



**M.E.- ENVIRONMENTAL ENGINEERING  
 (TWO YEAR FULL TIME)  
 CURRICULUM 2008  
 SEMESTER I**

<b>Code No.</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>THEORY</b>				
YEN 101	Engineering Statistics	3	1	0	4
YEN 102	Chemistry for Environmental Engineers	3	0	0	3
YEN 103	Microbiology for Environmental Engineers	3	0	0	3
YEN 104	Unit Operation in Environmental Systems	3	0	0	3
YEN105*	Elective – I	3	0	0	3
YEN106*	Elective – II	3	0	0	3
	<b>PRACTICAL</b>				
YEN 107	Environmental Engg. Lab-I (Water)	0	0	3	2
YEN 108	Environmental Engg. Lab-II (Wastewater)	0	0	3	2

**Total Hours : 25**

**Total Credits : 23**

\* Denotes A, B, C & D

## SEMESTER II

Code No.	Course Title	L	T	P	C
	<b>THEORY</b>				
YEN 201	Theory and Practice of Water Treatment	3	1	0	4
YEN 202	Theory and Practice of Wastewater Treatment	3	1	0	4
YEN 203	Air Pollution Control Management Practice	3	0	0	3
YEN 204	Solid Waste Management in Industries and Municipalities	3	0	0	3
YEN 205	Industrial Waste Treatment Theory and Practice	3	0	0	3
YEN 206*	Elective – III	3	0	0	3
YEN 207*	Elective – IV	3	0	0	3
	<b>PRACTICAL</b>				
YEN 208	Unit Operation and Processes Lab	0	0	3	2

\* Denotes A, B, C & D

**Total Hours : 26**

**Total Credits : 25**

## SEMESTER III

Sub. Code	Course Title	L	T	P	C
YEN 301	Thesis / Dissertation (Phase – I)	0	0	17	9
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>9</b>

**Total Hours : 26**

**Total Credits : 9**

## SEMESTER IV

Sub. Code	Course Title	L	T	P	C
YEN401	Thesis / Dissertation (Phase – II)	0	0	36	18
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>34</b>	<b>17</b>

**Total Hours : 25**

**Total Credits : 18**

**Over all Credits: 75**

## List of Electives

### ELECTIVE I

<b>Elective</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
YEN105 A	Transport of Water and Wastewater	3	0	0	3
YEN105 B	Energy and Environment	3	0	0	3
YEN105 C	Sustainable Urban Development Concepts and Strategies	3	0	0	3
YEN105 D	Water Resources Management	3	0	0	3

### ELECTIVE II

<b>Elective</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
YEN106 A	Environmental Sanitation and Public Health	3	0	0	3
YEN106 B	Principles and Practice of Environmental Management	3	0	0	3
YEN106 C	Ecology and Environment	3	0	0	3
YEN106 D	Environmental Legislation and Pollution Control Management	3	0	0	3

### ELECTIVE III

<b>Elective</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
YEN206 A	Ground Water Contamination and Transport Modeling	2	0	2	3
YEN206 B	Environmental Biotechnology	3	0	0	3
YEN 206 C	Design of Environmental Engineering Structures	3	0	0	3
YEN206 D	Advanced Water and Waste water Treatment	3	0	0	3

### ELECTIVE IV

<b>Elective</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
YEN207 A	Simulation and Modeling in Environmental Systems	2	0	2	3
YEN207 B	GPS and GIS Applications in Project Development	2	0	2	3
YEN207 C	Instrumental Methods and Analysis of Environmental Pollutants	2	0	2	3
YEN207 D	Occupational Health and Safety Practice in Industry	3	0	0	3

## SYLLABUS - 2008

### M.E ENVIRONMENTAL ENGINEERING

**YEN 101 ENGINEERING STATISTICS** 3 1 0 4

**UNIT- I** 9  
**EMPIRICAL STATISTICS**

Measures of Central tendency, dispersion, skewness and kurtosis - Principle of least squares - Correlation and regression - rank correlation.

**UNIT- II** 9  
**SAMPLING DISTRIBUTIONS AND ESTIMATION**

Sampling distributions - Point and interval estimates for population proportions, mean and variance – Maximum likelihood estimate method - Method of moments.

**UNIT- III** 9  
**TESTING OF HYPOTHESIS**

Sampling distributions - Tests based on Normal, t, Chi-square and F distributions - Analysis of variance – oneway and two-way classifications.

**UNIT- IV** 9  
**DESIGN OF EXPERIMENTS**

Completely randomized design - Randomized block design - Latin square design - 2 power 2 factorial design.

**UNIT- V** 9  
**LINEAR PROGRAMMING**

Basic concepts - Graphical and Simplex methods - Transportation problem - Assignment Problem.

**L:45; T :15; Total:60**

#### **REFERENCES:**

1. Berthouex, P.U., " Statistics for Environmental Engineers ", Lewis Publ., 1994.
2. Freund, J.E. and Miller, I.R., " Probability and Statistics for Engineers ", Prentice – Hall of India, 5th Edition, New Delhi, 1994.
3. Gupta, S.C. and Kapur, V.K., " Fundamentals of Mathematical Statistics ", Sultan Chand & Sons, New Delhi, 1999.
4. Ang, A.H.S. and Tang W.H., " Probability concepts in Engineering Planning and Design - Basic Principles Vol.1 ", John Wiley and Sons, Inc. New Delhi, 1975.
5. Taha, H.A., " Operations Research : An Introduction ", Prentice - Hall of India, 6th Edition, New Delhi, 1997.

**YEN 102 CHEMISTRY FOR ENVIRONMENTAL ENGINEERS 3 0 0 3**

**UNIT- I 9**

Principles of oxidation and reduction – pH and buffer solutions – Basic thermodynamics of chemical reactions (exothermic and endothermic) - Chemical kinetics – Equilibrium chemistry.

