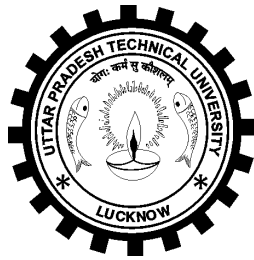


# U.P. TECHNICAL UNIVERSITY, LUCKNOW



**Syllabus**  
**of**  
**2<sup>nd</sup> , 3<sup>rd</sup> & 4<sup>th</sup> Year**  
**(Subject related to Environmental Engg.)**  
**[Effective from session 2009-10]**

**B. TECH. ENVIRONMENTAL ENGINEERING**

**U P TECHNICAL UNIVERSITY , LUCKNOW**  
**Study & Evaluation Scheme**  
**B Tech Civil Engineering/B.Tech. Environmental Engg.**  
[Effective from session 2009-10]

Second Year , III Semester

S No	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
<b>THEORY SUBJECT</b>											
1	EME302	Strength of Material	3	1	0	30	20	50	100	150	4
2	EAS-301/EOE 031-038	Mathematics III / Science based open elective	3	1	0	30	20	50	100	150	4
3	EHU301/ EHU-302	Industrial Psychology / Industrial Sociology	2	0	0	15	10	25	50	75	2
4	ECE 301	Fluid Mechanics	3	1	0	30	20	50	100	150	4
5	ECE 302	Building Materials & Construction	4	0	0	30	20	50	100	150	4
6	ECE303	Surveying - 1	2	1	0	15	10	25	50	75	3
7	EHU111	*Human Values and Professional Ethics	2	0	0	15	10	25	50	75	-
<b>PRACTICAL / DESIGN / DRAWING</b>											
8	ECE351	Fluid Mech Lab	0	0	3	10	10	20	30	50	1
9	ECE352	Buildg. Materials Lab	0	0	3	10	10	20	30	50	1
10	ECE353	Surveying Lab	0	0	3	10	10	20	30	50	1
11	ECE354	Building Planning & Drawing	0	0	3	10	10	20	30	50	1
12	GP 301	General Proficiency	-	-	-	-	-	50	-	50	1
		<b>Total</b>	<b>17</b>	<b>4</b>	<b>12</b>					<b>1000</b>	<b>26</b>

**Note : The syllabus of Subject with code ECE are Common to B.Tech. Civil Engineering.**

**U P TECHNICAL UNIVERSITY , LUCKNOW**

**Study & Evaluation Scheme**

B.Tech. Environmental Engineering

[Effective from session 2009-10]

Second Year , IV Semester

S No	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
<b>THEORY SUBJECT</b>											
1	EHU402/ EHU-401	Industrial Sociology/ Industrial Psychology	2	0	0	15	10	25	50	75	2
2	EOE 041- EOE048 / EAS401	Science based open elective / Mathematics- III	3	1	0	30	20	50	100	150	4
3	EEV 401	Environmental Chemistry and Microbiology	3	1	0	30	20	50	100	150	4
4	ECE 402	Geoinformatics	3	1	0	30	20	50	100	150	4
5	EEV 402	Water Treatment & Supply Engineering	3	1	0	30	20	50	100	150	4
6	ECE 404	Engineering Geology	2	1*	0	15	10	25	50	75	3
7	EHU 111	*Human Values and Professional Ethics	2	0	0	15	10	25	50	75	-
<b>PRACTICAL / DESIGN / DRAWING</b>											
8	EEV 451	Microbiology Lab	0	0	3	10	10	20	30	50	1
9	ECE 452	Geoinformatics Lab	0	0	3	10	10	20	30	50	1
10	EEV 452	Water Treatment and Supply Engineering Lab	0	0	3	10	10	20	30	50	1
11	ECE 454	CBSNT Lab	0	0	3	10	10	20	30	50	1
12	GP 401	General Proficiency	-	-	-	-	-	50	-	50	1
		<b>Total</b>	<b>16</b>	<b>5</b>	<b>12</b>					<b>1000</b>	<b>26</b>

\* - In this tutorial class students shall practice for mineral & rock identifications

**U P TECHNICAL UNIVERSITY , LUCKNOW**  
**Study & Evaluation Scheme**  
**B Tech Environmental Engineering**  
**Effective from session 2010-11**  
**Third Year, V Semester**

S No	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
<b>THEORY SUBJECT</b>											
1	EHU-501	Engineering & Managerial Economics	3	1	0	30	20	50	100	150	3
2	ECE-501	Geo Technical Engineering	3	1	0	30	20	50	100	150	4
3	EEV-501	Air Pollution and Control Engg	3	1	0	30	20	50	100	150	4
4	EEV-502	Solid Waste Management	3	1	0	30	20	50	100	150	4
5	EEV-503	Soil and Water Conservation Engineering	2	1	0	15	10	25	50	75	3
6	EEV-504	Health Safety and Environment	2	1	0	15	10	25	50	75	3
7	EHU-111	*Human Values and Professional Ethics	2	0	0	15	10	25	50	75	-
<b>PRACTICAL / DESIGN / DRAWING</b>											
8	ECE-551	Geotechnical Eng Lab	0	0	3	10	10	20	30	50	1
9	EEV-551	Air Pollution and Control Engg Lab	0	0	3	10	10	20	30	50	1
10	EEV-552	Solid waste management Lab	0	0	3	10	10	20	30	50	1
11	ECE-553	CAD Lab – 1	0	0	3	10	10	20	30	50	1
12	GP 501	General Proficiency	-	-	-	-	-	50	-	50	1
		<b>Total</b>	<b>16</b>	<b>6</b>	<b>12</b>					<b>1000</b>	<b>26</b>

**U P TECHNICAL UNIVERSITY , LUCKNOW**  
**Study & Evaluation Scheme**  
**B Tech Environmental Engineering**  
**Effective from session 2010-11**  
**Third Year, VI Semester**

S No	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
<b>THEORY SUBJECT</b>											
1	EHU-601	Industrial Management	3	0	0	30	20	50	100	150	3
2	EEV-011- EEV013	Departmental Elective-I	2	1	0	15	10	25	50	75	3
3	EEV-021- EEV023	Departmental Elective-II	2	1	0	15	10	25	50	75	3
4	EEV-601	Wastewater Engineering	3	1	0	30	20	50	100	150	4
5	EEV-602	Estimation and Project Management	3	1	0	30	20	50	100	150	4
6	EEV-603	Environmental Impact Assessment and Audit	3	1	0	30	20	50	100	150	4
7	EHU111	*Human Value and Professional Ethics	2	0	0	15	10	25	50	75	-
<b>PRACTICAL / DESIGN / DRAWING</b>											
8	ECE653	Cad Lab-2	0	0	3	10	10	20	30	50	1
9	EEV651	Waste water Engineering lab	0	0	3	10	10	20	30	50	1
10	EEV652	Environmental Sanitation Lab	0	0	4	10	10	20	30	50	1
11	EEV653	Eco-Camp**			-				50	50	1
	GP 601	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	16	5	9					1000	26

\*\* This will be done during Winter Break for one weeks

Note : 4 weeks Industrial Training after VI Sem. to be evaluated in VII Semester.

