

INSTITUTE OF ENGINEERING AND TECHNOLOGY LUCKNOW

(An Autonomous Constituent Institute of Dr. A.P.J. Abdul Kalam Technical University, Lucknow)



Syllabus

For

M.Tech.

(Environmental Engineering)

[Effective from the Session: 2016-17]

Course and Evaluation Scheme for M. Tech. Course (Environmental Engineering)

(Effective from session 2016-2017)

SEMESTER I

S. No .	Subject Code	Name of the Subject	Periods			Credit	Evaluation Scheme					Subject Total
			L	T	P		Theory			Practical		
							CT	TA	ESE	TA	ESE	
1	MTEV-101	Environmental Chemistry and Microbiology	3	0	0	3	20	10	70	--	--	100
2	MTEV-102	Water Treatment & Supply Systems	3	0	0	3	20	10	70	--	--	100
3		Departmental Elective-I	3	0	0	3	20	10	70	--	--	100
4		Department Elective-II	3	0	0	3	20	10	70	--	--	100
5		Research Process & Methodology	3	0	0	3	20	10	70	--	--	100
6	MTEV-151	Environmental Engineering Lab-I	--	--	3	2	--	--	--	20	30	50
7	MTEV-152	Environmental Engineering Lab-II	--	--	2	1	--	--	--	20	30	50
TOTAL						18						600

SEMESTER II

S. No	Subject Code	Name of the Subject	Periods			Credit	Evaluation Scheme					Subject Total
			L	T	P		Theory			Practical		
							CT	TA	ESE	TA	ESE	
1	MTEV-201	Waste Water Treatment	3	0	0	3	20	10	70	--	--	100
2	MTEV-202	Air and Noise Pollution and Control	3	0	0	3	20	10	70	--	--	100
3		Department Elective-III	3	0	0	3	20	10	70	--	--	100
4		Department Elective-IV	3	0	0	3	20	10	70	--	--	100
5		Department Elective-V	3	0	0	3	20	10	70	--	--	100
6	MTEV-251	Environmental System Design Lab	--	--	3	2	--	--	--	20	30	50
7	MTEV-252	Seminar-I	--	--	2	1	--	--	--	50	--	50
TOTAL						18						600

SEMESTER III

S. No	Subject Code	Name of the Subject	Periods			Credit	Evaluation Scheme					Subject Total
			L	T	P		Theory			Practical		
							CT	TA	ESE	TA	ESE	
1	MTEV-351	Seminar-II	0	0	6	3	--	--	--	100	--	100
2	MTEV-352	Dissertation	0	0	30	15	--	--	--	200	300	500
TOTAL						18						600

S. No	Subject Code	Name of the Subject	Periods			Credit	Evaluation Scheme					Subject Total
			L	T	P		Theory			Practical		
							CT	TA	ESE	TA	ESE	
1	MTEV-451	Dissertation (Final)	0	0	36	18	--	--	--	200	400	600
TOTAL						18						600

SEMESTER IV

NOTE: -

1. For dissertation, the students are required to compile a report including title of the dissertation, literature review, methodology of work to be pursued and activity schedule in the III semester. The compiled report shall be presented at the end of the IIIrd semester. Same dissertation shall be continued in the fourth semester.

LIST OF SUBJECTS FOR ELECTIVE-I

MTEV-011	EARTH AND ENVIRONMENT
MTEV-012	SYSTEM ANALYSIS AND MANAGEMENT
MTEV-013	COMPUTATIONAL METHOD AND PROBABILITY STATISTICS
MTEV-014	ENVIRONMENTAL GEOLOGY
MTEV-015	GROUNDWATER CONTAMINATION AND REMEDIATION

LIST OF SUBJECTS FOR ELECTIVE-II

MTEV-021	ENVIRONMENTAL REMOTE SENSING
MTEV-022	HYDROLOGY AND HYGROMETRY
MTEV-023	INSTRUMENTAL METHOD OF ANALYSIS
MTEV-024	ENVIRONMENTAL SYSTEM ENGINEERING
MTEV-025	CLIMATOLOGY

LIST OF SUBJECTS FOR ELECTIVE-III

MTEV-031	DISASTER MANAGEMENT
MTEV-032	ENVIRONMENTAL IMPACT ASSESSMENT
MTEV-033	BUILDING ENVIRONMENT AND SERVICES
MTEV-034	DESIGN OF WATER SUPPLY SYSTEMS
MTEV-035	CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

