source and area source.
5. Study of pollution control methods, mechanism and devices.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Understand classification, sources and effects of air pollution.
2. Discuss air quality standards.
3. Explain the role of meteorology and natural purification processes.
4. Do sampling, measurement and analysis of air.
5. Design control devices for particulate and gaseous contaminants.
6. Discuss industrial and vehicular pollution.
7. Understand indoor air pollution.
8. Analyze physics of sound. noise sources and standards.

9. Do measurement of sound and suggest ways and means towards control of noise pollution.

UNIT-I	9
Introduction, Classification, Sources, Effects, Air Quality Standards, Role of Meteorology and Natural Purification Processes	
UNIT-II	9
Sampling, Measurement and Analysis, Control Devices for Particulate and Gaseous Contaminants	
UNIT-III	9
Industrial and Vehicular Pollution, Indoor Air Pollution	
UNIT-IV	9
Physics of Sound, Noise-Sources and Standards, Measurement and Control of Noise Pollution	

EXPERIMENTS

1. Monitoring of ambient air quality for total suspended particulate matter and respirable SPM (OM10).
2. Measurements of CO and HC intail pipe exhaust emission of petrol vehicles (two wheelers).
3. Measurements of CO and HC intail pipe exhaust emission of petrol vehicles (four wheelers).
4. Measurements of smoke density in tailpipe exhaust emission of dieselvehicles.
5. Measurements of SO₂ in ambient air.
6. Measurements of NO₂ in ambient air.
7. Measurements of levels of noise pollution in residential, commercial, industrial and silence zones.
8. Comparison of energy equivalent noise level in indoor and outdoor environments.

Book & References:

1. Environmental Engineering-Peavey, Rowe and Technologies (McGrawHillCo.Ltd.)
2. Environmental Noise Pollution- Patrick D. Cunniff (McGrawHillCo.Ltd.)

MCE-256	ENVIRONMENTALSANITATIONANDECOLOGY	4 Credits(3-1-0)
----------------	--	-------------------------

Course category : Departmental Core (DC)

Pre-requisite Subjects :

Contact hours/week : Lecture : 3, Tutorial : 1 , Practical:0

Number of Credits : 4

Course Assessment Methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.

Course Objectives:

1. To impart students with strong knowledge base through theory courses and sessional that makes them suitable for industries, academics, research and consultancies.
2. To develop students analytical, computational and research skills through assignments, weekly presentations and modelling software.
3. To train the students on developing practical, efficient and cost effective solutions on problems and challenges on environmental sciences and engineering.
4. To inculcate among students sensitivity towards social and corporate responsibilities.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. gain the environment conscious and the culture human health.
2. have some information about the tasks of environmental health.
3. evaluate the relations among environment, human, and health.
4. Define the concepts related to environmental issues.
5. define effects reasons of environmental health and the precautions which should be taken.

UNIT-I	9
Introduction and terminology, Pollution types and Sources, Health hazards.	
UNIT-II	9
Water Supply and Sanitary Installations in Buildings, Ecology and Environment.	
UNIT-III	9
Principles of Ecology, Ecosystems, Energy Flow, Trophic Level.	
UNIT-IV	9
Food chain and Food Web, Eco-cycles of Pollutants and Species.	

Book & References:

1. WaterSupplyEngineering-S.K. Garg(KhannaPub.PvtLtd, NewDelhi)
2. Ecology-E.P.Oduni

MCE-259 RURALENVIRONMENTALTECHNOLOGY 4Credits(3-1-0)

Course Category : Departmental Core (DC)

Pre-requisite Subjects :

Contact hours/week : Lecture : 3, Tutorial : 1 , Practical: 0

Number of Credits : 4

Course Assessment Methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.

