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	***Open Elective – I**	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
Total		**275**	**525**	**21**	**0**	**6**	**25**

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	***Open Elective – II**	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
Total		**275**	**525**	**21**	**0**	**6**	**25**

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
Total	**200**	**100**	0	**3**	22	**14**

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
Total	**100**	**100**	**0**	**0**	**24**	**24**

***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 – I Sem. (Env. Engg.)

ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY
(PC-1)

Course Objectives: To impart knowledge on chemical and microbiological aspects related to various elements of environment viz., water, waste water, soil , air, etc.

Course Outcomes:

- Knowledge on chemical and biological characterization of water, waste water, soil and air
- Specific knowledge on equilibrium chemistry and oxidation potentials.
- Knowledge on reaction rate and cell growth kinetics and biodegradability concept

UNIT-I
Introduction – Water and Waste Water Characteristics, Principles of Analysis – Valency – Oxidation State and Bonding – Instrumentation Techniques.

UNIT - II.
Concepts of Equilibrium Chemistry – Le-Chatlier's principle, Factor influencing equilibrium – Activity Coefficient- Variations of the equilibrium relationship -Oxidation Reduction reactions – Gas laws – acids and bases – buffers – solubility of salts

UNIT - III.
Action kinetics – rate of reactions – factors effecting, order of reactions – biodegradation – BOD, COD.

UNIT - IV.
Cell Kinetics – Energy (Aerobic and anaerobic) reactions – Effects of Physical and Chemical agents on Cell control study of Protozoa, Bacteria, Viruses, Algae and fungi and their classification and significance – Enzyme Reaction.

UNIT V.
Applied Microbiology of water, waste water, soil, food and air. Applications in the field of environmental engineering

TEXT BOOKS:

1. Environmental Pollution Control Microbiology (Civil and Environmental Engineering) by McKinney - Marcel Dekker Inc publishers
2. Chemistry for Environmental Engineers by sawyer and McCarty - Tata McGraw-Hill Education(2003)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Env. Engg.)

ADVANCED WATER SUPPLY SYSTEMS
(PC-2)

Course Objectives: To impart Knowledge on Advanced Water Treatment Processes along with conventional water treatment system and also to focus on distribution systems.

Course Outcomes:

- Knowledge of design kinetics of sedimentation, filtration, and disinfection process.
- Theoretical outlook on advanced water treatment processes and the related Chemistry
- Knowledge on design of distribution networks.

UNIT I

Principles of Sedimentation – Classes of Sedimentation Factors affecting efficiency concepts of tube settlers, flow dispersion patterns, sludge removal devices, coagulation-stability of colloids –theory of coagulation – coagulant aids –dosing and mixing devices – velocity gradients – design of clarifioculator units- flotation – diffused air flotation and dissolved air flotation.

UNIT II

Theory of filtration – Hydraulics of flow through porous media, backwashing, different types of filters, components, and appurtenances. Filtrability index, mathematical modeling, Design of filters slow / rapid / multimedia filters – filter kinetics.

UNIT III

Theory of disinfection – factors affecting disinfection – kinetics of disinfection – types of chlorine compounds – chlorination chemistry.

UNIT IV

Advanced treatment systems – principles of aeration – theories of adsorption – Principles of mass transfer, adsorption Isotherms, rate of Sorption, activated carbon, ion exchange process – materials, reactions, operatic methods and applications, removal of Hardness, Iron, requirement of Chemicals. Membrane processes – separation – Reverse osmosis practical uses, Dialysis. Corrosion control and water conditioning

UNIT V

Water distribution systems – Design of distribution Networks using software techniques. Hardy cross methods – equivalent pipe method – Analysis of networks

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 Waste water Technology by Hammer Mark J., Hammer Mark J. Prentice- Hall New Arrivals

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Env. Engg.)

ADVANCED WASTE WATER TREATMENT
(PC-3)

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

Course Outcomes:

- Knowledge of design and operational concepts of different wastewater treatment units.
- An outlook on treatment and disposal of sludge from wastewater treatment units. By product recovery

UNIT- I

Water Pollution and Treatment: Types and Sources, quality of water, various stages of treatment Water treatment process: aeration, Sedimentation, Filtration: slow and rapid sand filters.