LIST OF SUBJECTS FOR ELECTIVE-IV

MTEV-041	DESIGN OF WASTEWATER SYSTEMS
MTEV-042	WATER POLLUTION
MTEV-043	ADVANCED GEO- ENVIRONMENTAL ENGINEERING
MTEV-044	ENVIRONMENTAL BIOTECHNOLOGY
MTCE-051	SOLID WASTE MANAGEMENT

LIST OF SUBJECTS FOR ELECTIVE-V

MTEV-051	INDUSTRIAL WASTE WATER TREATMENT
MTEV-052	WATER QUALITY MODELLING
MTEV-053	GROUNDWATER MANAGEMENT
MTEV-054	HAZARDOUS WASTE MANAGEMENT
MTEV-055	ENVIRONMENT QUALITY MANAGEMENT

SYLLABI OF SUBJECTS for M.Tech. Ist Semester

L	T	P
3	0	0

MTEV-101 Environmental Chemistry and Microbiology

Introduction, Basic Concepts from General Chemistry, Colloidal Chemistry, Environmental Biochemistry, Physico-Chemical and Biological examination of Water and Wastewater, Thermodynamics of Microbial systems, Mass and energy Balance of Microbial Process, Aerobic and Anaerobic Microbial growth.

TEXT BOOKS:

1. Benefield D. L., Judkins F. J., Weand L. B., Process Chemistry for Water and Wastewater Treatment, 1st Edition, Prentice Hall, 1982
2. Bitton, G., Wastewater Microbiology, 3rd Ed., Wiley, 2005
3. Mitchell, R., and Gu, J.D., Environmental Microbiology, 2nd Ed., Wiley-Blackwell, 2010
4. Sawyer, C. N., McCarty, P. L., and Perkin, G.F., Chemistry for Environmental Engineering and Science, 5th edition McGraw-Hill Inc., 2002

L	T	P
3	0	0

MTEV-102 Water Treatment & Supply Systems

Introduction and Sources of Water, Population Forecasting and Water Requirement, Physical, Chemical and Biological Water Quality Parameters, Solid Separation, Settling Operation, Coagulation, Softening, Filtration, Disinfection, Desalination, Dissolved Solids Removal, Adsorption and Ion Exchange, Electrolysis, Osmosis, Special Treatments, Pumping and Distribution Systems.

TEXT BOOKS:

1. Water and Wastewater Engineering: Water Supply and Wastewater Removal- by Fair, Geyer and Okum. - John Wiley & Sons Canada, Limited
2. Physicochemical Processes: For Water Quality Control by W.J. Weber - John Wiley & Sons, 1972

REFERENCE BOOKS:

1. Unit operations of Sanitary Engineering by linvil rich- Wiley, New York, 1961
2. Water and Wastewater Technology by Hammer Mark J., Hammer Mark J. - Prentice- Hall New Arrivals.

Departmental Elective-I

MTEV-011 EARTH AND ENVIRONMENT

Introduction, Biosphere and Environment, Importance of Clean Environment, Assimilation Capacity of Environment, Conservation of Environment, Impact of Development on Environment, Thermal Pollution, Radioactive and Non-Radioactive Pollution, Soil and Land Pollution, Impact of Mining and Deforestation, Green House Effect and Global Warming, Depletion of Ozone, Biodiversity, Sustainable Development, e-Waste, Plastic Waste.

MTEV-012 System Analysis and Management

Introduction to Computer languages, Linear, Quadratic, Geometric, Direct and Non-Linear Programming, Concepts of Optimization, Application of Optimization techniques, Theory of Random Variables, Modeling and Simulation, Design and Management of information systems applicable in Environmental Management.

MTEV-013 Computational Method and Probability Statistics

Introduction, Algorithms, Numerical Differentiation and Integration, Solution of Ordinary Differential Equation, Solution of Linear and Non-linear Algebraic Equations, Boundary Value Problems, Initial value Problems, Numerical Solution of Partial Differential Equation, Eigen value Problems, Frequency Distribution and Measures of Location, Measures of Dispersions, Skewness and Kurtosis, Moments of Frequency Distributions, Theory of Probability, Discrete Probability Distributions, Univariate and Special Continuous Probability Distributions, Principles of Least Squares, Fitting of Curves and Orthogonal Polynomials, Correlation and Regression, Multiple and Partial Correlation, Theory of Sampling, Sampling Distributions, Significance Tests.

MTEV-014 Environmental Geology

Earth science and its application in environmental engineering, interior of the earth, Character and capabilities of the terrain.