**UNIT- II 9**

Solubility – Gas laws- Vapour pressure of gas - Liquids and solids – Surface tension – Osmosis- Dialysis-Solvent extractions - Electrochemistry – Adsorption -Absorption

**UNIT- III 9**

Main categories of compounds of environmental significance – Principles of colloidal chemistry – Emulsions-Basic concepts from biochemistry - Substrates – Enzymes

**UNIT- IV 9**

Water and wastewater analysis – introduction – basic concepts from quantitative chemistry – sampling procedure - instrumental methods – physical characteristics – chemical characteristics.

**UNIT-V 9**

Composition of the atmosphere - atmosphere structure – earth's radiation balance – chemical and photochemical reactions in the atmosphere – pollutants reaction atmosphere.

**L:45; Total:75**

**REFERENCE:**

1. Glasstone & Lewis "Elements of physical chemistry"
2. Finar, I.L. "Organic Chemistry" Vol-I
3. Sawyer and McCarthy, "Chemistry for Environmental Engineering"

## **YEN 103 MICROBIOLOGY FOR ENVIRONMENTAL ENGINEERS**

**3 0 0 3**

### **UNIT-I**

**9**

Basic principles of microbiology – Structure and function of microbial cell - Pure and mixed cultures – Metabolism - Aerobic and Anaerobic pathways - Microbial growth and growth kinetics – Classification and morphological aspects of bacteria, fungi, protozoa and algae

### **UNIT-II**

**9**

Microbial nutrition and environment – Growth of micro-organisms in different media, growth curve, methods of enumeration of multiplying micro-organisms, culture media, sterilization and disinfection.

### **UNIT-III**

**9**

Biotechnological process in purification of wastewater units of treatment of wastewater – Units of treatment of wastewater – stabilization ponds – Activated sludge system – Aerobic digestion – Bio energy and Bio filtration.

### **UNIT-IV**

**9**

Role of microorganisms in water and wastewater treatment - Microbiology as applied in air pollution control (bio-filters, bio-reactors and bio-scrubbers) - Pathogenic and indicator organisms.

### **UNIT-V**

**9**

Environmental applications of microbiology – Recycling of waste biomass, production of biogas. Leaching of ores by micro-organism application of biofertilizers and bio-pesticides. Bioremediation.

**L:45; Total:75**

### **REFERENCES:**

1. M.C. Kinney, K.E. "Micro-biology for Sanitary Engineering"
2. Gainey and Lord " Micro-biology of water and sewage"
3. Talaro K and Talaro A Cassida Pelzar and Reid, Foundations in Microbiology, by W.C.Brown Publishers, 1993.

## **YEN 104 UNIT OPERATION IN ENVIRONMENTAL SYSTEMS**

**3 0 0 3**

### **UNIT I**

**6**

Screening-Solid Separation-Floatation – Equalization – measurement – Mixing – Coagulation and flocculation

### **UNIT II**

**9**

Principles – Types of settling – Thickening – Dick’s theory , Talmadge theory, principle of filtration – Carman – Kozeny equation – Types of filters

### **UNIT III**

**9**

Two film theory – Mass transfer – Fixed and floating aerators – Designing of aerator – Air stripping – packed columns and trays

### **UNIT IV**

**10**

Theory of adsorption – Isotherms – fixed and fluidized beds – break through curves – Leaching – Definition and types, ion exchange studies, Determinations of adsorption kinetics

### **UNIT V**

**11**

Fundamentals of microbiology of wastewater – kinetics of aerobic and anaerobic, anoxic process – suspended growth and attached growth – Biological reactors – Batch, plug flow – completely mixed.

**L:45; Total:45**

### **REFERENCES:**

1. Metcalf & Eddy, Wastewater Engineering, McGraw Hill Publications.
2. Weber, Physico – chemical Process.
3. Gainey and Lord “ Micro-biology of water and sewage”

pH, Conductivity, Turbidity, Solids, Chlorides, Acidity, Alakilnity, Residual Chlorine, DO, Sulphates, Fluorides, Nitrate and heavy metals.

Media preparation and inoculation - staining - environmental factors - bacteriological analysis of water, sewage, test for plate count - coliforms - fecal coliforms - E.coli - S.fecalis - M.P.N. and M.F. techniques. Techniques for studying aquatic organisms - identification of phytoplankton and zooplankton - bioassay study and biodegradation

**REFERENCES:**

1. Glasstone & Lewis "Elements of physical chemistry"
2. Sawyer and McCarthy, "Chemistry for Environmental Engineering"
3. Gainey and Lord " Micro-biology of water and sewage"

Physical And Chemical Analysis of Wastewater - Phosphate, COD, BOD,  
Organic and ammonical nitrogen, Oil & grease.

Adsorption studies / Kinetics, Kinetics of suspended growth process (activated  
sludge process), Kinetics of attached growth process (Rotating Biological  
Contactors).

Anaerobic Reactor systems / Kinetics, Advanced Oxidation Processes,  
Chlorine Demand Estimation

**REFERENCES:**

1. Metcalf & Eddy, Wastewater Engineering, McGraw Hill Publications.
2. Lee, CC and Shun dar Lin, Handbook of Environmental Engineering Calculations, McGraw-Hill, New York, 1999.

**Unit – I 9**

Principles of Screening – Mixing, Equalisation – Sedimentation - Filtration – Back washing – Evaporation - Incineration – gas transfer - mass transfer coefficients.

**Unit – II 9**

Principles of disinfection units, membrane separation, Reverse Osmosis, Nano filtration ultra filtration and hyper filtration – Electrodialysis, distillation – stripping and crystallization – hydraulic profile and layout of conventional treatment units - upgrading of existing plants -Recent Advances.

**Unit – III 9**

Design of conventional water treatment units, - Aeration, chemical dosing tanks, Flash mixers, Flocculators, Sedimentation tanks, Clariflocculators

**Unit – IV 9**

Design of filter beds, disinfection units - Design of softeners, Demineralisers, Desalination plants, Boiler feed water treatment

**Unit – V 9**

Operational problems - Trouble shooting , Planning, Organising and Controlling of plant operations - Training of operating personnel.

