

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech in ENVIRONMENTAL ENGINEERING**  
**Effective from Academic Year 2017 - 18 admitted batch**

**COURSE STRUCTURE AND SYLLABUS**

**I Semester**

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-1	Environmental Chemistry and Microbiology	25	75	4	0	0	4
PC-2	Advanced Water Supply Systems	25	75	4	0	0	4
PC-3	Advanced Waste Water Treatment	25	75	4	0	0	4
PE-1	Watershed Management Environmental Hydrology Environment and Ecology	25	75	3	0	0	3
PE-2	Environmental Sanitation Environmental System Engineering Environmental Impact Assessment	25	75	3	0	0	3
OE-1	<b>*Open Elective – I</b>	25	75	3	0	0	3
Laboratory I	Environmental Engineering Lab-I	25	75	0	0	3	2
Seminar I	Seminar-I	100	0	0	0	3	2
<b>Total</b>		<b>275</b>	<b>525</b>	<b>21</b>	<b>0</b>	<b>6</b>	<b>25</b>

**II Semester**

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-4	Air Pollution and Control	25	75	4	0	0	4
PC-5	Industrial Waste Water Treatment	25	75	4	0	0	4
PC-6	Solid Waste Management	25	75	4	0	0	4
PE-3	Ground Water Contamination and Remediation Disaster Management Water Quality Modelling	25	75	3	0	0	3
PE4	Environmental Geotechnology Environmental Biotechnology Hazardous Waste management	25	75	3	0	0	3
OE-2	<b>*Open Elective – II</b>	25	75	3	0	0	3
Laboratory II	Environmental Engineering Lab-II	25	75	0	0	3	2
Seminar II	Seminar-II	100	0	0	0	3	2
<b>Total</b>		<b>275</b>	<b>525</b>	<b>21</b>	<b>0</b>	<b>6</b>	<b>25</b>

### III Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Technical Paper Writing	100	0	0	3	0	2
Comprehensive Viva-Voce	0	100	0	0	0	4
Project work Review II	100	0	0	0	22	8
<b>Total</b>	<b>200</b>	<b>100</b>	<b>0</b>	<b>3</b>	<b>22</b>	<b>14</b>

### IV Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Project work Review III	100	0	0	0	24	8
Project Evaluation (Viva-Voce)	0	100	0	0	0	16
<b>Total</b>	<b>100</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>24</b>

\*Open Elective subjects must be chosen from the list of open electives offered by **OTHER** departments.

# For Project review I, please refer 7.10 in R17 Academic Regulations.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Envir. Engg.)

## AIR POLLUTION AND CONTROL (PC - IV)

**Course Objective:** To develop an outlook on various elements of air pollution and impart knowledge on control technologies.

**Course Outcome:** At the end of the Course, student will have

- Knowledge on sources and effects of air pollution.
- An outlook on meteorological aspects of air pollution.
- Comprehensive Knowledge on control of both particulate and gaseous air pollutants.
- An exposure to legal aspects of air pollution control.

### UNIT - I

**Sources of Air pollution**, effects of Air pollution on plants, animals, human health, classification of pollutants, properties of gaseous and particulate matter,

### UNIT - II

**Atmospheric transport of pollutant** – winds – wind profiles, inversions, plume behaviour, convective current – turbulence – Dispersion and diffusion of Air pollution – ground level concentrations Gaussian model. Air sampling and analysis, theory and equipment ambient and Stack sampling, monitoring of quality emission standards – Indoor air pollution

### UNIT - III

**Control of Particulate matter** – Dusts, fumes, smoke, samples, settling chambers, cyclones, spray towers, electrostatic precipitators, etc. for control.

### UNIT - IV

**Gaseous pollutants** – absorption, adsorption, combustion, and other methods of removal.

### UNIT - V

**Automobile pollution** – analysis and control of emissions. Air fuel ratio – types of flues - Air pollution legislation – Act and other provisions.

