

UTTAR PRADESH TECHNICAL UNIVERSITY LUCKNOW



SYLLABUS

Bachelor of Environmental Engineering

3rd Year (V & VI Semester)

(Effective from Session 2015-2016)

Study and Evaluation Scheme
 B. Tech. (Environmental Engineering)
 [Effective from Session 2015-16]
 Third Year, Semester V

S. No.	Subject Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CA	TA	Total			
Theory Subjects											
1	NEN 501	Fundamentals of Mass Transfer and Chemical Engineering	3	1	0	30	20	50	100	150	4
2	NEN 502	Structural Analysis	3	1	0	30	20	50	100	150	4
3	NEN 503	Design of Concrete Structures	3	1	0	30	20	50	100	150	4
4	NEN 504	Environmental Hydraulics	3	1	0	30	20	50	100	150	4
5	NEN 505	Industrial Pollution Control and Management	2	1	0	15	10	25	50	75	3
6	NHU 501	Engineering Economics	2	0	0	15	10	25	50	75	2
Practical											
7	NEN 551	Environmental Sampling and Analysis Lab	0	0	3	10	10	20	30	50	1
8	NEN 552	Environmental Hydraulics Lab	0	0	3	10	10	20	30	50	1
9	NEN 553	Structural Analysis Lab	0	0	3	10	10	20	30	50	1
10	NEN 554	Heat and Mass Transfer Lab	0	0	3	10	10	20	30	50	1
11	NGP 501	GP				50				50	
		Total	16	5	12					1000	25

Study and Evaluation Scheme
 B. Tech. (Environmental Engineering)
 [Effective from Session 2015-16]
 Third Year, Semester VI

S. No.	Subject Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
Theory Subject											
1	NEN 601	Design of Wastewater Engineering Systems	3	1	0	30	20	50	100	150	4
2	NEN 602	Environmental System and Analysis	3	1	0	30	20	50	100	150	4
3	NEN 603	Water Resource Engineering	3	1	0	30	20	50	100	150	4
4	NEN 011-015	Departmental Elective I	3	1	0	30	20	50	100	150	4
5	NEN 021-024	Departmental Elective II	2	1	0	15	10	25	50	75	3
6	NHU 601	Industrial Management	2	0	0	15	10	25	50	75	2
Practical											
7	NEN 651	Environmental System and Simulation Lab	0	0	3	10	10	20	30	50	1
8	NEN 652	Wastewater Engg. Lab	0	0	3	10	10	20	30	50	1
9	NEN 653	Environment Camp*	0	0	3	10	10	20	30	50	1
10	NEN 654	CAD Lab	0	0	3	10	10	20	30	50	1
11	NGP 601	GP				50				50	
Total			16	5	12					1000	25

*The teaching load of Environment camp will be counted as equivalent to 0-0-3. Field study of any environmental issue and report for remedy will be prepared during winter break of one week. Evaluation will be done by the group activity presentation.

Departmental Elective Papers

DE -I

[3-1-0]

NEN-011 Earth and Environment
NEN-012 Ecological and Biological Principles and Processes
NEN-013 Environmental Biotechnology
NEN-014 Disaster Management
NEN-015 Integrated Impact Assessment

DE II

[2-1-0]

NEN-021 Science and Policy of climate change
NEN-022 Environmental Policy & Legislation
NEN-023 Environmental Economics
NEN-024 Environmental Risk Assessment

NEN 501: Fundamentals of Mass Transfer and Chemical Engineering

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Unit 1

Conduction: Concepts of conduction in solids, liquids and gases, Steady state temperature fields, One dimensional conduction, Insulation materials, Critical and optimum insulation thickness.

Convection: Concepts and definitions, Natural and forced convection, Hydrodynamic and thermal boundary layers, Laminar and turbulent heat transfer inside and outside tubes, Heat transfer coefficients.

Radiation: Basic laws of heat transfer by radiation, Black body and gray body concepts, Kirchoff's law, Solar radiations, Heat transfer coefficients.

Unit 2

Heat transfer with phase change, Condensation of pure and mixed vapors, Loading in condensers, Boiling heat transfer coefficients.

Evaporation: Elementary principles, Types of evaporators, Single and multiple effect evaporators, Thermo compression.

Heat Transfer Equipment: Classification, principles and design criteria.

Unit 3

Rate of reaction, Elementary and non-elementary homogeneous reactions, Molecularity and order of reaction, Thermodynamic formulations of rates, Mechanism of reaction, Temperature dependency from thermodynamics, Arrhenius collision and activated complex theories.

Unit 4

Integral and differential methods for analyzing kinetic data, Interpretation of constant volume batch reactor, Data for zero, first, second and third order reactions, Half life period, Irreversible reaction in parallel and series, Auto catalytic reaction, Design equations for batch, plug flow, back mix flow and semi batch reactors for isothermal, adiabatic homogeneous reaction.

Unit 5

Holding time and space-time for flow system, Design of batch, plug flow and mixed flow reactors for first and second order single reactions, Optimum reactor size, Plug flow reactors in series and parallel.