Geological work of streams, wind and glacier and its significances.

Soil erosion and conservation, rock weathering.

Conservation of Mineral resources and Environmental Impact of Mining.

Desertification: Its causes and method of combating the desertification problems.

Geological consideration for the suitable sites for dams and reservoirs, roads, tunnels and bridge and their environmental impact.

Movement of surface and underground water, water-logging and its impact on environment and remedial measures. Natural hazards such as like earthquake, landslides, flood, cyclones, their effects, causes and migration.

Geological consideration for site selection for disposal of waste and pollutants

MTEV-015 Groundwater Contamination and Remediation

Introduction, hydrologic Cycle, Groundwater Contaminant and Transport Mechanism, Data collection Methods: Introduction, Geological data acquisition and Hydrological data acquisition, acquisition of soil and groundwater quality data, Groundwater Remediation, Sorption and other chemical reactions, Flow and transport in the Unsaturated Zone, Non-aqueous phase Liquids: Characterization, types, remediation at sites.

Water Harvesting: Types of storage structures, water yield from catchments, runoff diversion, pond and reservoirs, earth embankments.

TEXT BOOK:

1. Ground water contamination (Transport and remediation) - Philip.B.Bedient, Hanadi.S. Rifai & Charles.J.Newell Publishers: Prentice Hall.

Departmental Elective-II

MTEV-021 Environmental Remote Sensing

Definition of terms, Space and Airborne imageries, Characteristics of Photographic images, Color, Tone and texture, Techniques of photo-interpretation, Ground truth collection and verification, Principles of remote sensing, Spectral Characteristics of various earth features. The Multi-concept, Remote Sensing through Visible and other Spectral Regions. Different methods of remotely sensed data interpretation, Machine processing of remotely sensed data, Geographical Information System (GIS), Global Positioning System (GPS). Applications of Remote Sensing for Environmental studies, Land use and land cover analysis, Water resources management, Flood Zoning and Damage Estimation, Pollution Studies, Survey and Management of Natural Resources.

MTEV-022 Hydrology and Hygrometry

Introduction: Historical background, Hydrological cycle, forms of precipitation, its Aerial and time variation, missing records, hydrological abstraction, runoff, hydrograph analysis, unit hydrograph, IUH, Nash and Clarke models. Rainfall runoff models, black-box type and physics based models.

Statistical Methods: Correlation coefficient, curve fitting, regression analysis, multiple regression. Various distribution and their use in hydrology, plotting positions, frequency factors, extreme value theory. Generation of random numbers and synthetic data when persistence is absent.

Flow Generation: Stochastic processes, their classification, time series and its components, correlogram, autoregressive processes. Synthetic generation of yearly and monthly flows in hydrology.

Floods and Droughts: Flood estimation by various methods, design for various hydraulic structures, flood forecasting, droughts.

MTEV-023 Instrumental Method of Analysis

Introduction, Concepts of Quantitative Chemistry, Electron Paramagnetic Resonance, X-Ray Fluorescence, Infrared Spectroscopy, Emission Spectroscopy, Flame Photometry, UV-Visible spectroscopy, Atomic Absorption Spectroscopy, Nephelometry and Turbidimetry, Gas Chromatography, Gas-Solid Chromatography, Gas-Liquid Chromatography, High Pressure Liquid Chromatography, Polarography, Voltammetry and Chronopotentiometry, Colorimetry, Fluorimetry, Laser Techniques, Electron Microscopy, Ion Chromatography, Nuclear Magnetic Resonance, TOC analyser.

MTEV-024 Environmental System Engineering

Physical, chemical & biologic Phenomena: Gas transfer, Reaction Kinetics, Carbonate equilibrium, Organic materials, and micro organisms

Microbial growth kinetics, Microbiology and Ecology: Models, Time-Domain simulation, continuous flow microbiological systems-pesticide concentration, Eutrophication.

Natural transport systems, planning factors: Basic Models-DO system- streams-Estuaries-Transport-water quality criteria-Air Pollution-EIS

Population growth models, engineered transport systems: Population Growth models- Regional growth models; engineered transport systems-Pipe network analysis- water distribution system- Domestic waste water collection-storm water collection system
Treatment process, Individual household systems: Treatment- Lagoon systems-Renovation Systems

TEXT BOOKS:

1. Sincero and Gregoria, Environmental Engineering: A Design Approach, PHI Learning, 2009
2. Schnoor, J.L., Environmental Modelling: Fate and Transport of Pollutants in Water, Air and
3. Soil, John Willey and Sons, 1996
4. Rich, L.G., Environmental Systems Engineering, McGraw Hill Inc., 1975

MTEV-025 Climatology

Temperature: Temperature at the Earth's surface as a function of latitude, effect of land and sea on the temp distribution, Annual Variation of temp, diurnal variation of temp, temp distribution at higher altitudes.