### TEXT BOOKS:

1. Air pollution control theory by Martin Crawford - McGraw-Hill, 1976
2. Air pollution control by A.c. Sten.
3. Air pollution control by H.C. Perkins - McGraw-Hill, 1974
4. Air pollution control by Joe O. Ledbetter- Dekker, 1972
5. Air pollution: its origin and control by Kenneth Wark, Cecil Francis Warner, Wayne T. Davis - John Wiley & Sons Inc

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## M. Tech – I Year – II Sem. (Envir. Engg.)

### INDUSTRIAL WASTE WATER TREATMENT (PC -V)

**Course Objective:** To impart knowledge on composition treatment and effective disposal of industrial effluents

**Course Outcomes:**

- Knowledge on theories and systems of industrial effluent treatment and disposal.
- An outlook on industrial effluent management with reference to specific industries.

**UNIT - I:**

Pollutants from industrial effluents – sources, effects on streams, sewers, land – organic load on rivers. Basic theories of Industrial waste water management. Inplant survey– composite sampling – Tolerance limits for effluents discharges into inland surface water’s public sewers, and onland for irrigation – standards.

**UNIT - II**

Volume and strength reduction, neutralization, equalization and proportioning, recovery and recycle of waste products and bye products – joint treatment of Industrial wastes and domestic sewage – discharge into water bodies, consequent problems.

**UNIT - III**

Characteristics and composition of wastes from specific manufacturing units like, paper and pulp, textile, tannery, sugar industries.

**UNIT - IV**

Treatment of Industrial waste from distilleries, dairy, fertilizer plant, steel plant.

**UNIT - V**

Oil refiners, pharmaceutical plants, Thermal Power Plants, and radioactive wastes. Treatment units for the above industrial effluents.

**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 Weinemann publisher (2006)

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – II Sem. (Envir. Engg.)

## SOLID WASTE MANAGEMENT (PC - VI)

**Course Objective:** To develop an integrated approach on various elements of handling and management of solid wastes.

**Course Outcome:**

- An outlook on composition and characterization of solid wastes.
- Conceptual knowledge on recycling and reuse of solid wastes.
- Comprehensive knowledge on treatment and disposal of different types solid wastes.

**UNIT - I**

Types and Sources of solid wastes – Need for solid and hazardous waste management – Legislations on management and handling of municipal solid wastes, hazardous wastes and biomedical wastes.

**UNIT - II**

Waste generation rates – Composition – Hazardous Characteristics – TCLP tests – Waste sampling – Source reduction of wastes – Recycling and reuse.

**UNIT - III**

Handling and segregation of wastes at source – Storage and collection of municipal solid wastes – Analysis of collection systems – Need for transfer and transport – Transfer stations – labeling and handling of hazardous wastes

**UNIT - IV**

Waste processing – Processing technologies – biological and chemical conversion technologies – Composting – Thermal conversion technologies – Energy recovery – Incineration – Solidification and stabilization of hazardous wastes – treatment of biomedical wastes.

**UNIT - V**

Disposal in landfills – site selection – design and operation of sanitary landfills – secure landfills and landfill bioreactors – Leachate and landfill gas management – Landfill closure and environmental monitoring – landfill remediation  
Elements of integrated waste management

**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

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## M. Tech – I Year – II Sem. (Envir. Engg.)

### GROUND WATER CONTAMINATION & REMEDIATION (PE- III)

**Course Objective:** To develop a conceptual outlook and mathematical modelling skills related to groundwater pollution.

**Course Outcome:**

- Basic knowledge on Geo-Hydrological system.
- Mathematical modelling of pollutant transport and reactions in the geo-hydrological domain

#### UNIT - I

**Introduction:** The Hydrological Cycle, Ground water Contamination and Transport, Ground Water remediation, Sources and Types of Ground water contamination Introduction, Under Ground storage Tanks, Landfills, surface impoundment's, Waste disposal Injection wells Septic systems, Agricultural wastes, land applications, Radioactive contamination, other sources of contaminants, Data-collection methods: Introduction, Geological data acquisition, and hydrologic data acquisition, acquisition of soil and ground water quality data.