**L:45; T:15; Total:60**

**REFERENCES:**

1. Manual on " Water Supply and Treatment ", CPHEEO, Ministry of Urban Development ,GOI, New Delhi, 1999.
2. Lee, CC and Shun dar Lin, Handbook of Environmental Engineering Calculations, McGraw-Hill, New York, 1999.
3. Qasim, S.R., Motley, E.M., Zhu, G. Water works Engineering – Planning, Design and operation, Prentice Hall, New Delhi 2002.
4. Casey, T.J. Unit treatment processes in water and wastewater Engineering, John Wiley and Sons, London 1993

## YEN 202 THEORY AND PRACTICE OF WASTEWATER TREATMENT

3 1 0 4

### Unit – I

9

Principles of Screening – Mixing, Equalisation – Sedimentation, gas transfer - mass transfer coefficients. Adsorption – Isotherms Principles, equilibria and kinetics, reactors, regeneration,

### Unit – II

9

Design of sewage treatment plant units - screen chamber, Grit chamber with proportional flow weir, sedimentation tank

### Unit – III

9

Principles of Chemical treatment – Coagulation flocculation - Precipitation – flotation, solidification and stabilization – Disinfection. Ion exchange, Electrolytic methods, Solvent extraction – advance oxidation /reduction – Recent Advances.

### Unit – IV

9

Biological treatment – significance - kinetics of biological growth – Factors affecting growth -attached and suspended growth – Determination of Kinetics coefficients for organics removal – aerobic and anaerobic treatment : Septic tank, Trickling filters, Rotating Biological contactor, activated sludge process & variations, aerated lagoons, waste stabilization ponds – nutrient removal systems

### Unit – V

9

Sludge management, Sludge thickening, sludge digestion , sludge dewatering (mechanical and gravity) - Operational problems – Trouble shooting, Planning, Organising and Controlling of plant operations

**L = 45; T = 15 Total = 60**

### REFERENCES:

1. Arceivala, S.J., Wastewater treatment for pollution control, TMH, New Delhi, 1998.
2. Manual on “Sewerage and Sewage Treatment” CPHEEO, Ministry of Urban Development, Gol, New Delhi, 1999.
3. METCALF & EDDY, INC. ‘Wastewater Engineering, Treatment and Reuse. Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.
4. Qasim, S.R, Wastewater Treatment Plant, Planning, Design & Operation Technomic Publications, New York, 1994.

## **YEN 203 AIR POLLUTION CONTROL MANAGEMENT PRACTICE**

**3 0 0 3**

### **UNIT I 8**

Definition – classification – sources – Effects On Human, Animals, Vegetation, Building and materials, aquatic and terrestrial eco – systems. – laws and legislation of Air pollution – Ambient air quality standards.

### **UNIT II 10**

Meteorological Factors – primary and secondary parameters – Measurement of meteorological variables – plume behaviors – plume rise – Dispersion models – Gaussian plume model, Pasquill model .

### **UNIT III 9**

Classification of sampling methods – Instruments for sampling – Ambient air sampling collection of Gaseous Air pollutants – Particulate pollutants – stack sampling – monitoring of Air pollutants.

### **UNIT IV 9**

Control methods – cleaning of Gaseous Effluents – particulate emission control – control of Gaseous emission – control of specific Gaseous pollutants – Design of control equipments – simple problems.

### **UNIT V 9**

Green house effect – Green house gases – effect of green house gases in the atmosphere – El Nino phenomenon – Ozone layer depletion – Effects – Acid rain – Effects.

**L:45; Total:45**

### **REFERENCES:**

1. “Air Pollution” Edited by M. N. Rao
2. “Air Pollution” Edited by C. S. Rao
3. “Air Pollution” Edited by .A. C. Stern – Vol-I

**UNIT I** **7**

Sources - Characteristics - Composition – Health hazards – Availability of solid waste in India-methods of labeling solid waste-validity of waste-lifecycle assessment-source reduction .

**UNIT II** **10**

Collection and Transportation of Solid Waste - Types and Methods of collection and segregation – Collection facilities – Frequency of collection – Methods of transport – Choices.

**UNIT III** **10**

Site selection – Planning and Land use – Incineration – Composting – Sanitary Landfills - Disposal in to the sea, etc – Cost considerations – Control such as odour, flies, air and water Pollution.

**UNIT IV** **9**

Recovery of useful products – Hand sorting – Mechanical sorting – Incinerators, Fluid classifiers – Inertial classifiers – Bioenergy. Utilization – Reuse and Recycle - Research & development.

**UNIT V** **9**

Storage of radio-active waste above the ground and mines – Disposal Problems – Definition of hazardous waste – Classification – Collection – Storage – Treatment & disposal options.

**L:45; Total:45**

**REFERENCES:**

1. “Haggerty, D. J. et.al “Solid Waste Management”
2. “Municipal Refuse Disposal ‘NY American Public work’
3. Flintoff “Management of solid waste in Developing countries”

**UNIT I 9**

Effect of Industrial wastes on Air, Water, land Disposal standard, process Modification, Material changes (Raw material substitution and pretreatment), and strength-Reduction, Recovery methods.

**UNIT II 9**

Conventional methods of treatment – Equalization, Neutralization solid separation, Floatation, sedimentation, Filtration.  
Principles and efficiency of waste control techniques-fibrous filters, electrostatic precipitators, pyrolysis, sanitary land fill.

**UNIT III 9**

Physicochemical methods-Aeration, Neutralization, coagulation, Adsorption, Biological methods-Aerobic and anaerobic digestion, Trickling filters, Stabilization pond, activated sludge process.