Course Objectives:

1. To impart students with strong knowledge base through theory courses and sessional that makes them suitable for industries, academics, research and consultancies.
2. To develop students analytical, computational and research skills through assignments, weekly presentations and modelling software.
3. To train the students on developing practical, efficient and cost effective solutions on problems and challenges on environmental sciences and engineering.
2. To inculcate among students sensitivity towards social and corporate responsibilities.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Students will understand how to propagate, plant, and sustainably grow, manage and harvest fruit, vegetable, grain and/or forage crops within various environmental, marketing and financial conditions.
2. Students will be able to identify soil types and how they are formed and ways to modify soil structure and drainage to reduce erosion and improve water quality and water availability to plants.
3. Students will understand how soil fertility is determined and how plant nutrient deficiencies are identified, and means of improving soil fertility and adding nutrients for plant growth.
4. Students will be able to recognize how soil type and topography affects recommended agricultural, commercial and residential use and water quality at varying locations.
5. Students will understand how to identify and sustainably manage plant diseases in various production systems.
6. Students will understand how to identify and sustainably manage insects in various plant production systems.
7. Students will understand how to identify weeds and sustainably manage them in various plant production systems.

UNIT-I	9
General: Concept of environment and scope of sanitation in rural areas. Magnitude of problems of ruralwatersupplyandsanitation,Population tobocovered,difficulties,Nationalpolicy,WaterSupplyDesig npopulationand demandloads.Variousapproachesofplanningofwatersupplyschemesinruralareas.Developmentofprefer red sources ofwatersprings.	
UNIT-II	9

Wells, infiltration wells, radial wells and infiltration galleries, collection of raw water from surface source. Specific problems in rural water supply and treatment, Improved methods and compact systems of treatment of surface and groundwaters for rural water supply such as multi-bottom settlers (MBS), diatomaceous earth filter, cloth filter, slow sand filter, chlorine diffusion cartridges..

UNIT-III **9**

Pumps, pipe materials, appurtenances and improved devices for use in rural water. Planning of distribution system in rural areas, Treatment and Disposal of waste water, Various methods of collection and disposal of night soil. Community and sanitary latrines

UNIT-IV **9**

Compact and simple waste-water treatment units and systems in rural areas such as stabilization ponds, septic tanks, imhoff tank, soak pit etc. Disposal of waste water-soakage pits and trenches, Disposal of solid wastes composting, land filling, incineration. Biogas plants.

Book & References:

1. Water Supply Engineering-S.K. Garg (Khanna Pub.Pvt.Ltd.)
2. Water Supply Engineering- B.C. Punamia and A.K. Jain(Laxmi Publications)

MCE-261 GROUNDWATER MANAGEMENT **4 Credits(3-1-0)**

Course Category : Departmental Core (DC)

Pre-requisite Subjects :

Contact hours/week : Lecture : 3, Tutorial : 1 , Practical: 0

Number of Credits : 4

Course Assessment Methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.

Course Objectives: : This course will provide an insight into the field of groundwater hydrology.

1. The students will equip themselves with the knowledge of interpretation of groundwater data, conducting the surface and subsurface investigations for the groundwater using the latest methods and tools.
2. The students will be able to learn basic fundamentals of groundwater flow, storage and yield. They will also learn various methods of well development.
3. The concepts of groundwater basin management, conjunctive use, competing demands, recharge and mining will add in equipping students to take better decisions in groundwater management.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. To learn basic fundamentals of groundwater flow.
2. To learn the hydraulics of different kinds of wells.
3. Conjunctive use of ground water along with other fresh water sources

UNIT-I **9**

Introduction, Occurrence of ground water, Hydrological Cycle.

UNIT-II **9**

Ground water movement, Well Hydraulics and Water Wells.

UNIT-III **9**

Ground Water Modeling Techniques, Surface and Subsurface Investigations of Ground Water.

UNIT-IV **9**

Artificial discharge and Recharge of Ground Water, Ground Water Management Techniques.