**U P TECHNICAL UNIVERSITY , LUCKNOW**  
**Study & Evaluation Scheme**  
**B Tech Environmental Engineering**  
**Effective from session 2011-12**  
**Final Year, VII Semester**

S No	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
<b>THEORY SUBJECT</b>											
1	EOE071- EOE074	Open Elective – 1	3	1	0	30	20	50	100	150	4
2	EEV031- EEV033	Departmental Electives – III	3	1	0	30	20	50	100	150	4
3	EEV041- EEV043	Departmental Elective-IV	3	1	0	30	20	50	100	150	4
4	EEV701	Environmental System Simulation	3	1	0	30	20	50	100	150	4
5	ECE702	Water Resources Engg	3	1	0	30	20	50	100	150	4
6	EHU111	*Human Value and Professional Ethics	2	0	0	15	10	25	50	75	-
<b>PRACTICAL / DESIGN / DRAWING</b>											
7	EEV-751	Environmental System Simulation lab	0	0	3	10	10	20	30	50	1
8	EEV752	Seminar	0	0	4		50	50	-	50	1
9	EEV752	Industrial Training**					-	50	-	50	1
10	EEV753	Project#	0	0	4		50	50	-	50	2
11	GP 701	General Proficiency	-	-	-	-	-	50	-	50	1
		<b>Total</b>	<b>15</b>	<b>5</b>	<b>11</b>					<b>1000</b>	<b>26</b>

\*\* 4 weeks Industrial Training after VI sem. to be evaluated in VII semester.

# Project should be initiated in VII sem. beginning and should be completed by the end of VIII semester.

**U P TECHNICAL UNIVERSITY , LUCKNOW**  
**Study & Evaluation Scheme**  
**B Tech Environmental Engineering**  
**Effective from session 2011-12**  
**Final Year, VIII Semester**

S No	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam			ESE		
						CT	TA	Total			
<b>THEORY SUBJECT</b>											
1	EOE081- EOE084	Open Elective -II	3	1	0	30	20	50	100	150	4
2	EEV051- EEV053	Departmental Elective– V	3	1	0	30	20	50	100	150	4
3	EEV061- EEV063	Departmental Elective – VI	3	1	0	30	20	50	100	150	4
4	EEV801	Design of Waste water system s	3	1	0	30	20	50	100	150	3
5	EHU111	*Human Value and Professional Ethics	2	0	0	15	10	25	50	75	-
<b>PRACTICAL / DESIGN / DRAWING</b>											
6	EEV851	Project	0	0	12		100	100	250	350	8
7	GP 801	General Proficiency	-	-	-	-	-	50	-	50	1
		<b>Total</b>	<b>12</b>	<b>4</b>	<b>12</b>					<b>1000</b>	<b>24</b>

## **\*\* Science Based Open Elective**

EOE-031/EOE-041 Introduction to soft computing (Neural Network, Fuzzy Logic and Genetic Algorithm)  
EOE-032/EOE-042 Nanoscience  
EOE-033/EOE-043 Laser Systems and Applications  
EOE-034/EOE-044 Space Science  
EOE-035/EOE-045 Polymer Science & technology  
EOE-036/EOE-046 Nuclear Science  
EOE-037/EOE-047 Material Science  
EOE-038/EOE-048 Discrete Mathematics

### **Open Elective\*\*-I**

EOE-071 Entrepreneurship Development  
EOE-072 Quality Management  
EOE-073 Operation Research  
EOE-074 Introduction to Biotechnology

### **Open Elective\*\*-II**

EOE-081 Non Conventional Energy Resources  
EOE-082 Nonlinear Dynamic System  
EOE-083 Product Development  
EOE-084 Automation and Robotics

## **Elective Papers**

### **Elective-I**

EEV-011 Earth and Environment  
EEV-012 Ecological and Biological Principles and Processes  
EEV-013 Environmental Biotechnology

### **Elective II**

EEV-021 Science and Policy of climate change  
EEV-022 Environmental Policy & Legislation  
EEV-023 Environmental Economics

### **Elective III**

EEV-031 Disaster Management  
EEV-032 Integrated Impact Assessment  
EEV-033 Environmental Risk Assessment

### **Elective-IV**

EEV-041 Process Engineering Costing and Plant Design  
EEV-042 Chemical Reaction Engineering  
EEV-043 Heat Transfer and Operation

### **Elective-V**

EEV-051 Sustainable Agriculture, Building and Sanitation  
EEV-052 Ground water hydrology & management  
EEV-053 Design of structure

### **Elective-VI**

EEV-061 Water Power Engineering  
EEV-062 Integrated Watershed Management  
EEV-063 Transport Phenomena

## EEV-401: Environmental Chemistry & Microbiology

L T P

### Unit I:

3 1 0

Introduction to environmental chemistry: concept and scope of environmental chemistry, components of environment, natural cycles of matter in the environment.

Introduction to microbiology: Concept and scope of microbiology, kinds of microorganisms, major characteristics and the role of microorganisms, microorganisms in nature. 7

### Unit II:

Chemistry of water and waste water: Hydrological cycle, structure of water molecule, water as a solvent principles of equilibrium chemistry, pH, oxidation - reduction and the applications of principles of chemistry for solving Environmental Engineering Problems.

8

### Unit III:

Chemistry of the air environment: Chemistry of the atmosphere, combustion related air pollution, global environmental problems - chemistry of CFC, ozone depletion, greenhouse effect, acid rain, La Nino etc.

Chemistry of pollution due to detergents, pesticides, polymers, trace organics, metals, petroleum and radioactive compounds. 9

### Unit IV:

Environmental Microbiology: Basic principles of microbial transformation of organic matter, biodegradation, acclimatization of wastes and microbial inhibition mechanisms. Structure and function of cell constituents. (7)

### Unit V:

Pure and mixed cultures, Aerobic and anaerobic metabolism, microbial growth and dynamics, Microbial taxonomy, classification and morphological aspects of bacteria, fungi, protozoa, algae and other higher aquatic life forms.