**UNIT IV 9**

Petrochemicals and Refineries, Pharmaceuticals, Textile, Paper and Pulp, Distillery, sugar, Tannery, Thermal Power, Nuclear plants.

**UNIT V 9**

Monitoring Techniques, combined treatment of municipal and Industrial wastes, preparation of Environmental and Industrial wastes, preparation of Environmental statement and impact assessment.

**L:45; Total:45**

**REFERENCES:**

1. Theories of practice of Industrial Waste Treatment – Nemerow, N.I
2. Principles of Industrial Waste Treatment – Gurnham, C.F.
3. Treatment and Disposal of Industrial Wastes – Southgate

1. Coagulation and Flocculation
2. Batch studies for sedimentation
3. Characteristics of Filter media
4. Studies on Filtration
5. Silt Density Index
6. Reverse Osmosis
7. Water softening
8. Sludge volume Index

**REFERENCES:**

1. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, Gol, New Delhi, 1999.
2. METCALF & EDDY, INC. 'Wastewater Engineering, Treatment and Reuse. Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.

**UNIT I 9**

Importance requirements of water supply schemes – populations – forecast – fluctuations in demand – sources of water – Intake structures – transmission of water

**UNIT II 9**

Standards of water – quality of water – surface and underground sources – layout of water treatment plant – preliminary – secondary treatment – design – disinfection – radio isotope removal .

**UNIT III 9**

Pumps – pumping station – methods of distribution – systems of distribution – advantages and disadvantages – general layout of distribution – analysis of pipe networks – storage facilities - determination of storage capacity.

**UNIT IV 9**

Sewerage system – design – characteristics – analysis of sewage – decomposition of sewage – cycles of decomposition – microbiology of sewage – treatment preliminary methods – Building sewerage system .

**UNIT V 9**

Secondary treatment of sewage – trickling filters – activated sludge process – ditches – oxidation ponds – disposal of sewage – land treatment – dilution – self purification – oxygen sag curve – sewage sickness – prevention – choices of disposal methods.

**L = 45; Total = 45****Reference:**

1. Water supply and Sanitary Engineering by S.K. Hussian
2. Environmental Engineering Vol I & II by S.K. Garg
3. Water supply and Sanitary Engineering by Bride
4. Water supply and Sanitary Engineering by S.C. Rangawala.

**YEN105 B ENERGY AND ENVIRONMENT****3 0 0 3****UNIT- I****9**

Trends in waste generation-Processing Philosophy- Typical waste composition and its uses-Waste recovery methods-Waste recycling methods-Energy recovery methods

**UNIT-II****9**

Recovery of waste materials-Plastic recovery –Energy recovery-Metal recovery-Glass recovery-Non ferrous metals recovery-Composting-Check list

**UNIT-III****9**

Separation and recycling of waste –Principles-separation-Air classifier – Screening-Hammer mill-Products of recycling-Recycling applications-Case histories-House hold waste recycling –Scrap fragmentation Process

**UNIT-IV****9**

Waste handling and storage-Supply and demand-Compacting and storage-Storage hoppers-Waste handling systems-Access and safety –Compactors

**UNIT-V****9**

Waste disposal-Management-Conveyance –Specific examples-Refractories-Development-Chimneys-Control and instrumentation-Operation and safety

**L = 45; Total = 45****References:**

1. Waste recycling for energy recovery: David Kut and Gerard Hare
2. Rubber and plastic Waste by Chandra and Adab

**YEN105 C SUSTAINABLE URBAN DEVELOPMENT CONCEPTS AND STRATEGIES**

**3 0 0 3**

**UNIT-I**

**9**

Introduction to sustainable development –Energy Resources-Renewable Non –conventional energy sources-Energy needs-Conserving natural resources

**UNIT-II**

**9**

Environmental protection in urban areas-Co ordination and enforcement – Legislative aspects-Population control-Technological aspects-Application of EIA-Methodology to urban development programme

**UNIT-III**

**9**

Principles of urban landscape- Landscape design for frant areas and other functional areas in urban development -Develictareas-Reclamation of derlict areas

**UNIT—IV**

**9**

Community involvement in developing settlement – Developmental programs related to urban and rural society—Impact of programme on social development

**UNIT-V**

**9**

Socio economic factors in the development of urban and rural settlements- Legal administrative and financial frame works –Development management and control

**L = 45; Total = 75**

**Reference:**

1. Environmental, A., Divan and Noble M. Environmental Law and Policy in India(cases, Materials and Statutes) 1991 Tripathi Bombay.
2. Environmental Policy. Forest Policy. Bare Acts – Government Gazette Notification.
3. Neil S. Grigg., " Urban Water Infrastructure Planning - Management and Operations ", John Wiley and Sons, 1986.
4. Overtens D.E. and Meadows M.E., " Storm Water Modelling ", Academic Press, NewYork, 1976.

**YEN 105D WATER RESOURCES MANAGEMENT 3 00 3**

**UNIT I INTRODUCTION 8**

Water in the urban eco-system-Urban water resources-Four major problems-Urban hydrological cycle-Storm water management objectives and limitations-Storm water policies-Feasibility consideration

**UNIT II URBAN WATER RESOURCES MANAGEMENT MODELS 12**

Types of models-Physically based-Conceptual or unit hydrograph based-Urban surface runoff models- Management models for flow rate and volume control rate-Quality models

**UNIT III URBAN STORM WATER MANAGEMENT 10**

Storm water management practices(Structural and Non-Structural Management measures)-Detention and Retention concepts-Modelling concept-Types of storage-Magnitude of storage-Hydraulics analysis and design guidelines-Flow and storage capacity of urban components-Temple tanks

**UNIT IV MASTER PLANS 8**

Planning and organisational aspects-Inter dependency of planning and implementation of goals and measures- Measures of Urban drainage and flood control benefits-Effective urban water user organisations

**UNIT V OPERATION AND MAINTENANCE 7**

General approaches to operations and maintenance-Complexity of operations and need for diagnostic analysis- Operation and Maintenance in urban water system-Maintenance management systems-Inventories and conditions assessment-Social awareness and involvement

**L = 45; Total = 45**

**References:**

1. Geiger.W.F., Marsalek F., Rawls.W.J., and Zuidena.F.C., (Ed), " Manual on Drainage in Urbanised areas-Vol-1 and Vol.II ", UNESCO, 1987.
2. Hengeveld H. and De Voch.t(Ed)., " Role of Water in Urban Ecology ", 1982.
3. Martin P.Wanelista and Yousef., " Storm Water Management and Operations ", JohnWiley and Sons, 1993.
4. Neil S. Grigg., " Urban Water Infrastructure Planning - Management and Operations ",

John Wiley and Sons, 1986.