Book & References:

1. Ground Water Assessment, Development and Management-K.R.Karant (Tata McGraw Hill, New Delhi)
2. Water Resource System Planning and Management-M.C.Chaturvedi(Tata McGraw Hill, New Delhi)

MCE-262 BUILDING ENVIRONMENTAL LAND SERVICES 4 Credits(3-1-0)

Course Category : Departmental Core (DC)

Pre-requisite Subjects :

Contact hours/week : Lecture : 3, Tutorial : 1 , Practical: 0

Number of Credits : 4

Course Assessment Methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.

Course Objectives: Students are able to understand the property , use , advantage and disadvantage of different material.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Know state of the art concepts and strategies for lowering environmental impact of buildings and neighborhoods.
2. Know the background and understand the reasons for a more sustainable development of the built environment.
3. Know relevant architectural concepts and projects that have been developed in the last years as response to present environmental challenges.
4. Know alternative green building concepts, recognizing their qualities and limits in lowering environmental impact.
5. Understand the architectural potential of climate and principles behind climate adaptive design.
6. Recognize materials not only for their aesthetic qualities but also in relation to their potential for environmental performance and impact on the environment.
7. Understand a building life cycle and the environmental challenges related to materials' decay and required maintenance.
8. Know alternative energy systems that could be applied in different building typologies.

UNIT-I 9

Acoustics material properties, reverberation, acoustical design of assembly hall building, noise and its control. Ventilation, health and comfort ventilation, ventilation systems, natural and artificial ventilation for tropic regions.

UNIT-II 9

Electrical wiring systems in domestic and commercial buildings, conductors, cables and conduits. Communications, inter-communication systems, sound amplification equipments. Fire protection and equipments, code provisions from NBC. Illumination, artificial lighting, day lighting, laws and principles of illumination. Design of lighting systems, flood lighting, relevant IS Codes.

UNIT-III 9

Elevators, escalators and conveyors. Thermal environment inside a building and its control, factors affecting inside conditions, heat transfer through building fabric, steady state and periodic heat transfer, thermal properties of building materials and insulation materials for building. Thermal responding of building cooling and heating loads. Air – conditioning systems, types, design, installation and maintenance costs. Energy conservation in buildings.

UNIT-IV 9

Water supply to building, systems of water supply, appurtenances, and difficulties encounter red in water supply to high rise building systems suggested hot water and fire water systems. Drainage of buildings, systems of drainage from buildings, appurtenances, choice of systems, solid waste disposal from buildings

MCE-267 HAZARDOUS WASTE MANAGEMENT 4Credits(3-1-0)

Course Category : Departmental Core (DC)
Pre-requisite Subjects :
Contact hours/week : Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits : 4
Course Assessment Methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.

Course Objectives: .

1. To impart knowledge on solid waste management with particular emphasis on municipal solid waste management which includes different waste processing options such as pyrolysis, composting, and incineration; designing and operating sanitary landfill.
2. To enrich knowledge about characteristics of hazardous wastes and their management.
3. To make learners focus on energy recovery from biomass, agricultural and industrial wastes for production of biogas, ethanol, methanol and hydrogen.
4. To impart knowledge on industry specific solid waste management practices.
5. To provide an overview about the concept of land degradation and land reclamation

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Define the principles of hazardous waste management.
2. Examine the technical points that are required to set up a hazardous waste management system.
3. Apply the legal legislation related to hazardous waste management.
4. Make an economical analysis of the hazardous waste management system.
5. Design a hazardous waste recycling facility.
6. Collect required data with regard to type of hazardous waste that will be recycled.
7. Design the recycle process for a specific hazardous waste type.

UNIT-I	9
Hazardous Waste, Regulatory Process, Process Fundamentals, Fate and Transport of Contaminants, Toxicology.	
UNIT-II	9
Environmental Audits, Pollution Prevention, facility Development and Operations.	
UNIT-III	9
Physico-Chemical Treatment Process, Biological Treatment Methods, Stabilization and Solidification, Thermal Treatment Methods.	
UNIT-IV	9
Land Disposal, Quantitative Risk Assessment.	