#### UNIT - II

**Contaminant transport Mechanisms:** Introduction, advection processes, diffusion and dispersion processes, Mass- transport equations, one dimensional model, Governing flow and transport equation in two dimensions, semi-analytical methods, test for dispersivity, Natural gradient field test for dispersion.

#### UNIT - III

**Sorption and other Chemical Reactions:** Introduction, the concept of sorption, factor influencing sorption, sorption Isotherm, Hydrophobic theory for organic contaminants, sorption effects on fate and transport of pollutants, Estimation of sorption, Redox reaction, Hydrolysis, volatilization, Acid-Base reaction, Ion exchange, dissolution and precipitation of solids, complication reaction, models incorporating chemical reactions.

#### UNIT - IV

**Flow and Transport in the Unsaturated Zone:** Capillarity, soil-water characteristics curves, unsaturated hydraulic conductivity, governing equation for unsaturated flow, measurement of soil properties.

#### UNIT - V

**Nonaqueous- Phase Liquids:** Introduction, Types of NAPLs, NAPL transport- General processes, NAPL transport- computational methods- Fate of NAPLs in the sub surface, characterizing NAPLs at remediation sites.

**TEXT BOOK:**

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

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## M. Tech – I Year – II Sem. (Envir. Engg.)

### DISASTER MANAGEMENT (PE - III)

**Course Objective:** To understand the nature of various types of natural disasters and to develop skills to develop disaster management plans.

**Course Outcome:**

- Knowledge on the causes and effects of natural disasters like floods, cyclones, Earthquakes etc.
- An integrated approach on mitigation and management of disasters.
- A skill for the development of action oriented disaster management plan.

**UNIT - I:**

Overview of Natural disasters- Tropical cyclones, Floods, Droughts, Earthquakes & Tsunamis, Severe Thunderstorms & Tornadoes- Need for Disaster Management Plan;

**UNIT - II:** Cyclone warning system in India- cyclone disaster management plan, Floods-Flood management in India; Warning system for major river basins-Role of Central Water Commission; Water purification technologies in flood affected areas, Droughts-Meteorological drought and agricultural drought; monsoon long range Forecasts- Drought management plan-parameters & assessment; Drought Monitoring

**UNIT - III:**

Earthquakes-seismicity in India-status of prediction and disaster management; Tsunamis; Landslides and Avalanches; Volcanoes

**UNIT - IV:**

Hazards associated with convective clouds-Thunderstorms-Lightning; Tornadoes Waterspouts-Hail storms, Aviation hazards and safety measures.

**UNIT - V:**

Key Factors in Disaster management – Early warning, communications, Response by administration, Disaster Management & Mitigation- National Disaster Management Authority (NDMA) Govt. of India.

**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

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## M. Tech – I Year – II Sem. (Envir. Engg.)

### WATER QUALITY MODELLING (PE - III)

**Course Objective:** To develop a mathematical approach towards modelling of various mechanisms related to sustenance of quality of water

**Course Outcomes:**

- An outlook on water quality monitoring.
- Mathematical modelling dealing with various aspects like transport mechanisms. pollution from different sources etc.
- A brief outlook on legislations related to maintenance of water quality.

**UNIT- I:**

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

**UNIT- II:**

**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

**UNIT- III:**

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.

**UNIT- IV:**

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.

**UNIT- V:**

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.



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## M. Tech – I Year – II Sem. (Envir. Engg.)

### ENVIRONMENTAL GEOTECHNOLOGY (PE - IV)

**Course Objective:** To develop a conceptual outlook on application of geotechnical concepts to the soil environment in general and soil-water interaction in particular.

**Course Outcome:**

- Knowledge of soil environment.
- Knowledge on mechanisms of soil-water interaction.
- An outlook on transport and retention of contaminants through soil.

#### UNIT - I

Soil as a multiphase system; Soil-environment interaction; Properties of water in relation to the porous media; Water cycle with special reference to soil medium. Soil mineralogy – Soil behavior – Mineralogical characterization.