Bioassay tests for toxicity evaluation, Pathogens and indicator organisms.

Role of microorganisms in water and waste water engineering. Microbiology applied to air pollution control (Bio scrubbers and bio-filters). (9)

### References:

A.K. De: Environmental Chemistry

1. Sawyer, McCarty, and Parkin: Chemistry for Environmental Engineering
2. Manahan: Environmental Chemistry
3. Pelczar, Chan, and Krieg: General Microbiology
4. Stannier – General Microbiology
5. Larinzar – General Biochemistry
6. Sharma: Microbiology
7. Krueger and Johansson: Microbiology
8. Tortora, Funke and Case: Microbiology
9. McKinney: Microbiology for Sanitary Engineers

## EEV-402: Water Treatment and Supply Engineering

L T P

3 1 0

### Unit-I

Characteristics of water: Physical, chemical and biological standards.

Theory, Operation and design of aeration system, sedimentation, coagulation, and clariflocculation. Design of clariflocculator (8)

### Unit-II

Filtration: Slow and rapid gravity filter, multi-media filters and pressure filters. Design of slow sand filter and rapid sand filter. Disinfection: theory and application of chlorine. Miscellaneous methods of water treatment- removal of iron and manganese, hardness, fluorides, colour, taste and odour, dissolved metals and gases. (9)

### Unit-III

Adsorption, ion-exchange, membrane processes. O and M of water treatment plants, Industrial water treatment. (7)

### Unit-IV

Water Supply Engineering: Water demand, design period, population forecasting, sources of water; hydrological concepts, ground-water and its development. (7)

### Unit-V

Conveyance of water; pipe materials, corrosion, laying of pipes, pipe appurtenances, pumps for water supply, distribution system, planning of water supply projects. Design of water distribution network. Rural water supply distribution system. (9)

### References:

1. Fair, and Geyer: Water and Wastewater Engineering, Vol-I and II, John Wiley and sons, New York.
2. Steel and McGhee: Water Supply and Sewerage.
3. Peavy, Rowe and Tchobanoglous: Environmental Engineering
4. Hammer and Hammer, Jr.: Water and Wastewater Technology.
5. Garg: Water Supply Engineering (Environmental Engineering Vol.-I)
6. Raju: Water Supply and Wastewater Engineering
7. Kshirsagar: Water Supply and Treatment
8. Punmia: Water Supply and Wastewater Engineering
9. Birdie: Water Supply and Sanitary Engineering

## **EEV-451: Microbiology Lab**

**L T P**  
**0 0 3**

Use of microscope: Bacterial morphology and staining methods.

Biological examination of water: Algae, bacteria and Protozoa.

Quantitative plating method.

Bacterial water quality: Measuring quality of water by using coli form organisms (MPN method and membrane filter).

Indicator and Indices: Faecal streptococci, anaerobic bacteria

Estimation of sugars, proteins, lipids.

Biochemical activities of bacteria: hydrolysis of polysaccharides,

Bacteria in waste water.

Determination of Biodiversity index.

### **Reference:**

1. Sirockin and Cullimore: Practical Microbiology

## **EEV-452: Water Treatment and Supply Engineering Lab**

**L T P**  
**0 0 3**

Analysis of water for colour, turbidity, solids, hardness, alkalinity, acidity, iron, sulphate, chloride, fluoride, nitrate etc.

Sampling Techniques

Jar test for coagulation studies.

Application of laboratory and pilot plant scale units for evaluation of design criteria.

i. Settling analysis studies.

ii. Water treatment by slow sand filter / rapid gravity filter.

### **References:**

1. Sawyer, McCarty and Parkin: Chemistry for Environmental Engineering
2. Mathur: Water and Wastewater Testing
3. Standard Methods for the Examination of Water and Wastewater, A.P.H.A., New York.

## **EEV-501: Air Pollution and Control Engineering**

**L T P**  
**3 1 0**

### **Unit I:**

Air pollution: composition and structure of atmosphere, global implications of air pollution. classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants. (8)

**Unit II:**

Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion. (8)

**Unit III:**

Ambient air quality and standards, air sampling and measurements; Ambient air sampling, collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling. Design of gravitational settling chamber, cyclone separator, fabric filter, electrostatic precipitator, (8)

**Unit IV:**

Introduction to air pollution control, control devices for particulate contaminants: gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP). (8)

**Unit V:**

Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion  
Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons.  
Automotive emission control, catalytic converter, Euro-I, Euro-II and Euro-III specifications, Indian specifications. (8)

**References:**

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Wark and Warner: Air Pollution: Its Origin and Control.
4. Rao and Rao: Air Pollution Control Engineering.
5. Nevers: Air Pollution Control Engineering.
6. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology. Suess and Craxford: W.H.O. Manual on Urban Air Quality Management
7. C.S. Rao, Air pollution and control

**EEV-502: Solid Waste Management****L T P****3 1 0****Unit-1**

Solid waste: Public health and ecological impacts, Sources and types of solid wastes, material flow and waste generation in a technological society, factors affecting the generation rates, projections for futures, future challenges and opportunities.

Functional elements: Waste generation, storage, collection, Transfer and transport, processing and recovery, disposal.

**Unit-2**

Physical and chemical composition of municipal solid waste, integrated solid waste management, hierarchy of waste management options, different methods for generation rates.

**Storage:** movable bins, fixed bins. **Collection:** home to home collection, community bin system. Theory and design of hauled container system, stationary container system.

### **Unit-3**

**Transportation:** handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse carrier, railroad transport, water transport, conveyors, layout of routes. Engineering system for on-site handling and processing of solid waste: separators, size reduction equipments, screening equipments, densification, baling, cubing, pelleting equipments,

### **Unit-4:**

Landfilling: Site selection criteria, landfill layout, landfill sections, Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate.

### **Unit-5:**

Composting, types of composting, process description, design and operational consideration of aerobic composting, process description, design and operational consideration of anaerobic composting. Thermal conversion technologies: incineration and pyrolysis system, energy recovery, system, Electronic waste and Biomedical waste. Overview of solid waste management practices in India.

### **References:**

1. Tchobanoglous, G., Theisen, H., & Vigil, S.A; Integrated Solid Waste Management: McGraw Hill, New York
2. Solid Waste Engineering, Principle & Management issues by Ven Te Chow
3. Bhide, A.D., B.B. Sundaresan, Solid Waste Management in developing countries.
4. Manual on Municipal solid Waste Management, CPHEEO, Govt. of India.
5. Guidelines for Management and Handling of Hazardous wastes MOEF (1991), Govt. of India.
6. Datta, M; Waste Disposal in Engineered Land fills, Narosa Publishers, Delhi.
7. Waste Management "Asian and Pacific Center for Transfer of Technology (N.D.) India", September 1993.