Temperature and pressure effects for single reaction, Optimal temperature progression for first order reactions.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

1. Holman, J.P. "Heat Transfer", Tata Mc-Graw Hill.
2. Murphy, R. "Introduction to Chemical Processes: Principles, Analysis, Synthesis", Mc-Graw Hill.
3. Smith, J.M. "Chemical Engineering Kinetics", Mc-Graw Hill.
4. Coulson, J.M. & Richardson, J.F. "Chemical Engineering, Vol. I (Fluid flow, heat transfer and mass transfer)", Butterworth-Heinemann.
5. McAdams, W.H. "Heat Transmission", Mc-Graw Hill.
6. Kern, D.Q. "Process Heat Transfer", Mc-Graw Hill.
7. Badger, W.L. & Banchero, J.T., "Introduction to Chemical Engineering", Tata Mc-Graw Hill.
8. Levenspiel, O. "Chemical Reaction Engineering", Wiley.
9. Fogler, H.S. "Elements of Chemical Reaction Engineering", Prentice Hall.

NEN 502: Structural Analysis

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3 1 0

Unit 1

Classification of Structures, Static and kinematic indeterminacy for beams, Trusses and building frames.

Deflection of determinate beams and simple frames using moment area, energy, unit load and conjugate beam method.

Maxwell's reciprocal and Betti's theorem, Castigliano's theorem.

Unit 2

Influence lines - concept, Muller-Breslau's principle and its applications for determinate and indeterminate beams.

Application of influence lines for absolute maximum bending moment and shear force for moving point loads, several loads, uniformly distributed loads on beam.

Unit 3

Types of arches, Analysis of three hinged arches, Expression for horizontal thrust of two hinged circular and parabolic arch.

Unit 4

Concept of force and displacement approaches in analysis of indeterminate beams.

Analysis of indeterminate beams and simple frame using consistent deformation, Slope deflection and moment distribution methods.

Unit 5

Flexibility and stiffness matrix for indeterminate beams and their application in analysis of indeterminate beams.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

1. Jain, O.P. & Jain, B.K., "Theory and Analysis of Structures, Vol. I & II", Nem Chand & Bros., Roorkee.
2. Reddy, C.S. "Basic Structural Analysis", Tata Mc-Graw Hill.
3. Dayaratnam, P. "Analysis of Statically Indeterminate Structures", Affiliated East-West Press.
4. Wang, C.K. "Intermediate Structural Analysis", Tata Mc-Graw Hill.
5. Gupta, S.P., Pandit, G.S. & Gupta, R. "Theory of Structures, Vol. I & II", Tata Mc-Graw Hill.

6. Martin, H.C. "Introduction to Matrix Methods of Structural Analysis", Mc-Graw Hill.
7. Weaver, W.Jr. & Gere, J.M. "Matrix Analysis of Framed Structures", Van Nostrand Reinhold.
8. Vazirani, V.N. & Ratwani, M.M. & Duggal, S.K. "Analysis of Structures, Vol. II (Theory, Design and Details of Structures)", Khanna Publishers.

NEN 503: Design of Concrete Structures

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3 1 0

Unit 1

Concrete technology: Constituent materials and their properties, Fresh concrete, Workability, strength, elasticity and fracture of hardened concrete, Time dependent properties of concrete, Durability of concrete, Concrete admixtures, Mix design methods, BIS code provisions, Special concretes.

Introduction to various design philosophies, Assumptions in working stress and limit state design method, Factor of safety applied to different materials, IS-456 provisions, Load consideration for design of concrete structures as per relevant IS code.

Unit 2

Beam design by limit state: Moment of resistance of a beam of rectangular and flange section and their design using limit state, Spacing of vertical and inclined stirrups, Development length of reinforcement, Detailing of reinforcement as per IS-456 and IS-13920.

Unit 3

Column design by limit state: Short column under axial loading and uni-axial bending, column with helical reinforcement. Detailing of reinforcement as per IS-456 and IS-13920. Solid Slab design using limit state: Design of one way and two way slab.

Unit 4

Retaining wall: Structural behaviour, stability of retaining wall against overturning and sliding, Design of T-shaped retaining wall, Concept of counter fort retaining wall.

Unit 5

Water Tanks: Design of circular and rectangular tanks situated on the ground, underground and overhead tanks.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

1. Jain, O.P. & Krishna, J. "Plain and Reinforced Concrete, Vol. I & II", Nem Chand & Bros.
2. Dayaratnam, P. "Reinforced Concrete Design", Oxford & IBH.
3. Sinha, S.N. "Reinforced Concrete Design", Mc-Graw Hill.
4. Pillai, S.U. & Menon, D. "Reinforced Concrete Design, Mc-Graw Hill.
5. Gambhir, M.L. "Fundamentals of Reinforced Concrete Design", PHI Learning.
6. Park, R. and Pauley, T. "Reinforced Concrete Structures", John Wiley.
7. IS: 456 – 2000: Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards.

NEN 504: Environmental Hydraulics

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3 1 0

Unit 1

Difference between open channel flow and pipe flow, Geometrical parameters of a channel, Continuity equation for steady and unsteady flow, Critical depth, Specific energy. Chezy's and Manning's equations for uniform flow in open channel, Velocity distribution, Most efficient channel section, Compound channels. Application of specific energy principle for interpretation of open channel phenomena, Flow through vertical and horizontal contractions.

Unit 2

Equation of gradually varied flow and its limitations, Flow classification, Surface profiles, integration of varied flow equation – analytical - graphical - numerical methods, Flow in channels of non-linear alignment.