Book & References:

1. Hazardous Waste Management- Lagrega, Buckingham & Evans (McGraw Hill, N.Y.)
2. Hazardous Material and Waste Management- Cheremisinoff & Cheremisinoff (Elsevier)
3. Toxic & Hazardous Waste - La Grega & Hendrian (Butterworth Publications)

MCE-268 INDUSTRIAL WASTEWATER TREATMENT 4 Credits (3-1-0)

Course Category : Departmental Core (DC)
Pre-requisite Subjects :
Contact hours/week : Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits : 4
Course Assessment Methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination.

Course Objectives:

1. To inculcate the basics of water supply, purification and treatment.
2. To inculcate the basic concepts of waste water treatment, its design and management.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Compare the methods used in wastewater treatment and waste containing heavy metals such as metal plating and refinery.
2. Have information about treatment methods, pharmaceutical industry and the chemical (phenol) facilities which produces of wastewater properties of, operational problems.
3. Make the selection process for high organic load of waste water treatment needed.
4. Recognize the properties of the basic industries and the environmental impact of waste generated is able to compare.
5. Define the characteristics of industrial wastewater.
6. Establish a relationship between the properties of industrial wastewater.
7. Explain the principles of industrial wastewater refining.

UNIT-I **9**

Scenario of Industrial Pollution, Capabilities and Constraints of Industries for Pollution Control, Impact of Pollution Control on Project Coast.

UNIT-II **9**

Typical Industrial Wastes Characteristics and Treatment Planning of Sugar Industry, Distillery, Tannery, Electroplating Industry, Petroleum Industry, Pesticide and Fertilizer Industry, Pharmaceutical Industry, Textile Industry, Pulp and Paper Industry.

UNIT-III **9**

Chlor-Alkali Industry, Soap and Detergent Industry, Atomic Power Plants, dairy, Steel, Thermal Power Plants.

UNIT-IV **9**

General Standards for Disposal of Effluents, Concept of Common Effluent Treatment Plant

Book & References:

1. Industrial Pollution and Control - G.N. Pandey(Vikas Pub. Pvt. Ltd., NewDelhi)
2. Industrial Pollution and Control - K.N. Rao (CRCPress,Hyderabad)

MCE-151	ENVIRONMENTAL QUALITY MANAGEMENT	4Credits (3-1-0)
----------------	---	-------------------------

Course category : Engineering Fundamental(EF)

Contact hours/week : Lecture: 3 , Tutorial: 1 , Practical: 0

Number of Credits : 4

CourseAssessment :Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination methods.

Course Objectives :

1. Students will develop an understanding of natural resources and factors impacting on their management, including principles of sustainable use, the processes of environmental degradation (physical, chemical and biological), control of land degradation and practical development of quality management plans.
2. A feature of this course is the examination of environmental, economic and social consequences of the use of land for agriculture and other purposes.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Provide definitions of environment, management, systems and organisations in relation to environmental management.
2. Describe organisations as systems and their role in environmental management.

3. The students can understand the usefulness of systems thinking in relation to environmental management in organisations.
4. Explain how environmental management can be used as environmental protection and how organisations can define and manage risk.

UNIT-I	9
Introduction, Development Needs, Environmental Impact Assessment (EIA), Environmental Statement (ES)	
UNIT-II	9
Environmental Management Plan (EMP), Environmental Audit (EA), ISO-14000, Rules and Regulation for getting Consent to establish and Operate Industry	
UNIT-III	9
General Provisions and salient features of Water Act, Cess Act, Air Act, EPA Act, Hazardous Waste Act/Rules, Biomedical Waste Act/Rules, Noise Rules	
UNIT-IV	9
Municipal Solid Waste Rules, Ozone Depleting Substances Rules, Various International Treaties Related to Environmental issues	

MCE-152	EARTH AND ENVIRONMENT	4 Credits (3-1-0)
----------------	------------------------------	--------------------------

Course category : Engineering Fundamental (EF)

Contact hours/week : Lecture: 3 , Tutorial: 1 , Practical: 0

Number of Credits : 4

Course Assessment : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination methods.