## **EEV-503: Soil and Water Conservation Engineering**

### **Unit-1**

Definition and scope of soil conservation, cause of soil erosion, Mechanism of erosion, universal soil loss equation, soil erosion due to wind and its control, vegetation management, i.e., strip cropping, stubble mulching and other practices,

### **Unit-2**

Types of soil erosion due to water- sheet erosion, rill erosion, gully erosion, sediment transport in channels, sediment deposition in reservoirs. Methods of soil erosion control: bounding and terracing on agriculture land for gully control, bench terraces, vegetated water ways, chute spillways, drop inlet spillways, check dams, river training works.

### **Unit-3**

Biological methods of soil erosion control, grass land management, forest management. Soil quality management, drainage works, reclamation of salt affected soils. Water conservation: water harvesting, rainfall- run off relation, water storage in ponds, lakes, reservoirs and aquifers, groundwater recharge through wells, check dams and storage works.

#### **Unit-4**

Water losses: filtration, seepage and evaporation losses, pollution/ contamination of water quality due to agricultural practices i.e., fertilizers and pesticides, self purification of surface water, sources of agricultural water pollution, pollutant dispersion in ground water.

#### **Unit-5**

Need of planned utilization of water resources, economics of water resources utilization. Flood plain zones management, modifying the flood, reducing susceptibility to damage, reducing the impact of flooding.

#### **References**

1. Alam Singh – Modern Geotechnical Engineering
2. K. R. Arora – Soil Mechanics and foundation Engineering.
3. N. C. Brady – Principles of Soil Sciences
4. B. C. Punmia – Soil Mechanics and Foundation Engineering

### **EEV-504: Health Safety and Environment**

#### **Unit-1**

Introduction : Types of hazards, analysis of hazards , precautions & preventions , grades of hazards , Safety methods, Safety measures . IS 18001:2000/ 9001:2000 ISO 14001:1996 Comparison ,Importance of H.F& S, Industrial scope/Act/Compensation

#### **Unit-2**

Fire hazards : Classification of fire , Grades of fire hazard . Classification of buildings / structures / materials ./ chemicals according to fire load . Fire hazard analysis , consequences & management. Mode of fire , fire fighting , Provision of buildings & Industrial structures from – fire safety angle .

#### **Unit-3**

Different types of fire alarms / detectors & extinguishers , fire fighting requirements as per NBC 1983 / Municipality water supply requirements for fire , required fire flow , storage . wet risers, sprinkler , fire fighting services etc.

#### **Unit-4**

General discussion on toxicology . Physiological effects of various compounds , Classification of hazardous chemicals / conditions . Occupational health & safety concepts .Classes of Explosive

#### **Unit-5**

Protection & prevention measures of accidents & hazards Transportation & storage of chemicals, leakage & accident prevention .Industrial risk & Disaster management Survey of two industries for disaster / safety control systems, Electrical Safety Programme pollution control Practices in pesticides Industries

#### **Reference**

1. National Safety Council Publication
2. Environmental Chemistry by Stanley E. Manahan, VI<sup>th</sup> Ed. Lewis Publishers, London
3. CPCB Green Book
4. www.moef.gov.in

### **EEV-551: Air Pollution and Control Engineering Lab**

**L T P**

**0 0 3**

Preparatory works for stack and ambient air monitoring.

Measurement of meteorology; lapse rate, wind velocity humidity, pressure etc.

Determination of SPM, Smoke Number, Gas Composition (HC, CO, NO<sub>x</sub>, SO<sub>2</sub> and other pollutants).

Field monitoring by high volume and handy sampler.

#### **References:**

1. W.H.O.: Selected Methods of Measuring Air Pollutants.
2. Pandey and Carney: Environmental Engineering

### **EEV-552: Solid Waste Management Lab**

**L T P**

**0 0 3**

1. Sample preparation and sampling techniques,
2. Coning and quartering method,
3. Site description,
4. Profile sampling of municipal solid waste,
5. Analysis of solid waste/sludge for moisture content,
6. Analysis of solid waste /sludge for particle size,
7. Analysis of solid waste/sludge for calorific value,
8. Determination of N in the sample.

### **EEV-011-EEV-013: Departmental Elective-I**

#### **EEV- 011: Earth and Environment**

##### **Unit-1**

Understanding the Earth, atmosphere and processes governing environmental conditions; the biosphere, earth's energy budget, the 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, dams and environment, channelisation and environment, global climate and hazards,

### **Unit-5**

Effect of population increase on environment, historical perspective of growing environmental concerns.

#### **References:**

1. Atmospheric Chemistry and Physics by John H Seinfeld and Spyros N.Pandis
2. Atmospheric pollution: History, Science and Regulation by Jacobson.
3. Jacobson, Mark, Z; Fundamental of Atmospheric Modeling, Stanford University Press, California.
4. Masters, G.M; Introduction to Environmental Engineering & Science, PHI, New Delhi
5. Chaudhari, A.K. & OM Prakash; Environmental Engineering, Dhanpat Rai & sons, Delhi.
6. Sharma, B.K. & H. Kaur; Environmental Chemistry, Krishna Prakasan Mandir, Meerut.

## **EEV-012: Ecological and Biological Principles and Processes**

### **Unit-1**

Ecosystems; biotic and abiotic components, production and consumption, trophic levels, productivity and energy flow.

### **Unit-2**

Food webs, cycling of elements. 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.

**References:**

1. Sharma, P.D; Ecology and Environment, Rastogi Publications, Meerut.
2. Pelczar, Jr, M; & ECS Chan; Microbiology; Tata McGraw Hill, New Delhi
3. Best, D.I and Stafford D. The Environmental and Biotechnology Blackwell Sci and Publication.
4. Metcalf and Eddy., Wastewater Engineering: Treatment, disposal, and reuse., TMH, New Delhi.
5. ICAR Hand Book of Agriculture 1990.

**EEV -013-Environmental Biotechnology****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. a) Aerobic processes : Activated sludge, oxidation ditches, trickling filters, towers, rotating discs, rotating drums, oxidation ponds. b) Anaerobic processes : Anaerobic digestion, anaerobic filters, Up flow 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 CO<sub>2</sub> 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.