UNIT - II :

Waste Water Treatment

Characterization and degree of treatment: Self purification in a stream, characteristics of waste water and treatment plant effluents, Dissolved oxygen, Esturine pollution **Primary treatment**: Screening, Grit removal, Neutralization, equalization, Sedimentation, Flotation (oil & grease removal), Air stripping **Secondary treatment**: principles of waste treatment, basic kinetic equation, continuous flow treatment models, oxygen requirement in aerobic process, production of sludge. Conventional biological process: Activated Sludge Process (ASP), UASB and Trickling Filters. Biological waste treatment: RBC, Nitrogen removal: Nitrification and denitrification process, phosphorous removal, u-tube aeration system, anaerobic filters. Low cost wastewater treatment: Aerated lagoons, stabilization ponds, oxidation ditches.

UNIT - III:

Tertiary Treatment of Wastewater

Tertiary treatment – ion exchange, **Membrane separation Techniques:** Brief description of MF, UF, NF membranes. Reverse osmosis principle, Membrane materials, Types of membranes – Plate & frame, tubular, hollow fibre, spiral wound membranes, application of membranes in various industrial applications., **electro chemical techniques** : electro dialysis, electro coagulation, **Evaporators :** forces evaporation, Multiple effect evaporators – falling film, raising film, forced circulation, agitated thin film driers. Advanced oxidation process, photo catalysis.

UNIT - IV:

Sewage Treatment and Disposal: Introduction, importance of sewage, Characteristics of sewage, Sampling and analysis of sewage, Sewage treatment and disposal : Skimming, Grit chamber, Sedimentation tanks, Septic tank, Secondary treatment-types of filters, rate of filter loading, Activated sludge process, sludge digestition, Sludge disposal.

UNIT - V:

Industrial Wastewater Treatment : Sources, Characteristics, methodology and process for the treatment of industrial wastes of sugar industry- beverage industry – tannery industry – textile mill waste industry – fertilizer plant – steel plant – oil refinery – paper and pulp mill. Legislation, Cleaner technologies: Water conservation.

TEXT BOOKS:

1. Water Supply and Sanitary Engineering G.S. Bridie & J.S. Brides, Dhanpat Rai & Sons 1993.
2. A Treatise on Rural, Municipal, and industrial water management KVSG Murali Krishna.
3. Environmental sanitation (Social and Preventive medicine) Dr. P.V. Rama Raju & KVSG Mural Krishna.
4. Waste Water engineering, treatment and reuse by Metealf and eddy, fifth edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. Municipal and Rural Sanitation – Ehlers, V.M. & Steel, E.W. Mc. GRAW-HILL Book Company, Inc V edition, 1987.
2. Environmental Sanitation, Ehlers, V.M. add Steel, E.W., McGraw-Hill Book Co., Inc.
3. Environmental pollution and Toxicology, Meera Asthana and Asthana D.K., Alka Printers (1994).

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Env. Engg.)

WATERSHED MANAGEMENT
(PE-1)

Course Objectives: To obtain knowledge on concepts, principles and planning of watershed management activities.

Course Outcomes:

- Conceptual knowledge on characterization of watersheds, ecosystems.
- An outlook on management of watersheds and ecosystems.

UNIT - I

Introduction: Concept of watershed development, Objectives of watershed development, need for watershed development in India, Integrated and multi-disciplinary approach for watershed management.

UNIT – II

Characteristics and principles of Watershed: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds. Types of erosion, factors affecting erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion, Universal soil loss equation.

UNIT - III

Measures to Control Erosion and water harvesting: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rockfill dams, brushwood dam, Gabion. Rainwater Harvesting, catchment harvesting, harvesting structures, soil moisture conservation, check dams, artificial recharge, farm ponds, percolation tanks.

UNIT – IV

Land & Ecosystem Management: Land use and Land capability classification, management of forest, agricultural, grassland, and wild land. Reclamation of saline and alkaline soils. Role of Ecosystem, crop husbandry, soil enrichment, Inter, mixed and strip cropping, cropping pattern, sustainable agriculture, bio-mass management, dry land agriculture, Silvi pasture, horticulture, social forestry and afforestation.

UNIT – V

Planning of watershed management activities:peoples participation, preparation of action plan, administrative requirements.

TEXT BOOKS:

1. Land and Water Management by VVN Murthy, Kalyani Publications.
2. Watershed Management by JVS Murthy, New Age International Publishers.
3. Water Resource Engineering by R.Awurbs and WP James, Prentice Hall Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Env. Engg.)

ENVIRONMENTAL HYDROLOGY
(PE-1)

Course Objectives: To learn various Hydrological concepts applied in the context of different flow conditions.

Course Outcomes:

- Conceptual outlook on hydrological cycle and circulation of water in the environment.
- Mathematical outlook on surface and subsurface flow regimes.

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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. New York.
2. Chaudhry M.H. (1994), *"Open-Channel Flow",* Prentice Hall of India, New 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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Env. Engg.)