Unit 3

Equation of rapid varied Flow in channel, Classification and profiles Hydraulic jump, Evaluation of the jump elements in rectangular and non- rectangular channels on horizontal and sloping beds.

Unit 4

Open channel surge, Celerity of the gravity wave, Deep and shallow water waves, Rectangular free overfall. River engineering - Stages of river, Meandering, River training.

Unit 5

Rotodynamic pumps, Classification, Velocity triangles, Manometric head, Efficiencies, Cavitation in pumps, Characteristics curves, Rotodynamic machines, Specific speed, Characteristic curves.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

1. Chow, V.T. "Open Channel Hydraulics", Mc-Graw Hill.
2. Subramanya, K. "Flow Through Open Channels", Tata Mc-Graw Hill.
3. Ranga Raju, K.G. "Flow Through Open Channels", Tata Mc-Graw Hill.
4. Sturm, T. "Open Channel Hydraulics", Mc-Graw Hill.
5. Srivastava, R. "Flow Through Open Channels", Oxford University Press.
6. Streeter, V.L. & Wylie, E.B. "Fluid Mechanics", Mc-Graw Hill.

NEN 505: Industrial Pollution Control and Management

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Unit 1

Industrial wastes and their sources: Various industrial processes, Sources and types of solid, liquid, gaseous wastes, Noise & radiation emissions. Sources of industrial water usages and various industrial processes requiring water use and required water quality.

Unit 2

Processes responsible for deterioration in water quality, Various waste water streams, Control and removal of specific pollutants in industrial wastewaters, e.g., oil and grease, bio-degradable organics, chemicals such as cyanide, fluoride, toxic organics, heavy metals, radioactivity etc. Wastewater reuse & recycling, Concept of zero discharge effluent.

Unit 3

Control of gaseous emissions: Hood and ducts, Tall stacks, Particulate and gaseous pollutant control, Solid waste generation and disposal management.

Hazardous wastes: Definitions, concepts and management aspects.

Noise & radiation: Generation, control and management.

Unit 4

Recent trends in industrial waste management, Cradle to grave concept, Life cycle analysis, Clean technologies; Case studies of various industries, e.g., dairy, fertilizer, distillery, sugar, pulp and paper, iron and steel, metal plating, thermal power plants, etc.

Environmental audit: Definition and concepts, Environmental audit versus accounts audit, Compliance audit, Relevant methodologies, Various pollution regulations, Introduction to ISO and ISO 14000.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

1. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc Graw Hill.
2. Azad, H.S. "Industrial Wastewater Management Handbook", Mc-Graw Hill.
3. Arceivala, S.J. & Asolekar, S.R. "Wastewater Treatment for Pollution Control and Reuse", Mc-Graw Hill.
4. Culp, G., George, W., Williams, R. and Mark, Hughes, V.Jr. "Wastewater Reuse and Recycling Technology-Pollution Technology" Review-72, Noyes Data Corporation, New Jersey.
5. Pandey, G.N. and Corney, G.C. "Environmental Engineering", Tata Mc-Graw Hill.
6. Edmund, B. Besselieve P.E. "The Treatment of Industrial Wastes", Mc-Graw Hill.
7. Nancy, J.S. "Industrial Pollution Control: Issues and Techniques", Van Nostrand Reinhold.
8. Shen, T.T. "Industrial Pollution Prevention Handbook", Springer-Verlag.
9. Environment (protection) Act - 1986, Ministry of Environment and Forest, Government of India.

NEN 551: Environmental Sampling and Analysis Lab

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1. Collection of grab and composite sample from a water/ wastewater stream.
2. Flow measurement in a wastewater drain in field.
3. Determination of moisture content and pH of soil.
4. Digestion of samples for metal analysis.
5. Determination of Na and K by flame photometer.
6. Vehicle counting and classification on a highway.
7. Measurement of noise.
8. Determination of metals in samples.
9. Study of chromatography.

NEN 552: Environmental Hydraulics Lab

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Note: Any 8 experiments from the list:

1. To determine the Manning's coefficient of roughness 'n' for the bed of a given flume.
2. To study the velocity distribution in an open channel and to determine the energy and momentum correction factors.
3. To study the flow characteristics over a hump placed in an open channel.
4. To study the flow through a horizontal contraction in a rectangular channel.

5. To calibrate a broad-crested weir.
6. To study the characteristics of free hydraulic jump.
7. To study centrifugal pump and their characteristics.
8. To study the free overfall phenomenon in an open channel and to determine the end depth.
9. To determine coefficient of discharge for given rectangular notch.
10. To determine coefficient of disc.

NEN 553: Structural Analysis Lab

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1. To determine Flexural Rigidity (EI) of a given beam.
2. To verify Maxwell's Reciprocal theorem.
3. To find horizontal thrust in a three-hinged arch and to draw influence line diagrams for Horizontal Thrust end Bending moment.
4. To find horizontal thrust in a two hinged arch and to draw influence line diagrams for horizontal Thrust and bending moment.
5. To find deflection of curved members.
6. To find bar forces in a three members structural frames with pin jointed bar.
7. To find Critical load in Struts with different end conditions.
8. To find deflections in Beam having unsymmetrical bending.