**References :**

1. Microbial Biotechnology : A. N. Glazer and H. Nikaido .
2. Molecular Biotechnology : Gleek and Pasternack.
3. Biotechnology : A Text Book of Industrial Microbiology, T. D.Brock,
4. Industrial Microbiology : Prescott and Dunn.
5. Biotechnology : B. D. Singh , Kalyani Publishers.

## **EEV-021-EEV-023: Departmental Elective-II**

EEV-021: Science and Policy of climate change

### **Unit-I**

The Energy Balance, Basic Concepts: Radiation, Albedo, Emissivity  
The Nature of Climate, History of the Perception of Climate Change, The 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-II**

Paleo-indicators of climate, The 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-III**

History of Concern about Climate Change, 1970s (IIASA, DOE), 1980s, Startup of the U.N  
IPCC, Mission of the IPCC, The Framework Convention on Climate Change, The Kyoto  
Protocol to the Framework Convention, Policy Analyses, Internationally Adopted Emissions  
Restrictions, State and Local Ordinances

### **Unit-IV**

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

### **REQUIRED TEXT**

- Henderson-Sellers, A., and P.J. Robinson, 1999. Contemporary Climatology (second edition). Prentice-Hall. 344pp. (Excerpts; no purchase necessary)
- Houghton, J.T., 2001, (ed). Climate Change 2001, The Scientific Basis. 881pp. (excerpts; assignments available online)
- Kuhn, T.S., 1962 and updates. The Structure of Scientific Revolutions (excerpts; no )  
Current IPCC Assessment report

## **EEV022: Environmental Policy & Legislation**

<b>L</b>	<b>T</b>	<b>P</b>
<b>2</b>	<b>1</b>	<b>0</b>

### **UNIT 1**

The water (prevention and control of pollution) Act 1974, as amended unto 1988., The water  
(Prevention and control of pollution ) Rules 1975 , The water (Prevention and control of  
pollution) (Procedures for Transaction of Business) Rules 1975., The water (Prevention and  
control of pollution) cess Act, 1977 as amended by Amendment act, 1991, The water  
(Prevention and control of pollution ) cess rules , 1978

## **UNIT -II**

The Air (Prevention and control of pollution ) Act , 1981, as amended by Amendment Act , 1987, The Air (Prevention and control of Pollution ) Rules , 1982,

## **UNIT-III**

The Environment (Protection ) Act , 1986, The 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-IV**

The public Liability Insurance Act , 1991, The Public Liability Insurance , Rules , 1991, Municipal solid waste act/rule 2000, Biomedical waste act/rule-2004,

### **References:**

1. Pollution control acts, rules and notifications issues, there under by CPCB [Ministry of and Environment and forest, Govt. of India] Paryavaran Bhawan, CGO Complex, New Delhi-110003.
2. Atmospheric Pollution: History, Science and Regulation by Jacobson.
3. Environmental Chemistry by Stanley E. Manahan, VI<sup>th</sup> Ed. Lewis Publishers, London
4. EPA regulation on Test Procedures for the analysis of pollutants , “Environmental Reporter, section [136.3(a)]
5. Environmental Law by S.K. Mohanty (Universal Law Publications)
6. Environmental Law by Dharmendra S. Sengar (PHI)

## **EEV-023- ENVIRONMENTAL ECONOMICS**

<b>L</b>	<b>T</b>	<b>P</b>
<b>2</b>	<b>1</b>	<b>0</b>

### **Unit I**

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. [8]

### **Unit II**

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. [8]

### **Unit III**

Pollution Taxes

Efficiency properties of a tax on emissions, problems with pollution taxes. [8]

## **Unit IV**

Tradable Pollution Permits, Basic theory of tradable pollution permits, issues in tradable permits. Transboundary pollution problem, international organizations for environmental protection. [8]

## **EEV-601: Wastewater Engineering**

### **Unit-1**

Introduction: Wastewater flows, and characteristics, Wastewater collection systems, Estimation and variation of wastewater flows. Treated wastewater reclamation and reuse, wastewater preliminary, primary, secondary and tertiary treatment processes. Screens, grit chambers & their design, sedimentation, coagulation, flocculation,

### **Unit-2**

Theory of activated sludge process, extended aeration systems, trickling filters, aerated lagoons, stabilization ponds, oxidation ditches etc. Introduction to Duckweed Pond, Vermiculture and root zone technology for wastewater treatment, concept of anaerobic contact process, anaerobic Filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and up flow anaerobic sludge blanket (UASB) reactor.

### **Unit-3**

Disposal of treated wastewater on land and in water bodies, ocean discharge, agricultural irrigation, ground water recharge, problems of industrial wastewaters, sampling protocol, Indian standards for disposal of treated wastewaters in natural streams, equalization, neutralization, proportioning processes, volume and strength reduction.

### **Unit-4**

Physico-chemical and biological treatment strategies and their evaluation. Study on process flow sheets, wastewater characteristics, waste generation points, treatment scheme suggested for distillery, paper/pulp industry.

### **Unit 5**

Study on process flow sheets, wastewater characteristics, waste generation points, treatment scheme suggested for the following industries

1. Tannery,
2. Sugar,
3. Textile,
4. Steel, and
5. Oil refinery.

#### **References:**

1. Metcalf and Eddy Inc: "Waste water engineering", Tata Mc. Graw Hill, New Delhi
2. Peavy, Rowe & Tchobanoglous "Environmental Engineering", Mc. Graw Hill, New Delhi.
3. Qasim, S. "Water Works Engineering", Prentice Hall Publication, New Delhi.
4. Manual on sewerage & sewage Treatment, C.P.H.E.E.O., Ministry of urban development, GOI, New Delhi
5. Fair & Geyer "Water supply and waste water disposal".
6. Parker : Waste water system engineering
7. Wastewater Engineering by S.K.Garg, Khanna publication
8. Wastewater treatment by M.N.Rao & A.K.Dutta, PHI publication

## **EEV-602: Estimation and Project Management**

**L T P**

**3 1 0**

### **Unit-1**

Importance of estimation, different types of estimates, specification: general and detailed. Methods of estimation, Estimates of RC works, Estimates of building.

### **Unit-2**

Analysis of rates, prime cost, work charge establishment, quantity of materials per unit of work for major civil engineering items, Resource planning through analysis of rates, market rates, PWD schedule of rates and cost indices for building material and labour. Introduction to valuation.

### **Unit-3**

Project cycle, organization, planning, scheduling, monitoring, updating and management system in construction Bar chart, Milestone chart, Work down structure and preparation of networks. Application of network, Techniques like PERT, GERT, CPM, AON and AOA techniques.