ENVIRONMENT AND ECOLOGY
(PE-1)

Course Objectives: To develop a conceptual outlook on various ecological facets of environment.

Course Outcomes:

- Knowledge on Ecosystems and Ecological Balances.
- An outlook on living and non-living resources as well as energy resources of environment.

UNIT - I

Environment, Ecology, and Sustaining the Earth; Nature and Humans: Earth, population, environment.

UNIT - II

Ecosystems; Ecosystems, ecology of populations, human population dynamics – growth and urbanization; environmental economics and politics.

UNIT - III

Ecological Balances – Material cycles in ecosphere, Matter and Energy Resources; Energy flow in ecosystems; bio-geochemical systems.

UNIT - IV

Air, Water and Soil Resources**:** Air Resources, pollution, global warning, ozone depletion; water resources – surface and groundwater, sources of pollution; soil resources – conservation, contamination, salt water intrusion, hazardous wastes.

UNIT - V

Living Resources Food resources, pesticides, pest control: land resources – forests, wetlands, wilderness, national parks; wild plants and animal resources, Energy and Mineral Exploitation: perpetual and renewable energy; non-renewable energy; non-renewable mineral resources, solid and hazardous wastes.

TEXT BOOKS:

1. Environmental Science by Tyley Miller- Brooks Cole(2012)
2. Concepts of Ecology by Edward J Kormondy -Phi Learning (2009)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Env. Engg.)

ENVIRONMENTAL SANITATION
(PE-2)

Course Objectives: To learn sanitary and hygienic aspects in the context of a number of social institutions and processes.

Course Outcomes:

- An outlook on epidemiological concept vis-a-vis various sanitary measures.
- Knowledge on sanitary aspects in relation to different social institutions.

UNIT I

Epidemiology – Principles of protecting the environmental sanitation measures, Inspect and Rodent Control, community sanitation measures – sanitation of camps, festivals, schools, swimming pools etc.

UNIT II

Food and milk sanitation, hotel management with reference to sanitation – food preservation, pasteurization methods and plants. Housing need – lighting and ventilation, natural and artificial provisions.

UNIT III

Solid wastes – characteristics, collection, disposal by landfill, composting, incineration and other methods. Handling and disposal of Hazardous Wastes. Industrial Hygiene– Occupational hazards – Various operations in industrial units, Engineering and safety measures .Radiological health – radioactive wastes and disposal.

UNIT IV

Noise Pollution and control – Engineering and medical divisions – various programmes. Rural sanitation various methods of collection and disposal of fecal matter – community toilets – septic tanks and soak pits – biogas plants.

UNIT V

Public Health – Occupational hazards, Industrial hygiene, Rural Water Supply and sanitation, biogas – community toilets

TEXT BOOKS:

1. Municipal and Rural Sanitation (Sanitary Science & Water Engineering) by V. M. Ehlers, Ernest W. Steel- Tata Mcgraw-hill Education (1977)
2. Environmental Sanitation by Joseph A. Salvato - John Wiley & Sons Inc
3. Environmental Protection by Emil T. Chanlett – Mcgraw –hilll nc., us

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Env. Engg.)

ENVIRONMENTAL SYSTEMS ENGINEERING
(PE-2)

Course Objectives: To learn various concepts of environmental modelling.

Course Outcomes:

- Knowledge on chemical and biological kinetics related to environmental modelling.
- An outlook on pollution transport models.
- Knowledge on design concepts with reference to engineering transport systems.

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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 Soil, John Willey and Sons, 1996
3. Rich, L.G., Environmental Systems Engineering, McGraw Hill Inc, 1975

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

ENVIRONMENTAL IMPACT ASSESSMENT
(PE-2)

Course Objectives: To develop a methodical approach on assessment of environmental impacts due to developmental activities and a conceptual outlook on sustainable development.

Course Outcomes:

- Knowledge on prediction and assessment of environmental impacts due to developmental activities.
- Concepts on various environmental impact assessment methodologies.
- An outlook on legislations to safeguard environment.

UNIT-I:

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

UNIT-II:

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.

UNIT-III:

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.

UNIT-IV:

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.

UNIT-V:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Env. Engg.)

ENVIRONMENTAL ENGINEERING LAB-I

Determination of the following parameters:

1. Chlorine in Bleaching powder
2. Break point chlorination
3. Fluoride
4. Iron
5. Manganese
6. Sulphate
7. Phosphate
8. Ammonical nitrogen
9. Nitrates
10. BOD
11. COD
12. Phenols