NEN 554: Heat and Mass Transfer Lab

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Experiments on:

1. Hydrodynamics of a packed column.
2. Differential distillation.
3. Heat transfer in laminar and turbulent flow.
4. Boiling and condensation.
5. Plate heat exchanger.
6. Fluidization with heat transfer.
7. Heat transfer through a submerged helical coil.
8. Heat transfer in an agitated vessel.
9. Finned tube heat exchanger.

NEN 601: Design of Wastewater Engineering Systems

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Unit 1

Introduction: Wastewater flow and its characteristics, Wastewater collection systems, Estimation and variation of wastewater flows. Problems of industrial wastewaters, Sampling protocol, Equalization, Neutralization, Proportioning processes, Volume and strength reduction. Preliminary, primary, secondary and tertiary wastewater treatment processes. Theory and design of screens, grit chambers, sedimentation, coagulation, flocculation.

Unit 2

Physico-chemical and biological treatment strategies and their evaluation, Theory of activated sludge process (ASP), extended aeration systems, trickling filters (TF), aerated lagoons, stabilization ponds, oxidation ditches, sequential batch reactor, rotating biological contactor, etc., Mass balancing in ASP and TF and their design.

Unit 3

Anaerobic treatment process, Effects of pH, temperature and other parameters on anaerobic treatment, Concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and upflow anaerobic sludge blanket (UASB) reactor.

Unit 4

Indian standards for disposal of treated wastewaters on land and in natural streams, Agricultural irrigation, Ground water recharge, Treated wastewater reclamation and reuse, Introduction to duckweed pond, vermiculture and root zone technology for wastewater treatment, Special treatments, Recent technologies of treatment.

Unit 5

Study on wastewater generation points, wastewater characteristics, process flow sheets, treatment scheme for tannery, sugar, textile, steel, distillery, paper/ pulp and oil refinery industry wastewater.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

1. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc Graw Hill.
2. Peavy, Rowe & Tchobanoglous "Environmental Engineering", Mc. Graw Hill, New Delhi.
3. Davis, M. "Water and Wastewater Engineering", Mc-Graw Hill.
4. Fair, G.M. & Geyer, J.C. "Water supply and Wastewater Disposal", John Wiley & Sons.

5. Qasim, S.R., Motley, E.M., and Zhu, G. "Water Works Engineering", Prentice Hall Publication.
6. CPHEEO "Manual on Sewerage & Sewage Treatment", Ministry of urban development, Government of India, New Delhi.
7. Parker, H. "Wastewater System Engineering", Prentice Hall.
8. Garg, S.K. "Environmental Engineering Vol. II (Sewage Disposal and Air Pollution Engineering)", Khanna Publishers.
9. Rao, M.N. & Dutta, A.K. "Wastewater Treatment", Oxford & IBH Publishing.

NEN 602: Environmental System and Analysis

L T P
3 1 0

Unit 1

Introduction: System and system analysis, Static and dynamic system, Models and modeling, Types of models, Stochastic and deterministic models, Dynamic simulation modeling, Necessity of models in management of environmental system, Steps followed in modeling, Model conceptualization, Model development, Solution methodologies- numerical, analytical and monte carlo methods of simulation, Computer coding, Data acquisition and processing, Model calibration, Model validation and verification, Sensitivity analysis.

Unit 2

Air pollution dispersion modeling: Meteorological factors affecting air quality, Lapse rate, Dry adiabatic, moist Adiabatic and ambient lapse rates, Stable, unstable and neutral atmospheric condition, Maximum mixing height, Temperature inversions, Effect of lapse rate on plume behavior- conning, looping, lofting, fanning, fumigation. Point source Gaussian Plume Model- Effective stack height, Pasquill-gifforth stability criteria, Horizontal and vertical dispersion, Wind speed correction, Numerical examples and Some case studies on air pollution dispersion modeling.

Unit 3

Surface water quality modeling: Control mass and volume, Material balance equation, Dissolved oxygen depletion, Biochemical oxygen demand (BOD) measurement, Modeling BOD as a first-order reaction, Ultimate BOD, BOD: Temperature dependence, nitrogenous oxygen demand, Theoretical oxygen demand, Chemical oxygen demand, Dissolved oxygen sag curve, Steps in developing the DO sag curve, Numerical examples and some case studies on surface water quality modeling.

Unit 4

Storm Water Management Models: Component of urban drainage system, Elements of EPA Storm water management model, Visual and non visual objects, Computational methods of runoff, Infiltration, Evapotranspiration and Peak flow component in EPA SWMM, Rainfall-runoff modeling, Unit hydrograph methods, Hydrologic and hydraulic routing methods, Typical application of SWMM with examples.

Unit 5

Application of operation research in environmental engineering: Introduction, Linear programming model, Examples of linear programming problems, Developing linear programming models, Graphical solution to LP problems, Simplex method, Simplex tableau for maximization problem, Marginal values of additional resources, Sensitivity analysis, Complications in applying the simplex method, Application in resource allocation and, Water quality and wastewater treatment, Application of transportation problems and dynamic programming in water supply engineering.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

1. Sivakumar, R. "Introduction to Environmental Science & Engineering", Mc-Graw Hill.
2. Gordon, G. "System Simulation", Prentice Hall.
3. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G. "Environmental Engineering", Tata Mc-Graw Hill.
4. Arya, S.P. "Air Pollution Meteorology and Dispersion", Oxford University Press.
5. Barrat, R. "Atmospheric Dispersion Modelling", Earthscan Publications.
6. Warren, V.Jr. and Lewis, G.L. "Introduction to Hydrology", Pearson education.
7. Gupta, P.K. & Heera, D.S. "Operation Research", S. Chand.
8. Davis, M. & Masten, S. "Principles of Environmental Engineering and Science", Mc-Graw Hill.
9. Rao, M. & Rao, H.V.N. "Air Pollution", Mc-Graw Hill.