5. Overtens D.E. and Meadows M.E., " Storm Water Modelling ", Academic Press,

NewYork, 1976.

**YEN106A ENVIRONMENTAL SANITATION AND PUBLIC HEALTH**

**3 0 0 3**

**Unit I 9**

Introduction - sanitation - communicable diseases - general methods of communicable disease control - control of epidemic - insect & rodent control - public health organization - environmental protection laws.

**Unit II 12**

Housing - general requirements - fire protection - accident prevention - rural and urban housing - slums - environmental consideration in housing and town planning - housing regulations - enforcement of housing regulations - zoning and housing.

**Unit III 12**

Sanitation in public places - restaurants - hotels - hostels - schools - hospitals - nursing homes - research laboratories - railway stations - bus stands - cinema theatres - auditoriums - public bathing places - comfort stations – standards.

**Unit IV 12**

Ventilation - objects of ventilation - composition of air - combustion and respiration - quantity of air required - comfort by ventilations - systems of ventilation - air conditioning - lighting - natural and artificial - insulation of buildings - disinfection of air in occupied rooms - noise abatement measures - outdoor and indoor.

**L = 45 Total = 60**

**Reference books**

1. Ehlers V.M. & Steel E.W., *Municipal & Rural Sanitation*, McGraw Hill
2. Salveto J.A., *Environmental Sanitation*, John Wiley
3. Dhameja S.K., *Environmental Engineering & Management*

**YEN106 B PRINCIPLES AND PRACTICE OF ENVIRONMENTAL  
MANAGEMENT** **3 0 0 3**

**UNIT I** **9**

General - Important definitions - Environmental policy - Planning [Environmental aspects, legal and other requirements, objectives and targets, environmental management programme(s)] - Implementation and operation [Structure and responsibility, Training, awareness and competence, Communication, EMS documentation, Document control - Operational control, Emergency preparedness and response] - Checking and corrective action [Monitoring and measurement, Nonconformance, and corrective and preventive action, Records, Management Review]

**UNIT II** **9**

Commitment and policy [Top management commitment and leadership, initial environmental review] - Planning [Identification of environmental aspects and evaluation of associated environmental aspects, Internal performance criteria- Ensuring capability, [Resources (Human, physical and financial), EMS alignment and integration, Accountability and responsibility, Environmental awareness and motivation, Knowledge skills and training] - Support action [Communication and reporting, EMS documentation, Operational control - Measurement and evaluation - Emergency records and information management - Review and improvement (Review of the EMS - Continual improvement).

**UNIT III** **9**

Definitions - General description of LCA [Key features of LCA, Phases of an LCA] - Methodological framework [Goal of the study, scope of the study (function and functional unit, system boundaries, data quality requirements, comparison between systems, critical review considerations), Life cycle inventory analysis (general description of life cycle inventory, data collection and calculation procedures), Life cycle impact assessment, Life cycle interpretation - Reporting] - Critical review [general description of critical reviews, need for critical review, critical review processes (internal expert review, external expert review, review by interested parties)]

**UNIT IV** **9**

*Guidelines for Environmental Auditing - General principles*

Definitions - Requirements for an Environmental Audit - General principles [Objectives and scope, Objectivity, independence and competence, Due professional care, Systematic procedures, Audit criteria, evidence and findings, Reliability of audit findings and conclusions, Audit report]

*Guidelines for Environmental Auditing - Audit procedures - Auditing of EMS*

Definitions - EMS Audit objectives, roles and responsibilities [Audit objectives, Roles, responsibilities and activities (lead auditor, auditor, audit team, client, auditee)] - Auditing [Initiating the audit (audit scope, preliminary document review), Preparing the audit (audit plan, audit-team assignments), Conducting the audit (opening meeting, collecting audit evidence), Audit findings, Closing meeting - Audit reports and document retention (preparation of audit report, content of audit report, distribution of audit report) - Audit completion]

*Guidelines for Environmental Auditing - Qualification criteria for environmental auditors*

Definitions - Auditor training [formal training, on-the-job] - Objective evidence of education, experience and training - Personal attributes and skills - Lead auditor - Maintenance of competence - Due professional care - Language - Evaluating the qualifications of environmental auditors - Environmental auditor Registration body.

## **UNIT V**

**9**

Terms and definitions - General principles and statements [Usefulness, procedures, scientific methodology, relevant information, life cycle of a product or a service, innovation, administrative requirements, interested parties, effectiveness]

The Rio declaration environmental and development (27 principles) - International chamber of commerce (ICC) business charter of sustainable development.

**L = 45; Total = 45**

### **References:**

1. ISO 14001:1996 " Environmental Management Systems – Specification with Guide for use “.
2. ISO 14004: 1996 “ Environmental Management Systems – General Guidelines on Principles, system and supporting Techniques “.
3. ISO 14011: 1996 “ Guidelines for Environmental Auditing – Audit Procedures – Auditing of Environmental Management Systems”
4. ISO 14020: 1998 – “Environmental labels and declarations – General principle”.
5. ISO 14040: 1997 – “Environmental Management – Life cycle Assessment – Principles and Framework.”
6. ISO 14041: 1998 – “ Environmental Management – Life cycle Assessment – Goal and scope definition and inventory analysis.”
7. ISO 14050: 1998 – “ Environmental Management – Vocabulary “.