Course Objectives :

1. Explain the dynamic behavior of the Earth as a complex system.
2. Discuss issues related to human population growth and its impact on the natural world.
3. Discuss evidence of global climate change and impacts of anthropogenic warming.
4. Describe appropriate locations for waste disposal.
5. Explain the causes of soil, air and water pollution.
6. Explain the factors that go into determining our resource footprint.

Course Outcomes The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Describe the scientific method as applied in the earth sciences.
2. Describe common earth materials and their relationship to natural hazards.
3. Explain how earth and solar system processes create hazards to life and property.
4. Describe and explain the most common methods used to mitigate and prepare for each type of hazardous natural process.
5. Explain the causes and effects of global climate change.

UNIT-I	9
Introduction, Biosphere and Environment, Importance of Clean Environment, Assimilation Capacity of Environment, Conservation of Environment	
UNIT-II	9
Impact of Development on Environment, Thermal Pollution, Radioactive and non-radioactive pollution, Soil and Land Pollution.	
UNIT-III	9
Impact of Mining and Deforestation, Green House Effect and Global Warming, Depletion of Ozone	

UNIT-IV **9**
 Biodiversity, Sustainable Development, e-Waste, Plastic Waste

Books & References:

1. Chemistry of Environmental Engineering-C.N.Sawyer, P.L.McCartyandG.F.Perkai(Tata McGraw Hill)
2. EnvironmentalChemistry-A.K.De(NewAgeInternationalPvt.Ltd.,New Delhi)
3. Prospective in Environmental Studies-A.Kaushik&C.P.Kaushik (New Age International Pvt.Ltd.)

MCE-153 PRINCIPLES OF REMOTE SENSING **4Credits (3-1-0)**

Course category : Engineering Fundamental(EF)

Contact hours/week : Lecture: 3 , Tutorial: 1 , Practical: 0

Number of Credits : 4

Course Assessment :Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination methods.

Course Objectives: To learn the principles of remote sensing phenomenon including image acquisition, analysis and processing to extract information.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Understand the sources of electromagnetic radiation and their characteristics and their active and passive utilization for remote sensing.
2. Understand the interaction of electromagnetic radiation with atmosphere and earth surface objects..
3. Be familiar with different types of sensors and remote sensing space missions that are used to detect and record certain parts of the electromagnetic spectrum
4. Understand simple image enhancement, filtering operations over digital images and other restoration techniques.
5. Develop a knowledge and understanding of spectral classification of images for feature extraction.
6. Develop an understanding of Image transformations such as NDVI and principal component analysis.

UNIT-I **9**

Remotesensing-Introduction,Sourcesofenergyforremotesensing-activeandpassivesources,electromagnetic radiation and their characteristics, thermal emission

UNIT-II **9**

Interaction of EMR with atmosphere-atmospheric windows, interaction of EMR with earth surface-spectral reflection curves. Multi concept of remote sensing, idealisms and real sequence of remote sensing, sensors and orbital characteristics

UNIT-III **9**

Varioussensingplatformsforremotesensing,principleofRemotesensingdevices (RBV,MSS,LISS),IRSand othersensingsystemssuchasLandsat,andSpot,Remotesensingdataproductsandtheiruses.

UNIT-IV **9**

DigitalImageProcessing- Introduction,digitalimagerepresentationandcharacterization,histogramsandscatter plot, image enhancement-contrast stretching, pattern recognition and featureextraction. Imageclassification-unsupervisedandsupervisedtechniques,classificationaccuracyassessment,NDVI, Principle componentanalysis.