Wind and Pressure: wind and pressure distribution at the earth's surface, effect of land and sea on wind and pressure distribution, Monsoon circulation; wind and pressure distribution at higher levels

Precipitation: Annual Precipitation over the Earth as a function of latitude, effect of continents and oceans on the distribution of precipitation, precipitation and altitude, annual variation of precipitation, diurnal variation of precipitation

Weather and Climate, factors on which climate of a place depend; classification of climates, Koeppen's climate classification, Thornthwaite's Climate classifications, Climatic regions of the world. SOI, El Nino, ENSO, IOD; Basic concepts of Global warming and climate change

Indian Climatology: Four Meteorological seasons in India – Climatology. Mean M.S.L. pressure, Temperature, Rainfall and upper wind patterns. General Circulation of the Atmosphere

TEXT BOOKS:

1. An introduction to climate by G.T. Trewartha
2. Climatology by B. Haurwitz and J.M. Austin - McGraw-Hill Inc., US
3. General climatology by H.J. Critchfield- Prentice-Hall, 1974

PRACTICAL COURSES

MTEV-151 ENVIRONMENTAL ENGINEERING LAB-I (Wet Lab)

Group A

1. To determine the chlorine demand and residual chlorine in water.
2. To estimate the hardness of the given water sample.
3. To estimate the total solids, total dissolved solids and volatile solids of the given water sample.
4. To determine cations (Na, K, Li) and anions (sulfate, nitrate, fluoride).
5. To determine MPN count - total and fecal.
6. To estimate the chloride concentration of the given water sample

Group B

1. To determine the COD of the given sample.
2. To verify Class I sedimentation.
3. To determine the sludge volume index (SVI) of the given sludge sample.
4. To determine Heavy Metals (Pb, Cr, As, CN, Cd) in waste water.
5. To determine phenol compounds and total/kjeldahl nitrogen in wastewater.
6. To determine total phosphate in wastewater.

Field visit of water treatment plant.

NOTE:

From the above list of experiments minimum 4 experiments are required to be done from each group for the completion of practical course along with compulsory field visit.

Readings:

1. Standard methods for the examination of water and wastewater, 21st Edition, Washington: APHA., 2012
2. Sawyer, C. N., McCarty, P. L., and Perkin, G.F., Chemistry for Environmental Engineering and Science, 5th edition McGraw-Hill Inc., 2002
3. B. Kotaiah and Dr. N. Kumara Swamy, Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 1st Ed., 2007
4. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, Environmental Engineering, McGraw Hill Inc., New York. 1995

MTEV-152 ENVIRONMENTAL ENGINEERING LAB-II (Dry Lab)

Group A

1. Monitoring of ambient air quality for total suspended particulate matter and respirable SPM.
2. Measurement of CO, HC, H₂S and NH₄ in exhausts.
3. Measurements of SO₂ and NO_x in ambient air.
4. Detection of levels of noise pollution in residential/commercial/industrial and silent/sensitive areas of Lucknow city.
5. Demonstrate the feasibility of the geolocation of a sound source by simultaneous noise power measurements
6. Demonstrate, with a bell jar, that a material medium such as air is needed for transmission of sound waves
7. Determine the relationship between air pressure and sound decibel.

Field visit of Industrial/wastewater treatment plant and stack monitoring by BIS/EPA methods

Group B (Software)

Design of water supply and sewerage systems using WATER CAD and SEWER CAD and design of other environmental systems using HYDRUS, MODFLOW VISUAL, MATLAB, ORIGIN, Arc GIS, GWM, Air MOD, SPSS, PSPP, JASP and other statistical software.

NOTE:

From the above experiments minimum 4 experiments are required to be done from Group A and Group B respectively. For the completion of practical course mandatory field visit is required along with field visit report.