NEN 603: Water Resources Engineering

L T P
3 1 0

Unit 1

Water resources planning and management: Objectives, constraints and criteria based on technical, economical social & political factors, Assessment of surface water resources of India, Intra & inter-basin development concepts, Single and multipurpose projects.

Unit 2

Surface Run off: Components and factors affecting run off methods of estimation of run off volume and perk runoff, Rating curve, Rainfall–run off relationships, Sediment transportation: Suspended and bed load and its estimations, Various losses in canal & their preventive measures, Water logging.

Unit 3

Irrigation: Developments in India, Necessity & types advantages and disadvantages of irrigation, Function of water in plant growth, Methods of irrigation, Water requirement of

crops, Irrigation frequency, Irrigation efficiencies, Principal crops & crops season, Crop rotation.

Unit 4

Regulation and control of canal system: Purpose, types of canal regulation works and their functional aspects, River training: Objective & need, Classification of rivers training works, Meandering, Methods of river training, River bank protection.

Unit 5

Earth Dam: Classification, Causes of failure, Introduction to stability analysis.

Gravity Dam: Forces, Methods of analysis, Modes of failure and factor of safety stability analysis, Galleries.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

1. Asawa, G.L. "Irrigation and Water Resources Engg.", New Age International.
2. Linsley, R.K. "Water Resources Engg.", Mc Graw Hill.
3. Larry W. Mays "Water Resources Engg.", John Wiley.
4. Wurbs, R.A. & James, W.P. "Water Resources Engg.", John Wiley.

NEN 011: Earth and Environment

L T P
3 1 0

Unit 1

Understanding the earth, Atmosphere and processes governing environmental conditions, Biosphere, Earth's energy budget, Atmosphere, Climate and climate change, The geologic, tectonic, Hydrological and biogeochemical cycles.

Unit 2

Study and significance of natural resources, Renewable biological resources, Wildlife conservation/ management, Fisheries, Forestry, Energy resources, Energy consumption, Scarcity and conservation.

Unit 3

Mineral resources, Mineral availability and recycling, Air, water and soil resources, World food supply, Traditional agriculture, Green revolution, Aquaculture, Modern agriculture, Ecological impacts of modern agriculture, Organic farming.

Unit 4

Major environmental concerns, Natural hazards and processes, Environmental impacts, Dams and environment, Channelisation and environment, Global climate and hazards.

Unit 5

Effect of population increase on environment, Historical perspective of growing environmental concerns, Environmental and social issues, Case studies regarding local-national-international environmental problem, Causes of global warming, Water-treaties, International treaties.

Note: The students should be given a comprehensive problem at the end which requires inputs/ knowledge/ application from all the units of the syllabus. It may be evaluated as a part of TA.

Books

1. Seinfeld, J.H. and Pandis, S.N. "Atmospheric Chemistry and Physics: From Air Pollution to Climate Change", John Wiley.
2. Jacobson, M.Z. "Atmospheric Pollution: History, Science and Regulation", Cambridge University Press.
3. Jacobson, M.Z. "Fundamental of Atmospheric Modeling", Cambridge University Press.
4. Masters, G.M. "Introduction to Environmental Engineering and Science", PHI.
5. Chaudhari, A.K. & Prakash, O. "Environmental Engineering", Dhanpat Rai & Sons.

NEN 012: Ecological and Biological Principles and Processes

L T P
3 1 0

Unit 1

Ecosystems, Biotic and abiotic components, Production and consumption, Trophic levels, Productivity and energy flow, Imbalance of ecosystem: Causes and effects, Lotka-Volterra equations.

Unit 2

Food webs, Cycling of elements, Population dynamics, Ecology of population, Ecological niche, Mortality and survivorship, Community interactions, Changes in ecosystems, Succession, Long range changes, Long range stability.

Unit 3

The organization and dynamics of ecological communities, Description and study of typical natural and artificial ecosystems, Biochemistry, Photosynthesis and respiration, Important biological compounds, Enzymes.

Unit 4

Microbiological concepts, Cells, Classification and characteristics of living organisms, Characterization techniques, Reproduction, Metabolism, Microbial growth kinetics.

Unit 5

Applications of microbiology to environmental engineering; assimilation of wastes, Engineered systems, Concepts and principles of carbon oxidation, Nitrification, Denitrification, Methanogenesis, etc., Concepts of quantification of degradable pollutants.

Books

1. Pelczar, Jr.M. & Chan, E.C.S. "Microbiology", Tata Mc-Graw Hill.
2. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc-Graw Hill.
3. Sharma, P.D. "Ecology and Environment", Rastogi Publications.
4. ICAR "Hand Book of Agriculture", Indian Council of Agricultural Research.

NEN 013: Environmental Biotechnology

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3 1 0

Unit 1

Concept of environmental biotechnology and environmental engineering, Scope and importance, Genetic engineering structure of DNA, RNA, Replication of DNA, Genetic code, Transcription, Protein synthesis.