Books & References:

1. Remote Sensing & Geographic Information System-M.Anji Reddy (BSPublication)
2. Remote Sensing &GIS - B. Bhatta (OxfordUniversity Press)
3. Remote Sensing & Geographic Int. System –KalicharanSahu (Atlantic Publishers)

MCE-156 ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT4 Credits (3-

1-0)

- **course category** : Engineering Fundamental (EF)
- **Contact hours/week** : Lecture: 3 , Tutorial: 1 , Practical: 0
- **Number of Credits** : 4
- **Course Assessment** : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination methods.
- **Course Objectives:**
 1. Appreciate the purpose and role of EIA in the decision-making process.
 2. Understand strengths & limitations of environmental management procedures.
 3. Understand screening & scoping processes.
 4. Interpret options for evaluating environmental and social impacts.
 5. Know formats of EIA Report (Environmental Impact Statement, or Environmental Statement).
 6. Understand the purpose of developing follow-up procedures, and options for designing these procedures.
- **Course Outcomes:** The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.
 1. Explain the concepts about the Environmental Impact Assessment (EIA).
 2. Express environment law, aim and concept.
 3. Explain the necessity of EIA.
 4. Evaluate the subjects which must be considered in EIA projects.
 5. Know important plant or animal groups.
 6. Identify these species or have these species identified.

UNIT-I	9
Environmental Impact Assessment, Historical Background Global Environmental Policy Need for EIA.	
UNIT-II	9
Definition, Aims and Methodology of EIA, Role of EIA as a Planning Tool	
UNIT-III	9
Environmental Impacts of developmental projects- Recent Case Studies Management and Audit Traditional Approach vs. the ISO 14000 Environmental Management Systems Approach,	
UNIT-IV	9
Management through Environmental Legislations Management through Awareness, Environmental Education and Incentives Environmental Audit-Definition and role of EA, Methodology of EA Current Stratus of EA.	

Books & References:

1. Environmental Impact Assessment- Training ResourceManual,UNEP
2. EIA Notification - MOEP, Govt.ofIndia
3. EnvironmentalScienceandEcologicalStudies-S.K.Garg,RajeshwariGargandRanginiGarg

MCE-162 NON-CONVENTIONAL SOURCES OF ENERGY 4 Credits(3-1-0)

- **Course category** : Engineering Fundamental(EF)
- **Contact hours/week** : Lecture:3 , Tutorial: 1 , Practical: 0
- **Number of Credits** : 4
- **Course Assessment** : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination methods.
- **Course Objectives** :
 1. The energy has become an important and one of the basic infrastructures for the economic development of the country. it is imperative for the sustained growth of the economy.
 2. This course envisages the new and renewable source of energy, available in nature and to expose the students on sources of energy crisis and the alternatives available, also stress up on the application of non-conventional energy technologies.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Demonstrate the generation of electricity from various Non-Conventional sources of energy, have a working knowledge on types of fuel cells.
2. Estimate the solar energy, Utilization of it, Principles involved in solar energy collection and conversion of it to electricity generation.
3. Explore the concepts involved in wind energy conversion system by studying its components, types and performance.
4. Illustrate ocean energy and explain the operational methods of their utilization.
5. Acquire the knowledge on Geothermal energy.

UNIT-I 9

Definition of micro, mini and small hydro, Role of micro-mini and small hydro in power development, their advantages and disadvantages, Problems in operation and maintenance, Planning new micro-mini and small hydro especially in hilly tracts, Diversion works, conveyance channels and appurtenant structures

UNIT-II 9

Layout of conveyance channels, Layout of power plant, design of various structures of the power plant panchakkis, Standard tubular turbines, bulb turbines, and the types of soft Turbines, their selection and layout. Power from existing irrigation works, methods of combining several falls. Power from wind, geysers, biogas and other renewable sources.

UNIT-III 9

Design of Biogas plants and windmills and their comparison with hydel power, Concept of partial benefit from diversion tunnels, Development of power from partial heads by mobile runners, Interim benefits as making available power during construction period.