### **Unit-4**

Project monitoring; cost planning, resources allocation through network techniques. Time value of money, present economy studies, Equivalent concept, financing of projects, economic comparison, present worth method, equivalent annual cost method, discounted cash flow method, depreciation and break even cost analysis.

### **Unit-5**

Legal aspects of contracts, their relative advantages and disadvantages, Different types of contracts, their relative advantages and disadvantages, Elements of tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tender preparation, process of tendering, Evaluation of tender, contract negotiation and award of work.

### **References:**

1. Estimating and costing by B.N.Datta.
2. PERT and CPM principle and application by L.S.Srinath.
3. PERT and CPM principle and application by B.C.punamia.
4. Construction planning and management by U.K.Srivastva.
5. Estimating, costing and Valuation in Civil Engineering by M. Chakraborty.
6. Construction, planning, equipment and method by R.L. Peurify.
7. Network analysis techniques by S.K.Bhatnager.

## **EEV-603: Environmental Impact Assessment and Audit**

**L T P**

**3 1 0**

### **UNIT 1**

Introduction to EIA & Audit, Environment & Industries, Input information, Plant operation, Environmental Management planning, Waste Streams impact on water bodies.

### **UNIT 2**

Environmental Impact Assessment planning. Activities, Methodology for Environmental Impact Assessment, Role of Environmental Engineering firm, Role of Regulatory agencies & control boards, Role of the Public.

### **UNIT 3**

Environmental Audit: Introduction , Environmental information Purpose & advantage of studies, General approach of environmental Auditing Environmental Audit , Audit programs in India, Auditing program in major polluting Industries , Reports of the Environmental audit studies .

### **UNIT 4**

Pollution prevention and control laws & acts: Constitution of India & environment , Constitution protection to Environment laws , Administrative & legislative arrangement for Environmental production , Indian Standards , Pollution control acts in India , critical appraisal ,fiscal incentives for environmental protection .

### **UNIT 5**

Guidelines of preparation of project report and its evaluation, methods of clearance from the concern authorities at various labels.

### **References:**

1. “Environmental pollution & Control in Chemical process Industries by S.C. Bhatia “ Khanna Publishers”, Delhi
2. Environmental impact assessment by Canter.
3. Environmental Chemistry by Stanley E. Manahan, VI<sup>th</sup> Ed. Lewis Publishers, London
4. Dying Wisdom: Rise, Fall, and potential of India’s Traditional rain water harvesting systems by Anil Agarwal & Sunita Narayan, CSE Publication. New Delhi.

## **EEV-651: Waste Water Engineering Lab**

**L T P**

**0 0 3**

1. Physical analysis of wastewater sample
2. Analysis of samples for DO.
3. Analysis of samples for BOD.
4. To determine the COD.

5. Sampling protocol of wastewater from an Industry.
6. Preservation of wastewater samples for different tests i.e., DO, BOD, Metals etc.
7. To determine the nitrogen contents.

**Reference:**

1. Mathur : Water & waste water testing.
2. Sawyer, Mc Carty & Parkin Chemistry for Environmental Engg.
3. Standard Methods P.A, H.A New York

**EEV-652: Environmental Sanitation Lab**

**L T P**  
**0 0 4**

1. **Study of Storm Water:** Collection & Estimation By Different Formulae
2. **Study on Constructions and Design of Sewers:** Flow in Sewers, Flow in Full & Partially Full Sewers, Types of Sewers, Materials of Sewers, Joints & Sewer Appurtenances
3. **Study on Layout and Constructions of Sewer Lines:** Small Bore Sewer Systems, Planning of Sewerage System. Institutional Wastewater Management.
4. Study of various type of sanitary units
5. Construction and design of septic tank
6. Study of sanitation in rural areas: visit to nearby village
7. Methods of disposal of effluent from residential / commercial buildings.
8. Preparation of drawing of connectivity and net working of sanitary units.

**EEV-031-033: Departmental Elective-III**

**EEV-031-Disaster Management**

**L T P**  
**3 1 0**

**Unit-I**

**Natural Hazards and Disasters.**

Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Types of Environmental hazards & 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 ( Human adjustment, perception & mitigation), Droughts: - Impacts of droughts, - Drought hazards in India, - Drought control measures.

**Unit-II**

**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 -III**

#### **Emerging approaches in Disaster Management- Three Stages:**

1. Pre- disaster stage (preparedness)-(a) Preparing hazard zonation maps, Predictability/ forecasting & warning, b) Preparing disaster preparedness plan, c) Land use zoning, d) Preparedness through (IEC) Information, education & Communication Pre-disaster stage (mitigation) Disaster resistant house construction, Population reduction in vulnerable areas, Awareness
2. Emergency Stage:- a) Rescue training for search & operation at national & regional level, b) Immediate relief, c) Assessment surveys
3. Post Disaster stage-Rehabilitation- a) Political Administrative Aspect, b) Social Aspect, c) Economic Aspect d) Environmental Aspect

### **Unit-IV:**

#### **Natural Disaster Reduction & Management**

a) Provision of Immediate relief measures to disaster affected people, b) Prediction of Hazards & Disasters, c) Measures of adjustment to natural hazards

**Mitigation-** discuss the work of following Institution-(a) Meteorological observatory, (b). Seismological observatory, (c). Volcanology institution, (d). Hydrology Laboratory, (e.) Industrial Safety inspectorate,( f). Institution of urban & regional planners, (g). Chambers of Architects, (h). Engineering Council, (i) National Standards Committee, Integrated Planning-Contingency management

**Preparedness :-**a) Education on disasters, b) Community involvement, c) The adjustment of Human Population to Natural hazards & disasters, Role of Media,

Application of Geographical Information System(GIS) in Disaster risk management

### **Unit –V**

A regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India, Ecological planning for sustainability & sustainable development in India-Sustainable rural development:A Remedy to Disasters, -Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India-Institutions & National, Centres for Natural Disaster reduction

### **References**

Savinder Singh *Environmental Geography, Prayag Pustak Bhawan, 1997*

Kates,B.I & White, G.F The Environment as Hazards, oxford, New York, 1978

R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000

H.K. Gupta (Ed) Disaster Management, Universiters Press, India, 2003

R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo, 1994

A.S. Arya Action Plan For Earthquake,Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994

R.K. Bhandani: An overview on Natural & Man made Disaster & their Reduction, ,CSIR, New Delhi