TEXT BOOKS:

1. Metcalf & Eddy, Inc., Waste water Engineering Treatment and Reuse, McGraw Hill Inc., New Delhi., 2003
2. Air pollution: its origin and control by Kenneth Wark, Cecil Francis Warner, Wayne T. Davis - John Wiley & Sons Inc

SYLLABI OF SUBJECTS for M.Tech. IInd Semester

L	T	P
3	0	0

MTEV-201 Wastewater Treatment

Overview of Wastewater Engineering, Terminology in Wastewater Treatment, Wastewater Flow rates, Wastewater Characteristics, Water Borne Disease, Physical and Chemical Unit Operations, Biological Unit Processes including Kinetics of Biological growth, Sludge Thickening, Digestion, Disposal and Nutrient removal, Self-Purification of Streams, Advanced Treatment Processes, Wastewater Collection, Disposal and Reuse, Introduction to generation of Industrial Waste Water.

TEXT BOOKS:

1. Wastewater Engineering by Metchal and Eddy- Tata McGraw-Hill Education
2. Environmental Systems Engineering by L.G. Rich - Tata McGraw-Hill
3. Water and Wastewater Engineering: Water Supply and Wastewater Removal- by Fair, Geyer and Okum. - John Wiley & Sons Canada, Limited
4. Biological Process Design for Wastewater Treatment (Prentice-Hall series in environmental sciences) by Clifford W. Randall, Larry W. Benefield - Prentice Hall (1980-01)
5. Water and Waste Treatment by E.D. Schroeder - Tata McGraw-Hill Education

L	T	P
3	0	0

MTEV-202 Air and Noise Pollution and Control

Introduction, Classification, Sources, Effects, Air Quality Standards, Role of Meteorology and Natural Purification Processes, Sampling, Measurement and Analysis, Control Devices for Particulate and Gaseous Contaminants, Industrial Pollution, Vehicular Pollution, Indoor Air Pollution.

Physics of Sound, Noise - Sources and Standards, Measurement and Control of Noise Pollution.

TEXT BOOKS:

1. Air pollution control theory by Martin Crawford - McGraw-Hill, 1976
2. Air pollution control by A.C. Stern.
3. Air pollution control by H.C. Perkins - McGraw-Hill, 1974
4. Air pollution control by Joe O. Ledbetter- Dekker, 1972
5. Atmospheric Chemistry and Physics: From Air Pollution to Climate Change, 2nd Edition by John H. Seinfeld, Spyros N. Pandis.
6. Fundamentals of air pollution engineering. Environmental engineering by Seinfeld, John H.

Departmental elective-III

MTEV-031 Disaster Management

Disaster: Type, causes, consequences and mitigation technique with respect to earthquake, landslides, floods, avalanches, cyclones, tsunamis and drought, dam failure due to reservoir included seism city.

Glacier: Type, characteristics protection of important monuments from glacial flow.

Disaster Management: Scope, concept and terms in disaster management, tools and methods of disaster management, technologies of disaster management.

Disaster preparedness and mitigation: Preparedness planning, role and responsibility, public awareness and warning, basic principles and elements of disaster mitigation.

TEXT BOOKS:

1. Natural Disaster Management: New Technologies and Opportunities by Subir Ghosh; Icfai University Press
2. Earth and Atmospheric Disasters Management by N.Pandharinath and C.K.Rajan, BS Publication

REFERENCE BOOK:

1. Natural Hazards and Disaster Management by R.B.Singh; Rawat Publication

MTEV-032 Environmental Impact Assessment

Basic concept of EIA and Methodologies: Initial environmental Examination, Elements of EIA, - factors affecting EIA Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters

E I A Methodologies: Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/Benefit Analysis.

Impact of Developmental Activities and Land use. Introduction, Methodology for the assessment of soil and ground water, Delineation of study area, Identification of activities. Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

Prediction and Assessment of Impact: Quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, generalized approach for assessment of Air pollution Impact. Environmental Audit & Environmental legislation: objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, on-site activities, evaluation of Audit data and preparation of Audit report. Post Audit activities: The Environmental pollution Act, The water; Act, the Air (Prevention & Control of pollution Act.), Mota Act. Wild life Act. Case studies and preparation: of Environmental Impact assessment statement for various Industries.

TEXT BOOKS:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad.
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers

REFERENCE BOOKS:

1. Environmental Science and Engineering, by Suresh K. Dhaneja – S.K.,Katania & Sons Publication., New Delhi
2. Environmental Pollution and Control, by Dr. H.S. Bhatia – Galgotia Publication (P) Ltd, Delhi

MTEV-033 Building Environment and Services

Acoustics material properties, reverberation, acoustical design of assembly hall and building, noise and its control.

Ventilation, health and comfort ventilation, ventilation systems, natural and artificial ventilation for tropic regions.