Unit 2

Bioremediation, Types of bioremediations, Bio augmentation for bioremediation, Bioreactors, Bioremediation of herbicides, pesticides, hydrocarbons, oil spills, Novel methods of pollution control – Vermi technology, Methane production, Root zone treatment, Membrane technology, Biodegradable plastics.

Unit 3

Microbiology of waste water treatment: Aerobic processes-Activated sludge, Oxidation ditches, Trickling filters, Towers, Rotating discs, Rotating drums, Oxidation ponds, Anaerobic processes: Anaerobic digestion, Anaerobic filters, Upflow anaerobic sludge blanket reactor, Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industry.

Unit 4

Air pollution and its control through biotechnology, Biotechnology in reduction of CO₂ emission, Bioscrubbers, Biobeds, Biotrickling filters and their applications.

Unit 5

Microbiology of degradation of xeno biotic in environment–ecological considerations, Decay behavior and degradative plasmids, Hydrocarbons, Substituted hydro carbons, Oil pollution,

Surfactants, Pesticides, Biological detoxification of cyanide, oxalate, urea, petrochemical industry effluents, toxic organics, phenols.

Books

1. Patnaik, B.K., Kara, T.C., Ghosh, S.N. & Dalai, A.K. "Textbook of Biotechnology", Mc-Graw Hill.
2. Glazer, A.N. & Nikaido, H. "Microbial Biotechnology", Cambridge University Press.
3. Glick, B.R., Pasternack, J.J. & Pattern, C.L. "Molecular Biotechnology: Principles and Applications of Recombinant DNA", Wiley.
4. Brock, T.D., "Biotechnology: A Text Book of Industrial Microbiology", Smaeur Associates.
5. Prescott and Dunn, "Industrial Microbiology", CBS Publishers & Distributors.
6. Singh, B.D. "Biotechnology", Kalyani Publishers.

NEN 014: Disaster Management

L T P
3 1 0

Unit 1

Natural Hazards and Disasters, Concept of environmental hazards, Environmental stress & environmental disasters, Types of environmental hazards and disasters, Natural hazards and disasters, Volcanic hazards/ disasters: Causes and distribution of Volcanoes, Hazardous effects of volcanic eruptions, Environmental impacts of volcanic eruptions, Earthquake hazards/ disasters, Causes of earthquakes, Distribution of earthquakes, - Hazardous effects of earthquakes, Earthquake hazards in India, Human adjustment, Perception & mitigation of earthquake, Cumulative atmospheric hazards/ disasters, Lightning, Hailstorms, Cyclones, Tropical cyclones & Local storms, Destruction by tropical cyclones & local storms (causes, distribution human adjustment, perception & mitigation), Cold waves, Heat waves, Floods, Causes of floods, Flood hazards in India, Flood control measures, Droughts, Impacts of droughts, Drought hazards in India, Drought control measures.

Unit 2

Man induced hazards & disasters, Mechanics & forms of Soil Erosion, Factors & causes of soil erosion, Conservation measures of soil erosion, Chemical hazards/ disasters, Release of toxic chemicals, Nuclear explosion, Sedimentation processes, Global sedimentation problems, Regional sedimentation problems, Sedimentation & environmental problems, Corrective measures of erosion & sedimentation, Biological hazards/ disasters, Population Explosion.

Unit 3

Emerging approaches in Disaster Management.

Pre-disaster stage (preparedness), Preparing hazard zonation maps, Predictability/ forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Preparedness through (IEC) Information, Education & communication.

Pre-disaster stage (mitigation), Disaster resistant house construction, Population reduction in vulnerable areas, Awareness.

Emergency Stage, Rescue training for search & operation at national & regional level, Immediate relief, Assessment surveys.

Post Disaster stage-Rehabilitation, Political administrative aspect, Social aspect, Economic Aspect, Environmental aspect.

Unit 4

Natural disaster reduction and management, Provision of Immediate relief measures to disaster affected people, Prediction of hazards & disasters, Measures of adjustment to natural hazards, Mitigation.

Working of institutions: Meteorological observatory, Seismological observatory, Volcanology institution, Hydrology laboratory, Industrial safety inspectorate, Institution of urban & regional planners, Chambers of architects, Engineering council, National standards committee, Integrated planning, Contingency management.

Preparedness: Education on disasters, Community involvement, The adjustment of human population to natural hazards & disasters, Role of media, Application of geographical information system (GIS) in disaster risk management.

Unit 5

A regional survey of land subsidence, Coastal disaster, Cyclonic disaster and disaster in hills with particular reference to India, Ecological planning for sustainability and sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of panchayats in disaster mitigations, Environmental policies & programs in India: Institutional & National, Centres for natural disaster reduction.

Books

1. Bhattacharya, T. "Disaster Science and Management", Mc-Graw Hill.
2. Sinvhal, A. "Understanding Earthquake Disasters", Mc-Graw Hill
3. Singh, S. "Environmental Geography", Prayag Pustak Bhawan.
4. Burton, I., Kates, R.W. & White, G.F. "The Environment as Hazard", Oxford University Press.
5. Singh, R.B. (Ed.) "Disaster Management", Rawat Publications.
6. Gupta, H.K. (Ed.) "Disaster Management", University Press.