## **EEV-032- Integrated Impact Assessment**

<b>L</b>	<b>T</b>	<b>P</b>
3	1	0

### **UNIT-I**

#### **Introduction & an Overview of IIA**

Defining IIA; Sustainable Development challenges and need for IIA, Key Approaches of IIA: Environment, Social Health and Economic, Current Practices, Changing Perspectives & Debate in IIA, Environmental Impacts – examples, need for assessment, difficulties; The EIA Approach – Background, Objectives, Components & Techniques, Impact prediction & analysis, Treatment of Risk and Uncertainty, EIA inputs to the project cycle and development planning, EIA in India – Legislative aspects, Current practices & Constraints, EIA case study

### **UNIT-II**

**Biodiversity and Health Impact Assessment** 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 Health Impact Assessment, Health Need Assessment, tools and techniques in HIA, HIA Case Study

### **UNIT-III**

#### **Handling Social Issues: the SIA Approach**

Overview and scope of Social Impact Assessment (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-IV**

#### **Integrated Analysis of Environmental, Social & 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-V**

#### **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 & Future Directions, Strategic Environmental Assessment (SEA), Technology Assessment, Risk Assessment, IIA Case Studies: Case Study 1, Case Study 2, Case Study 3

### **References:**

1. Canter, L.W. 1996. Environmental Impact Assessment. 2<sup>nd</sup> Edn. New York, McGrawHill.

2. Asian Development Bank 1997. Environmental impact assessment for developing countries in Asia, Vol I & II. ADB Publication
3. Lee, N. and C. Kirkpatrick (Eds). 2000. Integrated Appraisal and Sustainable Development in a Developing World. Cheltenham, Edward Elgar.
4. British Medical Association 1998. Health and Environmental Impact Assessment- an integrated approach. Earthscan
5. Vanclay F and Bronstein D A 1995. Environmental and Social Impact assessment, Wiley publishers.
6. Linkage methods for environment and health analysis – General guidelines. Edited by D Briggs, C. Corvalan, M. Nurminen, World Health Organization, Geneva, 1996. 136 p
7. Handbook of Environmental Impact Assessment. R.R. Bathwal. New Age, international Publishers.
8. Dale, R. 2004. Evaluating Development Programme and Project, Second Edition, Sage Publication.

### **EEV-033-Environmental Risk Assessment**

<b>L</b>	<b>T</b>	<b>P</b>
3	1	0

#### **Unit 1**

Environmental Risk, What is an environmental risk, types of environmental risk, the management risk, why do we need environmental risk management. International collaborations in risk management

#### **Unit 2**

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 3**

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 4**

Risk evaluation and national policies

Policy considerations, legislative considerations, legal considerations, economic considerations.

Managing environmental risks

#### **Unit 5**

Developing a national risk profile, institutional arrangements, risk management tasks.

Environmental links, socio-economic links, common national problems, emerging needs and suggested actions.

#### **Reference Books**

1. Environment Risk Assessment (Scope 13-18)-Anne V. Whyte and Ian Burton
2. Environmental Impact Assessment Methodologies, 2nd Ed.

## **EEV-041-043: Departmental Elective-IV**

### **EEV-041- Process Engineering Costing and Plant Design**

<b>L</b>	<b>T</b>	<b>P</b>
3	1	0

#### **Unit I**

##### **Process Development:**

Process selection, study of alternative processes, pilot plant, Scale up methods, Flow sheet preparation, sketching techniques, Equipment numbering, Stream designation, Material and energy balances.

##### **Plant Design:**

Design basis, Process selection -Selection of equipment, specification and design of equipment's, material of construction, Plant location, Plant layout and installation, Safety, Start up, Shutdown and Operating guidelines. [8]

#### **Unit II**

##### **Cost Engineering**

Time value of money and equivalence, Interest, cost comparisons by present worth, Annual equivalent cost and capitalised cost methods, Uniform gradient and series. Depreciation, Taxes and Insurances

Nature of depreciation, Methods of determining depreciation, depreciation rates in current Indian situation, Types of taxes and insurance's, Procedure for cost comparison after taxes. [8]

#### **Unit III**

##### **Cost Estimation**

Types of cost estimation, capital investment cost, fixed capital cost, working capital cost, start-up costs, process equipment cost estimation, cost index, Equipment costs due to inflation, Battery limit investments, estimation of plant cost, Estimation of total product cost, Manufacturing cost, General expenses.

##### **Profitability**

Criteria of profitability, Payout period, Return on investment, Present value, Cash flow analysis, Alternative investment analysis, Sensitive analysis in project profitability. [8]

#### **Unit IV**

##### **Economic Optimization and Optimum Design**

Nature of optimisation, Uni-variable and multivariable systems, Analytical, graphical and incremental methods of solution, LaGrange multiplier method, Linear programming and dynamic programming establishing optimum conditions, Break even chart for production schedule, Optimum production rates in plant operation, Optimum conditions in batch, cyclic and semicyclic operation, Sensitivity and response analysis. [8]

#### **Unit V**

##### **Optimisation of Different Process Equipment**

Viz., transportation systems, heat exchangers, evaporators, mass transfer equipments and reactors. Determination of height and diameter of different process equipments at conditions of optimum cost .Pinch Technology analysis.

Preparation of techno-economic feasibility report.

## References

### EEV-042-CHEMICAL REACTION ENGINEERING

L	T	P
3	1	0

#### Unit I

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. [8]

#### Unit II

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. [8]

#### Unit III

Interpretation of variable volume batch reactions data for zero, first and second order reactions, Design equations for batch, plug flow, back mix flow and semi batch reactors for isothermal, adiabatic homogeneous reaction. [8]

#### Unit IV

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/parallel. Equal and different size of mixed reactors in series and finding the best system for the given conversion, Recycle reactor, Design of reactors for multiple reactions, parallel and series reaction, series-parallel reactions. [8]

#### Unit V

Temperature and pressure effects for single reaction, Optimal temperature progression for first order reactions. Residence time distribution of fluid in vessels, E , F and C curve, Dispersion models, Tanks in series model [8]

#### Text Books

1. Levenspiel, Octave. "Chemical Reaction Engineering", 3rd ed. New York John Wiley (1998)

#### Reference Books

1. Fogler, H.S. "Elements of Chemical Reaction Engineering", 3rd ed. Prentice Hall (1997).

2. Smith, J. "Chemical Engineering Kinetics ", 3rd edition. McGraw-Hill, . (1990).

### EEV-043- HEAT TRANSFER OPERATIONS

L	T	P
3	1	0

### **Unit 1**

Introduction to heat transfer and general concepts of heat transfer by conduction, convection and radiation. Conduction: Basic concepts of conduction in solids, liquids and gases, steady state temperature fields and one dimensional conduction without heat generation, e.g., through plane walls, cylindrical and spherical surfaces, composite layers, etc. Insulation materials, critical and optimum insulation thickness. Extended surfaces, fins and their practical applications. Introduction to unsteady state heat transfer.