Electrical wiring systems in domestic and commercial buildings, conductors, cables and conduits.

Communications, intercommunications systems, sound amplification equipment's.

Fire protection and equipment's, code provisions from NBC. Illumination, artificial lighting, day lighting, laws and principles of illumination.

Design of lighting systems, flood lighting, relevant IS codes.

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 buildings.

Thermal responding of building cooling and heating loads.

Air-conditioning systems, types, and design, installation and maintenance costs.

Energy conservation in buildings.

Water supply to building, systems of water supply, appurtenances, and difficulties encountered in water supply to high rise buildings, system suggested, hot water and fire water supply systems.

Drainage of buildings, systems of drainage from buildings, appurtenances, choice of systems, solid waste disposal from buildings.

MTEV-034 Design of Water Supply Systems

Concepts of Planning of Water Supply Projects, Topographic Surveys, Design of Intake wells and rising mains, Detailed Design and drawings of Water Treatment Systems, Design of Distribution Systems, Working Drawings.

MTEV-035 Climate Change and Sustainable Development

Introduction: Climate in the spotlight, The Earth's Climate Machine, Climate Classification, Global Wind Systems, Trade Winds and the Hadley Cell, The Westerlies Cloud Formation and Monsoon Rains, Storms and Hurricanes, Hydrological Cycle, Global Ocean Circulation, El Nino

and its Effect, Solar Radiation, Earth's Natural Green House Effect, Green House Gases and Global Warming, Carbon Cycle.

Observed Changes and Its Causes: Observation of Climate Change, Changes in patterns of temperature, precipitation and sea level rise, Observed effects of Climate Changes Patterns of Large Scale Variability, Drivers of Climate Change, Climate Sensitivity and Feedbacks, Montreal Protocol, UNFCCC, IPCC, Evidences of Changes in Climate and Environment – on a Global Scale and in India, climate change modeling.

Impacts Of Climate Change: Impacts of Climate Change on various sectors, Agriculture, Forestry and Ecosystem

Climate Change Adaptation And Mitigation Measures: Adaptation Strategy/Options in various sectors, Water Agriculture, Infrastructure and Settlement including coastal zones, Human Health, Tourism, Transport, Energy, Forestry, Key Mitigation Technologies and Practices, Energy Supply, Carbon sequestration Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste, International and Regional cooperation.

Clean Technology And Energy: Clean Development Mechanism, Carbon Trading- examples of future Clean Technology, Biodiesel, Natural Compost, Eco- Friendly Plastic, Alternate Energy: Hydrogen, Bio-fuels, Solar Energy, Wind, Hydroelectric Power, Mitigation Efforts in India and Adaptation funding.

TEXT BOOKS:

1. Anil Markandya , Climate Change and Sustainable Development: Prospects for Developing Countries, Routledge, 2002
2. Heal, G. M., Interpreting Sustainability, in Sustainability: Dynamics and Uncertainty, Kluwer Academic Publ., 1998
3. Jepma, C.J., and Munasinghe, M., Climate Change Policy – Facts, Issues and Analysis, Cambridge University Press, 1998
4. Munasinghe, M., Sustainable Energy Development: Issues and Policy in Energy, Environment and Economy: Asian Perspective, Kleindorfer P. R. et.al (ed.), Edward Elgar, 1996
5. Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007

Departmental Elective-IV

MTEV-041 Design of Wastewater Systems

Concepts of Planning of Wastewater Collection, Treatment and Disposal Projects, Topographic Surveys, Design of Sewerages, Detailed Design and drawings of Wastewater Treatment Systems, Design of Disposal Systems, Working Drawings.

MTEV-042 Water Pollution

Definition of Pollution, Effluent Standards, Development of Water Quality Standards, Water Quality Index, River Water Classification, Classification and impacts of Pollution Variables, Stream Surveys, Pollution zones and classification, Physical, Chemical and Biological Water Purification Processes in Natural Systems, BOD Kinetics assimilation and DO sags, Impoundments and their effects, Pollution control strategies including legislative approach, Surface Water Modeling.

MTEV-043 Advanced Geo- Environmental Engineering

Introduction, Geo-synthetics, Forms of Waste and their Engineering Properties, Selection of Waste Disposal Sites, Landfills for Municipal and Hazardous Waste, Ash Pond and Mine Tailing Impoundments, Site Investigations for detection of Subsurface Contamination, Remediation, Geotechnical reuse of Waste Materials and Fills, Mechanics of Erosion and Erosion Control Methods, Landslides and Their Control.