NEN 015: Integrated Impact Assessment

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Unit 1

Introduction and an overview of integrated impact assessment (IIA), Definition, Sustainable development challenges and need for IIA, Key approaches of IIA: Environment, Social health and economic, Current practices, Changing perspectives and debate in IIA, Environmental impacts – Examples, need for assessment, difficulties; The EIA Approach – Background, Objectives, Components and techniques, Impact prediction and analysis, Treatment of risk and uncertainty, EIA inputs to the project cycle and development planning, EIA in India – Legislative aspects, Current practices and constraints, EIA case study.

Unit 2

Biodiversity and health impact assessment (BIA and HIA), Role of BIA in the existing EIA process, Identification, Prediction and evaluation of impacts on biodiversity, Techniques of biodiversity impact assessment and monitoring, Threat reduction methods, Case study, Impact of environment on health, Morbidity pattern in India, Developing framework for HIA analysis, Changing concept and approach in HIA, Health need assessment, Tools and techniques in HIA, HIA case study.

Unit 3

Handling social issues: the social impact assessment (SIA) approach, Overview and scope of SIA, SIA and community, Marginalized/ vulnerable groups, Indigenous people, Resettlement & rehabilitation and development, SIA and gender impact assessment, SIA and NRM, SIA case studies.

Unit 4

Integrated analysis of environmental, social and health impacts, Challenges for IIA: Removing inconsistencies and differences between different approaches, Other methodological and practical issues, Scope for integrated approach in economic analysis: Concept of economic analysis, Cost-benefit analysis (CBA), Social CBA, Cost Effectiveness analysis (CEA), The analytic hierarchy process (AHP) based approach to project appraisal.

Unit 5

Mapping tools and contribution of IIA in decision makings, Role and relevance of GIS Techniques in IIA, Public participation in IIA and its relevance to decision-making, Contribution of IIA to decision-making: Prospects & constraints, Stakeholder participation in IIA: Importance, Methodological and practical issues, Emerging dimensions and future directions, Strategic environmental assessment (SEA), Technology assessment, Risk assessment, IIA Case Studies.

Books

1. Canter, L.W. "Environmental Impact Assessment", Mc-Graw Hill.
2. Lohani, B., Evans, J.W., Ludwig, H., Everitt, R.R., Carpenter, R.A. & Tu, S.L. "Environmental Impact Assessment for Developing Countries in Asia, Vol. I (Overview)". ADB Publication.
3. Lee, N. & Kirkpatrick, C. (Eds). 2000. "Integrated Appraisal and Sustainable Development in a Developing World", Edward Elgar, Cheltenham.
4. British Medical Association "Health and Environmental Impact Assessment- an Integrated Approach", Earthscan.
5. Vanclay, F. and Bronstein, D.A. "Environmental and Social Impact Assessment", John Wiley.
6. Briggs, D., Corvalan, C. & Nurminen, M. "Linkage Methods for Environment and Health Analysis; General Guidelines", World Health Organization.
7. Bathwal, R.R. "Handbook of Environmental Impact Assessment", New Age International.
8. Dale, R. "Evaluating Frameworks for Development Programmes and Projects", Sage Publication.

NEN 021: Science and Policy of Climate Change

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2 1 0

Unit 1

Energy balance, Basic concepts: Radiation, Albedo, Emissivity, Nature of climate, History of the perception of climate change, Climate machine: Atmospheric general circulation, Early analog simulations, Global circulations: ITCZ, Hadley, Westerlies, Polar, Modern general circulation models, Changes in greenhouse gases and influence on models.

Unit 2

Paleo-indicators of climate, Nature of storms: Cyclones and hurricanes, Expected changes with warming, Dynamics of storm generation and effects on ecosystems, Return to secondary circulations, El Nino, Atlantic multidecadal oscillation, Pacific-North American pattern, Pacific decadal oscillation.

Quantitative analysis of climate change, Case study: Hurricanes and global warming.

Unit 3

History of concern about climate change, 1970s (IIASA, DOE), 1980s, Startup of U.N. IPCC, Mission of the IPCC, Framework convention on climate change, Kyoto protocol to framework convention, Policy analyses, Internationally adopted emissions restrictions, State and local ordinances.

Unit 4

Class legislative proposals and discussion, Hearings on subject matter chosen by leaders, Testimony by staff, Continue hearings and testimony, Submission of legislation, Active federal Legislation on climate change.

Books

1. Robinson, P.J. & Henderson-Sellers, A. "Contemporary Climatology", Prentice-Hall.
2. Houghton, J.T., Ding, Y., Griggs, D.J., Naguer, M., van der Linden, P.J. & Xiaosu, D. "Climate Change 2001: The Scientific Basis", Cambridge University Press.
3. Kuhn, T. "The Structure of Scientific Revolutions", University of Chicago Press.

NEN 022: Environmental Policy & Legislation

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2 1 0

Unit 1

Water (prevention and control of pollution) act 1974 as amended upto 1988, Water (Prevention and control of pollution) rules 1975, Water (Prevention and control of pollution) (Procedures for Transaction of Business) rules 1975., Water (Prevention and control of pollution) cess Act, 1977 as amended by amendment act, 1991, Water (Prevention and control of pollution) cess rules, 1978.