**YEN106D ENVIRONMENTAL LEGISLATION AND POLLUTION CONTROL  
MANAGEMENT**

**3 0 0 3**

**UNIT I**

**8**

**INTRODUCTION**

Basics of jurisprudence – Environmental law relation with other disciplines - Criminal law – Common Law – Relevant sections of the Code of Civil Procedure, Criminal Procedure Code – Indian Penal Code.

**UNIT II**

**10**

**INDIAN CONSTITUTION AND ENVIRONMENT**

Introduction – Fundamental Rights – Directive Principles of State Policy – Article 48 (A) and 51-A(g) Judicial enforceability – Constitution and Resources management and pollution control – Indian Forest Policy (1990) – Indian Environmental Policy (1992).

**UNIT III**

**9**

**ADMINISTRATIVE REGIME & LEGAL REGIME**

Administrative regulations – constitution of Pollution Control Boards Powers, functions, Accounts, Audit etc. – Formal Justice Delivery mechanism Higher and Lower of judiciary – Constitutional remedies writ jurisdiction Article 32, 226 136 special reference to Mandamus and Certiorari for pollution abatement – Equitable remedies for pollution control.

**UNIT IV**

**9**

**POLLUTION CONTROL LAWS**

Administrative regulation under recent legislations in water pollution control. Water (prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (prevention and control of pollution) Rules 1975 Water (prevention & control or Pollution) Cess Act. 1977 as amended by Amendment Act 1987 and relevant notifications.

**UNIT V**

**9**

**ENVIRONMENTAL (PROTECTION) ACT 1986**

Relevant notifications in connection with Hazardous Wastes (management and handling) Biomedical wastes (management and handling), Noise pollution, Eco-labelling, and E.I.A.

**L = 45; Total = 45**

**REFERENCES**

1. Constitution of India Eastern Book Company Lucknow 12<sup>th</sup> Edn. 1997.
2. Constitutional Law of India – J.N. Pandey 1997 (31<sup>st</sup> Edn.) Central Law Agency Allahabad.
3. Administrative Law U.P.D. Kesari 1998. Universal Book Trade Delhi.
4. Environmental Law H.N. Tiwari, Allahabad Law. Agency 1997.

5. Environmental, A., Divan and Noble M. Environmental Law and Policy in India (cases, Materials and Statutes) 1991 Tripathi Bombay.
6. Environmental Policy. Forest Policy. Bare Acts – Government Gazette Notificaiton.

## **YEN206A GROUND WATER CONTAMINATION AND TRANSPORT MODELING**

**2 0 2 3**

### **UNIT - I**

**5**

#### **INTRODUCTION**

Ground water and the hydrologic cycles – Ground water as a resource - Ground water contamination – Water quality standards – Sources of contamination – Land disposal of solid wastes – Sewage disposal on Land. Ground water and geologic processes. Physical properties and principles – Darcy’s Law – Hydraulic Head and Fluid Potential – Piezometers and Nests. Hydraulic conductivity and permeability – Homogeneity and Anisotropy – Porosity and voids Ratio– Unsaturated flow and the water table – Steady state flow and Transient flow – Compressibility and effective stress – Transmissivity and storativity – Equations of Ground water Flow – Limitations of Darcian Approach – Hydro dynamic dispersion.

### **UNIT - II**

**3**

#### **HYDROLOGIC CYCLE AND FLOW NETS**

Flow nets – Graphical construction – Flow nets by numerical simulation. Steady state Regional Ground Water flow – steady state hydrologic budgets – Fluctuations in ground water levels.

### **UNIT - III**

**8**

#### **RESOURCE EVALUATION**

Development of Ground Water resources – Exploration for Aquifers – the response of Ideal aquifers to pumping – Measurement of parameters – Laboratory tests – Piezometer test – Pumping tests – Estimation of saturated hydraulic conductivity – Numerical simulation for aquifer yield prediction – Artificial recharge and induced infiltration – Land subsidence – Sea water intrusion.

### **UNIT - IV**

**7**

#### **CHEMICAL PROPERTIES AND PRINCIPLES**

Constituents – Chemical equilibrium – Association and Dissociation of dissolved species – effects of concentration gradients – Mineral dissolution and solubility – Oxidation and reduction Process – Ion exchange and Adsorption – Environmental isotopes – Field Measurement of Index parameters. Chemical Evolution: Hydro Chemical sequences and facies – graphical methods – Hydro chemical Facies – Ground water in carbonate terrain – Ground Water in crystalline rocks – Ground Water in complex

sedimentary systems – Geochemical interpretation of  $^{14}\text{C}$  Dates – Process rates and molecular diffusion.

## **UNIT - V**

**7**

### **SOLUTE TRANSPORT**

Transport process – non-reactive constituents in homogeneous media and Heterogeneous media – Transport in Fracture media – Hydro chemical behavior of contaminants – Trace metals– Trace nonmetals – Nitrogen, organic substances – Measurement of parameters – Velocity – Dispersivity – chemical partitioning. Modelling Principles – MOC Modelling. Case studies

**L = 30; P = 30 Total = 60**

## REFERENCES

1. Randall J. Charbeneau, "Ground water Hydraulics and Pollutant transport "Prentice Hall, Upper Saddle River, 1999.
2. Todd David Keith, Ground water Hydrology, Second edition, John Wiley and Sons, New York, 1980
3. Allen Freeze, R. and John A. Cherry, "Ground Water", Prentice Hall, Inc., 1979.

## **UNIT I**

5

### **INTRODUCTION**

Principles and concepts of environmental biotechnology—usefulness to mankind, current status.