Environmental cycles and their interaction with Geo-Technology.

Particle – Energy – Energy theory and its application.

Soil Mineralogy and Technology changes in respect of waste water flow.

Thermal and Electrical properties of soil and Rock.

Application of Geo- Environmental Engineering:

Load- Environmental factors design, soil structure- soil interaction, Bearing Capacity, Lateral Earth pressures, Pile foundation grouting and injection, Slope Stability of waste material, stability of landfills, Stabilization and remedial works.

Wetlands, Coastal Margins and Soil. Erosion problems and control / management.

Arid lands, Desert and Anti-desertification.

Special Topics related with Field Problems.

TEXT BOOKS:

1. Mitchell, J.K and Soga, K Fundamentals of Soil Behaviour, John Wiley and Sons Inc., 2005
2. Fang, H-Y, Introduction to Environmental Geotechnology, CRC Press, 1997.
3. Daniel, D.E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993.
4. Rowe, R.K., Quigley, R.M. and Booker, Clay Barrier Systems for Waste Disposal Facilities, J.R., E & FN Spon, 1995.
5. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic publishers, 2001
6. Reddi, L.N. and Inyang, H.F, Geoenvironmental Engineering – Principles and Applications, Marcel Dekker Inc, 2000
7. Sharma, H.D, and Lewis, S.P, Waste Containment Systems, Waste Stabilisation and Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994

MTEV-044 Environmental Biotechnology

Environmental Biotechnology: Principles and concepts, usefulness to mankind. Degradation of high concentrated toxic pollutants, halogenated non halogenated, petroleum hydrocarbons, metals- Mechanisms of detoxification, oxidation, dehalogenation, biotransformation of metals biodegradation of solid wastes.

Biotechnological remedies for environmental pollution, decontamination of groundwater bioremediation, Production of proteins, biofertilizers, Physical, chemical and microbiological factors of composting, odor management.

Mircobial cell/enzyme technology: adapted microorganisms, biological removal of nutrients, algal biotechnology, extra cellular polymers, and Biogas technology.

Concept of rDNA technology: expression vectors, cloning of DNA mutation, construction of microbial strains, radioactive probes, protoplast fusion technology applications.

Environmental effects and ethics of microbial technology, genetically engineered organisms, Microbial containment, Risk assessment.

TEXT BOOKS:

1. Chaudhury, G.R. Biological degradation and bioremediation of toxic chemicals, Dioscorides Press, Oregon, 1994.
2. Martin. A.M. Biological degradation of wastes, Elsevier Applied Science, London, 1991.
3. Blaine Metting .F (Jr.) Soil Microbiology Ecology, Marcel Dekker Inc., 1993.

MTEV-045 Solid Waste Management

Introduction, Overview of Solid Waste Management, Types of Solid Wastes, Sources of Solid Wastes, Properties of Solid Wastes, Solid Waste Generation, On-site Handling, Storage, Collection, Transfer and Transport, Processing Techniques, Ultimate Disposal, Resource and Energy recovery Systems, Biomedical Waste Management, Introduction to Hazardous Waste and Fly Ash Management, Site selection Criteria for Landfill.

TEXT BOOKS:

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, Integrated Solid Waste Management, McGraw-Hill, New York, 1993
2. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000

Departmental Elective-V

MTEV-051 Industrial Wastewater Treatment

Scenario of Industrial Pollution, Capabilities and Constraints of Industries for Pollution Control, Impact of Pollution Control on Product Cost, 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, Chlor-Alkali Industry, Soap and Detergent Industry, Atomic Power Plants, Dairy, Steel, Thermal Power Plants, General Standards for Disposal of Effluents, Concept of Common Effluent Treatment Plant.

TEXT BOOKS:

1. Wastewater Treatment by M.N. Rao and A.K. Datta - Oxford I.B.H Publishers
2. Handbook of Industrial Waste Disposal by Richard A. Conway Richard Ross - Van Nostrand publisher(1980)
3. Industrial Waste Treatment: Contemporary Practice and Vision for the Future by Nelson Leonard Nemerow, Nemerow – Butterworth heinemann publisher (2006)

MTEV-052 Water Quality Modelling

Introduction: Water Quality, Water quality characteristics, sampling and analysis, Analytical methods, Automated analysis and remote monitoring.