Unit 2

Air (Prevention and control of pollution) act, 1981 as amended by amendment act, 1987, Air (Prevention and control of Pollution) rules, 1982.

Unit 3

Environment (Protection) act, 1986, Environment (Protection) rules, 1986, Hazardous wastes (Management and Handling) rules, 1989, Basel convention, Manufacture, storage and import of hazardous chemical rules, 1989. Scheme of labeling of environment friendly products (ECO –Marks).

Unit 4

Public liability insurance act, 1991, Public Liability insurance rules, 1991, Municipal solid waste act/ rule 2000, Biomedical waste act/ rule-2004.

Books

1. Pollution Control Acts, rules and notifications issued by CPCB [Ministry of Environment and forest, Government of India], Paryavaran Bhawan, CGO Complex, New Delhi-110003.
2. Jacobson, M.Z. "Atmospheric Pollution: History, Science and Regulation", Cambridge University Press.

3. Stanley E.M. "Environmental Chemistry", Lewis Publishers.
4. Mohanty, S.K. "Environment & Pollution Law Manual", Universal Law Pub.
5. Sengar, D.S. "Environmental Law", PHI.

NEN 023: ENVIRONMENTAL ECONOMICS

L T P
2 1 0

Unit 1

Economy and environment, Economic operation and environmental issues, Environmental pollution and sources, Adversities on the economy, Markets and environmental assets, Incomplete markets, Externalities, Non-exclusion, Non-rivalry and public good, Nonconvexities, Asymmetric information.

Unit 2

Economic incentive and environmental protection:

- (i) Price rationing: Charges and subsidies.
- (ii) Liability rules: Non-compliance fees, bonds and deposit refunds.
- (iii) Quantity rationing: Marketable permits.
- (iv) Evaluation criteria.
- (v) Practical Conditions for use of economic incentives.

Unit 3

Pollution Taxes. Efficiency properties of a tax on emissions, problems with pollution taxes.

Unit 4

Tradable pollution permits, Basic theory of tradable pollution permits, Issues in tradable permits, Transboundary pollution problem, International organizations for environmental protection.

Books

1. Kolstad, C.D. "Environmental Economics", Oxford University Press.
2. Bhattacharya, R. "Environmental Economics: An Indian Perspective", Oxford University Press.
3. Jhingan, M.L. "Environmental Economics - Theory, Management & Policy", Vrinda Publications.

NEN 024: Environmental Risk Assessment

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Unit 1

Environmental risk, Definition, Types of environmental risk, Management risk, Need of environmental risk management, International collaborations in risk management.

Establishing an overview of the problem, Models, Boundaries and contexts, Modeling the problem, Setting boundaries to the risk system, Putting the risk into comparative context.

Unit 2

Identifying and estimating risk selection of techniques, Environmental monitoring and health surveillance, Testing and screening, Modeling, Environmental models, Establishing the relationship between the dose and the effect.

Unit 3

Risk evaluation and national policies, Policy considerations, Legislative considerations, Legal considerations, Economic considerations, Managing environmental risks.

Unit 4

Developing a national risk profile, Institutional arrangements, Risk management tasks, Environmental links, Socio-economic links, Common national problems, Emerging needs and suggested actions.

Books

1. Whyte, A.V. & Burton, I. "Environment Risk Assessment (Scope 13-18)", John Wiley.
2. Anjaneyulu, Y. & Manickam, V. "Environmental Impact Assessment Methodologies", Taylor & Francis.

NEN 651: Environmental System and Simulation Lab

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1. Exercise on computer simulation of air pollution.
2. Exercise on computer simulation of surface water quality.
3. Exercise on computer simulation of soil water balance.
4. Exercise on application of storm water management model.
5. Exercise on application of linear programming in environmental engineering.
6. Exercise on application of transportation problem in environmental engineering
7. Exercise on application of dynamic programming in environmental engineering.

NEN 652: Wastewater Engg. Lab

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1. Determination of color and odor of wastewater sample.
2. Determination of BOD constants.
3. To determine the COD.
4. Sampling protocol of wastewater from an Industry.
5. Preservation of wastewater samples for different tests i.e., DO, BOD, Metals etc.
6. To determine the nitrogen content.

Books

1. A.P.H.A. "Standard Methods for the Examination of Water and Wastewater", American Public Health Association.
2. Sawyer, C.N., McCarty, P.L. & Parkin, G.F. "Chemistry for Environmental Engineering", Mc-Graw Hill.
3. Mathur, R.P. "Water & Wastewater Testing", Lab Manual, Roorkee.

NCE-653: Environment Camp

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The purpose of the camp is to train students in applying modern techniques/ equipment to prepare a detailed report of selected study area.

The course will be run in the form of a camp for 7 working days and will involve one or more of the following components:

1. Study of the environmental problems in the study area.
2. Sampling work and analysis in the lab.
3. Field study and primary data collection.
4. Secondary data collection from agencies.
5. Statistical analysis of data, model development and estimating pollutant quantities.
6. Designing of system using software/ model/ data.
7. Preparing a map using GIS software and report writing.

NEN 654: CAD Lab

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1. Design of water distribution system using available software.
2. Design of sewer line/ wastewater drain network using available software.
3. Digitization of your city map using available software and showing pollution map.
4. Predicting concentration of air pollutant, emitted from stack, at any given location in ambient environment by using any dispersion modeling software.