#### UNIT - II

Mechanisms of soil-water interaction: Diffuse double layer models; Force of attraction and repulsion; Soil-water-contaminant interaction; Theories of ion exchange; Influence of organic and inorganic chemical interaction.

#### UNIT - III

Introduction to unsaturated soil mechanics; Water retention property and soil-water characteristic curve; flow of water in unsaturated soil.

#### UNIT - IV

Concepts of waste containment facilities; desirable properties of soil; contaminant transport and retention; contaminated site remediation.

#### UNIT - V

Introduction to advanced soil characterization techniques; Volumetric water content; gas permeation in soil; electrical and thermal properties; pore-size distribution; contaminant analysis.

#### TEXT BOOKS:

1. Mitchell, J. K and Soga, K Fundamentals of Soil Behavior, 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 Stabilization and Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994

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## M. Tech – I Year – II Sem. (Envir. Engg.)

### ENVIRONMENTAL BIOTECHNOLOGY (PE - IV)

**Course Objective:** To impart knowledge on application of biotechnological concepts to minimize and mitigate environmental pollution.

**Course Outcome:**

- An outlook on biotechnological concepts and biodegradation.
- Knowledge on the usage of biotechnology like enzyme/cell/DNA technology etc. for mitigation of environmental pollution.

#### UNIT - I

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.

#### UNIT - II

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

#### UNIT - III

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

#### UNIT - IV

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

#### UNIT - V

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.

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M. Tech – I Year – II Sem. (Envir. Engg.)

## HAZARDOUS WASTE MANAGEMENT (PE - IV)

### UNIT - I:

**Waste and Their Handling:** Definition of Hazardous wastes – types of Hazardous wastes – Sources – Characteristics. Hazardous waste Problems - impact on environmental health

### UNIT - II:

**collection, Segregation and Transportation of Hazardous Wastes:** Handling and segregation of wastes at source. Collection and storage of hazardous wastes; Physical and biological routes of transport of hazardous substances – sources and characterization. Sampling and analysis of hazardous wastes –proximate analysis – survey analysis – directed analysis

### UNIT - III

**Hazardous Waste and Management:** Handling, collection, storage and transport. Hazardous waste treatment technologies: TSDF concept - Physical, chemical and thermal treatment of hazardous waste: solidification, chemical fixation, encapsulation, pyrolysis and incineration. Hazardous waste landfills - Site selections, design and operation. HW reduction, recycling and reuse, Regulatory aspects of HWM/HWM rules.

### UNIT - IV

#### **Biomedical Waste Management:**

Classification, collection, segregation Treatment and disposal. Radioactive waste: Definition, Low level and high level radioactive wastes and their management, Radiation standard by ICRP and AERB

### UNIT - V

**E-Waste Management:** Waste characteristics, generation, collection, transport and disposal, regulatory aspects of e waste, global strategy, recycling.

### TEXT BOOKS:

1. Hazardous waste management Charles A. Wentz. Second edition 1995. McGraw Hill International.
2. Integrated solid waste management George Tchobanoglous, Hilary Theisen & Samuel A. Vigil.
3. Criteria for hazardous waste landfills – CPCB guidelines 2000.
4. Hazardous waste management by Prof. Anjaneyulu.
5. Environmental Sciences by Daniel B. Botkin and Edward A. Keller, Wiley student, 6<sup>th</sup> edition-2009.
6. Standard handbook of Hazardous waste treatment and disposal by Harry M. Freeman, McGraw Hill 1997.
7. Management of Solid waste in developing countries by Frank Flintoff , WHO regional publications 1976

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**M. Tech – I Year – II Sem. (Envir. Engg.)**

**ENVIRONMENTAL ENGINEERING LAB - II**

**PART- A**

1. Standard plate count test
2. MPN
3. Morphology of Algae, Fungi, Protozoa and insects.

**PART- B:** Experiments using the following instruments

1. Spectrophotometer
2. Mercury Analyzer
3. Flame Photometer
4. High Volume Sampler
5. Stack Monitoring Equipment
6. Noise Level Meter
7. Meteorological instruments