Water quality monitoring: Water Pollution, Sources of Pollution, Nature of pollutants, Existing Approaches for Control/ - Abatement of Water Quality Degradation, Water Quality Monitoring in River Basins

Water quality modeling: Modelling and Monitoring, Evolution of Water Quality Models, Types of Water Quality Models, DO and BOD in streams, Transformation and transport processes, Oxygen transfer, Turbulent mixing, Non-Point Source Pollution, Modelling Approaches For Modeling Non-point Sources.

Water Quality Management: Water quality objectives and standards, Water quality control models, Flow augmentation, River and Lake water quality Models, Groundwater quality Models, Wastewater Transport Systems.

Legal Aspects of Water quality: Water pollution control acts and Legislation.

TEXT BOOKS:

1. Tebutt, T.H.Y., (1998), “Principles of Water Quality Control”, Pergamon Press, Oxford
2. Gerard Kiely, (1998), “Environmental Engineering”, McGraw Hill Publications
3. Viessman, W. Jr and M.J. Hammer (1985), “Water Supply and Pollution Control”, Harper and Row Publishers, New York.
4. Jerald L. Schnoor, (1996), “Environmental Modeling – Fate and Transport of Pollutants in Water, Air and Soil”, John Wiley & Sons Inc., New York.

MTEV-053 Groundwater Management

Introduction, Occurrence of ground water, Hydrological Cycle, Ground water movement, Well Hydraulics and Water Wells, Ground Water quality, Ground Water Modeling Techniques, Surface and Subsurface Investigations of Ground water, Artificial discharge and Recharge of Ground Water, Ground Water Management Techniques.

MTEV-054 Hazardous Waste Management

Introduction to Hazardous Waste, Regulatory Process, Process Fundamentals, Fate and Transport of Contaminants, Toxicology, Environmental Audits, Pollution Prevention, Facility Development and Operations, Physico-Chemical Treatment Processes, Biological Treatment Methods, Stabilization and Solidification, Thermal treatment Methods, Land disposal, Quantitative Risk Assessment.

Hazardous Waste Management and Risk Assessment: Types of Hazardous waste, Health effect, nuclear fission, Cradle-to-Cradle Management, Final Disposal, Risk Assessment, Case Histories.

MTEV-055 ENVIRONMENTAL HYDROLOGY

Uniform and Non-uniform flow in sewers and channels, gradually and rapidly varied flow in channels,

Hydrologic Cycle and its interaction with human activity, systems concepts, hydrologic model Classification.

Hydrologic Processes, Reynolds Transport theorem, Continuity equation, discrete time continuity momentum equations, energy balance, Transport processes, Porous medium flow, open channel flows.

Atmospheric and Subsurface water, atmospheric circulation, water vapour, Precipitation, Evaporation, Infiltration, Unsaturated flow.

Surface water - Stream flow hydrograph, excess rainfall and direct runoff, abstractions using Infiltration equations.

TEXT BOOKS:

1. Chow, V.T. (1979) "*Open Channel Hydraulics*", McGraw Hill Inc. N.York.
2. Chaudhry M.H. (1994), "*Open-Channel Flow*", Prentice Hall of India, N.Delhi.
3. Chow, V.T., Maidment, D.R. and Mays, L.W., "*Applied Hydrology*", McGraw Hill Inc., 1988.
4. Singh, V.P., "*Hydrologic Systems*", Prentice Hall Inc., 1986.
5. Viessman, W., Lewis, G.L. and Knapp, J.W., "*Introduction to Hydrology*", Harper & Row Publications Inc., Singapore, 1989.
6. Raudkivi, A.J., "*Hydrology*", Pergamon Press, 1979.

PRACTICAL COURSE

MTEV-251 Environmental System Design Lab

From the following design problem minimum 4 designs are required to be done for completing Laboratory work:

1. Design problem: Design of Wastewater Treatment plant
2. Design problem: Determination of Rate Constants and Ultimate BOD
3. Design problem: Kinetics of Biological Processes
4. Design problem: Kinetics of Chemical Processes
5. Design problem: Design integrated solid waste management system
6. Design problem : Analysis of Precipitation Data
7. Design problem : Analysis of Distribution Networks
8. Design problem : Design of water Treatment plant
9. Experimental Design Problems
10. Design of Noise barrier
11. Response, Assessment and Analysis (survey and questioner based modelling)
12. Design of Air Pollution Control Devices
13. Determine the efficiency of Class II sedimentation tank for a given wastewater sample.
14. To perform Class III type settling test to determine the zone settling rate of sludge.
15. Design of Health Effect Monitoring System

On the basis of expertise subject teacher can add more design problem which are relevant to Environmental Engineering Programme