## **UNIT II**

8

### **DETOXIFICATION OF ENVIRONMENTAL POLLUTANTS**

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 III**

12

### **MICROBIAL TECHNOLOGY FOR WASTE TREATMENT**

Biotechnological remedies for environmental pollution—decontamination of groundwater systems, subsurface environment—reclamation concepts—bioremediation. Production of proteins – biofertilizers. Physical, chemical and microbiological factors of composting – health risk – pathogens – odour management – Microbial cell/enzyme technology – adapted microorganisms – biological removal of nutrients – algal biotechnology and applications in agriculture – role of extracellular polymers. Biogas technology – case studies.

## **UNIT IV**

10

### **RECOMBINANT DNA TECHNOLOGY AND GENETIC APPLICATION**

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

## **UNIT V**

10

### **ETHICAL AND REGULATORY ISSUES**

Environmental effects and ethics of microbial technology – safety of genetically engineered organisms – microbial containment – Risk assessment, IPR – patents.

**L = 45; Total = 45**

### **REFERENCES**

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.

4. Wainwright, M, An Introduction to Environmental Biotechnology, 1999.
5. Old, R.W., and Primrose, S.B., Principles of Gene Manipulation 3<sup>rd</sup> Ed. Blackwell Sci. Publ., Cambridge, 1985.

**UNIT I** **4**  
**DESIGN OF PIPES**

Structural design of a) Concrete b) Prestressed Concrete c) Steel and d) Castiron piping mains, sewerage tanks design - anchorage for pipes - massive outfalls - structural design and laying - hydrodynamic considerations. Advances in the manufacture of pipes.

**UNIT II** **12**  
**ANALYSIS AND DESIGN OF WATER TANKS**

Design of concrete roofing systems a) Cylindrical b) Spherical and c) Conical shapes using membrane theory and design of various types of folded plates for roofing with concrete. IS Codes for the design of water retaining structures.

**UNIT III** **12**

Design of circular, rectangular, spherical and Intze type of tanks using concrete. Design of prestressed concrete cylindrical tanks - Economic analysis - introduction to computer aided design and packages.

**UNIT IV** **12**  
**REPAIR AND REHABILITATION OF STRUCTURES**

Diagonising the cause and damage, identification of different types of structural and non structural cracks - repair and rehabilitation methods for Masonry, Concrete and Steel Structures.

**UNIT V** **5**

Exposure on Steel , Lattice Structures Used in Water and Sewerage Works

**L = 45; Total = 45**

**References:**

1. Reinforced Concrete by P.Dayaratnam.
2. Prestressed Concrete by Krishna Raju, Tata McGraw Hill Publishing Co. 2nd Edition 1988.
3. Reinforced Concrete by N.C.Sinha & S.K.Roy - S.Chand and Co. 1985.
4. Hulse R., and Mosley, W.H., " Reinforced Concrete Design by Computer ",Macmillan Education Ltd., 1986.
5. Ramaswamy, G.S., " Design and Construction of Concrete shell roofs ",CBS Publishers, India, 1986.
6. Green, J.K. and Perkins, P.H., " Concrete liquid retaining structures ", Applied Science Publishers, 1981.

**YEN206D ADVANCED WATER AND WASTE WATER TREATMENT**

**3 0 0 3**

**UNIT- I**

**9**

Need for advanced wastewater treatment-Residual constituents in treated wastewater-Treatment technologies-Selection of filters-Problems

**UNIT- II**

**9**

Removal of residual suspended solids by microscreening –Control of Nutrients-Conversion of ammonia by biological nitrification

**UNIT- III**

**9**

Removal of nitrogen by biological nitrification/denitrification-Phosphorus removal by biological methods

**UNIT- IV**

**9**

Combined removal of nitrogen and phosphorus by biological methods-Nitrogen by physical and chemical process

**UNIT- V**

**9**

Removal of phosphorus by chemical oxidation-Toxic compounds and refractory organics-Removal of dissolved inorganic substances

**L = 45; Total = 45**

**References:**

1. Waste Water Engineering by Metcalf and Eddy
2. Environmental Engineering by Peavy

## YEN207A SIMULATION AND MODELING IN ENVIRONMENTAL SYSTEMS

2 0 2 3

### UNIT I 6

Scope of Environmental modeling – transport phenomena – advection - diffusion – sediment transport – lake dispersion calculation – simple transport models – equilibrium chemical model – equilibrium principles – numerical solution techniques – redox reactions in equilibrium models .

### UNIT II 6

Eutrophication of lakes – conventional pollutants in rivers – toxic organic chemicals – modeling trace metals – mass balance and waste load allocation for rivers – study state model for metals in lakes – metals migration in soils .

### UNIT III 6

Groundwater contamination – Darcy's law – flow equations – contaminant solute transport equation – biotransformations - biofilms and bio availability – remediation – numerical methods.

### UNIT IV 6

Atmospheric deposition and biogeochemistry – genesis of acid deposition – neutralizing capacities – biogeochemical models – ecological effects – critical loads – case studies –metal deposition.

### UNIT V 6

Global change and Global cycles – Climate change and general circulation models – global carbon box model – nitrogen cycle – Global sulfur cycle – trace gases.

**L = 30; P = 30 Total = 60**

#### Reference:

1. Environmental Modelling by Gerald .L. Schnoor, John Wiley and sons, Inc.
2. Process Dynamics in Environmental Systems by Walter .J. Weber,Jr and Francis ,John Wiley and sons, Inc.
3. Transport Modelling for Environmental Engineers and Scientists by Mark .M. Clark, John Wiley and Sons, Inc.

**UNIT I 6**  
**INTRODUCTION AND SATELLITE ORBITAL MOTION**

Definition -Basics of Geodesy -Classification and basic concepts of Satellite Geodesy Historical development and applications of Satellite Geodesy

**UNIT II 6**  
**HISTORICAL TECHNIQUES AND DOPPLER TECHNIQUE**

Fundamentals and perturbed Satellite motion, Geodetic Satellites. Photographic determination of directions -Electronic Distance Measurements (SECOR) - Other early observation techniques. Doppler. effect and basic positioning concept -Development and status of the Navy Navigation Satellite Systems (TRANSIT).