UNIT-IV 9

Lifting water by pumps coupled to turbines and by windmills and hydro schemes

Books & References:

1. Alternative Energy Sources-T.Negat Veziroglu(TMh)
2. Non-Conventional Sources of Energy-G.D.Roy(Khanna Publisher, New Delhi)

MCE-167 GEOGRAPHIC INFORMATION SYSTEMS 4Credits(3-1-0)

- **Course category** : Engineering Fundamental(EF)
- **Contact hours/week** : Lecture: 3 , Tutorial: 1 , Practical: 0
- **Number of Credits** : 4
- **Course Assessment** :Continuous Assessment through Tutorials, Assignments, Quizzes and Three Minor Tests and One Major Theory Examination.
- **Course Objectives:** To learn the concepts and techniques of geographic information systems to include data formats, acquisition, processing and analysis for a set of applications using spatial modelling.
- **Course Outcomes** :The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.
 1. Define what GIS is and know different types of spatial and non-spatial data.
 2. Know what are the questions that GIS can answer.
 3. Differentiate between Raster and Vector Models.
 4. Create maps and overlay features/raster data for basic analyses.
 5. Understand the concepts of spatial modeling for problem solving using Classification, Aggregation, overlay, buffers, inter-visibility and Network Analysis.
 6. Understand the applications of GIS in the in planning of utility lines, Water resources, Erosion modeling, and Environmental Impact Assessment.

UNIT--I 9

Geographic Information System(GIS)-
Introduction, Geographical concepts and terminology, Components of GIS.

UNIT-II 9

Data acquisition, Raster and vector formats, Inter-conversion between raster and vector formats, Scanners and digitizers, Methods of digitization, Data pre-processing, form conversion, Data reduction and generalization.

UNIT-III 9

Attributed database: scale and sources of inaccuracy Database structures. Conventional database management systems, Spatial database management.

UNIT-IV 9

Data merging, Edge matching, registration and resampling, Data manipulation and analysis, Representation of real world problems, Problem solving and spatial modeling. Classification, Aggregation, overlay, buffers, and inter-visibility, Network Analysis, Application of GIS in planning of utility lines, Water resources, Erosion modeling, Environmental Impact Assessment.

Books & References:

1. Remote Sensing & Geographic Information System - M. Anji Reddy (BS Publication)
2. Remote Sensing & GIS - B. Bhatta (Oxford University Press)
3. Remote Sensing & Geographic Int. System –Kalicharan Sahu (Atlantic Publishers)

MCE-169 DISASTER MANAGEMENT 4Credits(3-1-0)

- **Course category** : Engineering Fundamental (EF)
- **Contact hours/week** : Lecture:3, Tutorial: 1 , Practical: 0
- **Number of Credits** : 4
- **Course Assessment** : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory Examination methods.
- **Course Objectives** :
 1. To provide basic conceptual understanding of disasters and its relationships with development.
 2. To gain understand approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.

Course Outcomes :The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. **Appropriate actions at all points in the cycle lead to greater preparedness, better warnings, reduced vulnerability or the prevention of disasters during the next iteration of the cycle.**
2. **The complete disaster management cycle includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.**
3. **Capacity to obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.**

UNIT-I **9**

Type of disasters, Accent on land slides, earthquakes flashflood, avalanches, snow blizzards. Causes, consequences and mitigation techniques, Flash floods their management and relief, Contingency planning for dam failures.

UNIT-II **9**

Characteristics of glaciers and protection of important monuments from glacial flow.

UNIT-III **9**

Landslides, their classification, causes, & preventive measures. Concept, growth presents trends status in India and concept of contingency planning and systems approach of disaster management. Sociology of disasters, Human and media response and role.

UNIT-IV **9**

Disaster prevention techniques, Disaster legislation, Disaster prone area building codes, Vulnerability analysis, Health and sanitation aspects, Relief administration in India and role of engineers in disaster mitigation.