**UNIT III 7**  
**GLOBAL POSITIONING SYSTEM**

Fundamentals -Introduction Space, control segments -observation principle - signal structure, Broad cast ephemerides, orbit representation, structure of GPS Data, GPS receivers -Concepts & Receiver components. Navigation receivers. GPS observables & Data Processing -Parameter estimation - solution of ambiguities -Data handling - Cycleslips -RINEX Data -Software concepts. Static, kinematic surveys. Error budget correction -Satellite Geometry & accuracy measures -Multipath effect

**UNIT IV 5**

Definition of GIS – history and development of GIS – hardware requirement – system concepts - co-ordinate systems – standard GIS packages – type of data – spatial and non spatial data - data structure – polygons – data compression.

**UNIT V 6**

Modeling in GIS – cost and path analysis artificial intelligence – expert system – application in resources management – agriculture – soil – water – environmental resource management – knowledge based techniques.

**L = 30; P = 30 Total = 60****Reference:**

1. Paul curran . P. J. Principles of Remote sensing, ELBS, 1983
2. Lille sand . T.M. Remote sensing principles and interpretation
3. Geo Information systems – Applications of GIS and related spatial information techniques, ASTER publication co. chestern(England) 1992
4. Jeffery star and John Estes, Geographical Information system – An introduction, prentice – Hall Inc- 1990.

**YEN207C INSTRUMENTAL METHODS AND ANALYSIS OF ENVIRONMENTAL POLLUTANTS**      2    0    2    3

**UNIT I**

4

**INTRODUCTION:**

Instrumental Methods, Selection of method, Precision and Accuracy, Errors in measuring signals, Noise/signal ratio, base line drift, Indicator tubes.

**UNIT II**

**8 SPECTROSCOPIC METHODS:**

Electromagnetic radiation, matter radiation interactions; Colorimetry and spectrophotometry, fluorimetry, nephelometry and turbidimetry, flame photometry Atomic Absorption Spectrometry (AAS), Atomic Emission Spectrometry (AES) – Inductively coupled plasma (ICP) and Direct Current Plasma (DCP) spectrometry. ICP – MS (Mass spectrometry).

**UNIT III**

6

**CHROMATOGRAPHIC METHODS:**

Classical methods, Column, Paper and thin layer chromatography (TLC), Gas Chromatography (GC), GC-MS, High performance liquid chromatography (HPLC) and Ion chromatography (IC).

**UNIT IV**

6

**ELECTRO AND RADIO ANALYTICAL METHODS:**

Conductometry, potentiometry, coulometry, amperometry polarography, Neutron Activation Analysis (NAA), X-ray Fluorescence (XRF) and X-ray Diffraction (XRD) methods.

**UNIT V**

6

**CONTINUOUS MONITORING INSTRUMENTS:**

Non – dispersive infra-red (NDIR) analyzer for CO, chemiluminescent analyzer for NO<sub>x</sub>, Fluorescent analyzer for SO<sub>2</sub>, Auto analyzer for water quality using flow injection analysis; permeation devices.

**L = 30; P = 30 Total = 60**

**REFERENCES**

1. Willard. H., Merritt, L., Dean, D.A. and Settle. F.A. 'Instrumental methods of analysis, 7<sup>th</sup> Edn. Words Worth, New York, 2004.
2. Ewing 'Instrumental Methods of Chemical Analysis, 5<sup>th</sup> Edn., McGraw-Hill, New York, 1995.

## **YEN207D OCCUPATIONAL HEALTH AND SAFETY PRACTICE IN INDUSTRY**

**3 0 0 3**

### **UNIT I 11**

Unsafe conditions and acts - Hazardous situations in industries and other places - Review of existing occupational health and safety regulations - Hazardous material formation in the workplace - Safe working procedures - Occupational hazards (Noise, Electrical, Mechanical, Microbiological, Radiation, Fire, Running nicks, etc.)

### **UNIT 12 II**

Group Risk Assessment - Loss exposure identification - Safety at construction sites - System safety tools [Hazard and operability (HAZOP) study, Management Oversight and Risk Tree (MORT), Failure Mode and Effects Analysis (FMEA), Critical Incident Technique, etc.] - Loss exposure identification, Evaluation and Risk Assessment Tools.

### **UNIT III 12**

Important definitions [Accident, OHS management audit, Continual improvement, Control (of OHS risks), (OHS) Hazard, Health and safety, Incident, Interested parties, (OHS) hazard, Health and safety, Incident interested parties, (OHS) Management system, (OHS) Objective, Organisation, (OHS) Performance, (OHS) Policy, (OHS) Management programme, (OHS) Review, (OHS) Risk, (OHS) Target, Workplace]

### **UNIT 13 IV**

OHS Management system requirements [General, OHS policy, OHS planning, OHS Risks, Legal and other requirements, Objectives and targets and OHS management programme] - Implementation and operation [Structure and responsibility, Training awareness and competence, Consultation and Communication, OHS management system and documentation, Document and data control, Operational control] - Checking and corrective action [Monitoring and measurement, Non-conformance, Corrective and preventive action, Records, OHS management system audit] - Management Review.

### **UNIT - V 12**

Control in OHSMS - Lack of control (failure to maintain conformance with adequate standards) - Common reasons for lack of control - Loss Causation Concept - Basic causes [Personal factors, Job/system factors] - Immediate causes [Substandard acts/practices, Standard conditions] - Incident [Events/Contracts] - Loss [United harm or damage] - Loss measurement formulae - Threshold limit - Ergonomics - Emergency preparedness and response - Fundamentals of total quality - Role of standards.

**L = 60; Total = 60**

## References

BS 8800:1996, “ Guide to Occupational Health and Safety Management Systems”