### **Unit 2**

Convection: Fundamentals of convection, Basic concepts and definitions, natural and forced convection, hydrodynamic and thermal boundary layers, laminar and turbulent heat transfer inside and outside tubes. Dimensional analysis, determination of individual and overall heat transfer coefficients and their temperature dependence, heat transfer in molten metals.

### **Unit 3**

Radiation: Basic laws of heat transfer by radiation, black body and gray body concepts, view factors, Kirchoff's law, solar radiations, combined heat transfer coefficients by convection and radiation.

### **Unit 4**

Heat Transfer with Phase Change: Condensation of pure and mixed vapors, film wise and drop wise condensation, loading in condensers and basic calculation on condensers, heat transfer in boiling liquids, boiling heat transfer coefficients. Evaporation: Elementary principles, types of evaporators. Single and multiple effect evaporators and their calculation, thermo compression.

### **Unit 5**

Heat Transfer Equipment: Classification, principles and design criteria, types of exchangers, viz., double pipe, shell and tube, plate type, extended surface, Furnaces and their classification and application.

### **Books Recommended**

Holman, J.P.: "Heat Transfer" 9 th ed. McGraw Hill (1989).

### **Reference Books**

1. Coulson, J.M. & Richardson, J.F. "Chemical Engineering :Vol-1", 6th ed. Butterworth-Heinemann(1999)
2. McAdams W.H. "Heat Transmission", 3rd ed., McGraw-Hill, (1954)
3. Kern D.Q. "Process Heat Transfer" McGraw Hill Book (1950)
4. Badger W.L. & Bancharo J.T. , "Introduction to chemical engineering" Tata McGraw Hill .

## **EEV-701: Environmental System Simulation**

**L T P**

**3 1 0**

### **Unit-I**

#### **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-II**

### **Air Pollution Dispersion Modeling**

Meteorological factors affecting air quality, Lapse rates, 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- Coning, 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-III**

### **Surface Water Quality Modeling**

Control mass and volume, Material balance equation, Dissolved Oxygen Depletion, Biochemical Oxygen Demand Measurement, Modeling BOD as a First-order Reaction, Ultimate Biochemical Oxygen Demand, Biological Oxygen Demand: 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-IV**

### **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-V**

### **Application of Operation Research in Environmental Engineering**

Introduction, The Linear Programming Model, Examples of Linear Programming Problems, Developing Linear Programming Models, Graphical Solution to LP Problems, The 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.

## **References:**

1. **System Simulation** By Geoffrey Gordon, Prentice Hall (Higher Education Division, Pearson Education)
2. Peavy and Rowe: Environmental Engineering: (TMH publications)
3. Arya, S. Pal (1998). Air Pollution Meteorology and Dispersion, 1st Edition, Oxford University Press. ISBN 0-19-507398-3.
4. Barrat, Rod (2001). Atmospheric Dispersion Modelling, 1st Edition, Earthscan Publications. ISBN 1-85383-642-7.
5. Introduction to Hydrology by Warren Vissman, Jr and Gary L Lewis (Pearson education)
6. Heera and Gupta: Operation Research
7. Manuals of relevant EPA Models

## **ECE-702: 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 & interbasin development concepts .Single & 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 , 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

### **References:**

1. Irrigation and water resources Engg. By G.L. Asawa New age international publishers.
2. Water resources Engg. By Larry W. Mays John Wiley, India.
3. Water resources Engg. By Wurbs & Jams John Wiley, India.
4. Water resources Engg. By R. K. Linsley , Mc Graw Hill.

## **VII Semester, PRACTICAL/DESIGN/DRAWING**

### **EEV-751: Environmental System Simulation Lab**

**L T P**

**0 0 3**

1. Simple exercise on computer simulation of air pollution.

2. Simple Exercise on Computer Simulation of Surface Water quality.
3. Simple Exercise on Computer Simulation of Soil Water Balance
4. Simple 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.

## **Final Year, VIII Semester**

### **EEV051-053: Departmental Elective-V**

**Paper Name:**

**EEV-051      Sustainable Agriculture, Building and Sanitation**

<b>L</b>	<b>T</b>	<b>P</b>
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#### **Unit-1**

Meaning and Scope of Sustainable Development Sustainable agriculture, water harvesting and irrigation techniques, water resources management, watershed management, ground water management, rain water harvesting , waste water management – recycle and reuse.

#### **Unit-2**

Agro produce processing, organic farming systems – sustainability organic manure, biofertilizr. Post harvest technologies.

#### **Unit-3**

Health , Sanitation and community psychology Psychological aspects of community health , family planning, infant mortality rates information on communicable diseases and prevention , drinking water quality parameters, WHO standards , Water contamination , prevention methods of water treatment, sanitation practices for common facilities such as community toilets, sewage system to pit latrines for waterlogged areas.

#### **Unit-4**

Building of cost effective and energy efficient houses , materials used in rural housing selection based on local availability , cost , strength and durability , thermal comfort , direction of sunlight , passive solar heating , bonding schemes, site selection based on wind direction and solar rays , ventilation and natural lighting , government policies , habitat management pre-fabrication of building components , new materials ,protection against rain .

#### **Unit-5**

Water harvesting techniques

1. Buckman, H.O, and Brady, N.C.(1969): The nature and properties of soils, Euvasia Publishing House (Pvt.) Ltd.
2. Ray Chaudhar; S.P (1996): Land and soil, National Book Trust, New Delhi
3. Thomson, L.M.(1957) Soil and soil fertility, McGraw Hill Book Company.
4. Rural Water Supply in Developing Countries-IDRC-167e
5. Sanitation in Developing countries –IDRC 168e
6. Waste Management “Asian and Pacific Center for Transfer of Technology (N.D.) India”, September 1993.

## EEV-052- GROUND WATER DEVELOPMENT AND MANAGEMENT

L	T	P
3	1	0

### Unit– I

Ground Water Occurrence: Ground water hydrologic cycle, origin of ground water, rock properties effecting ground water, vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention, Groundwater Basin Management: Concepts of conjunction use, Case studies.

### Unit – II

Ground Water Movement: Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing ground water flow in three dimensions derivation, ground water flow equation in polar coordinate system. Ground water flow contours their applications.

### Unit – III

Analysis of Pumping Test Data – I: Steady flow groundwater flow towards a well in confined and unconfined aquifers – Dupit's and Theism's equations, Assumptions, Formation constants, yield of an open well interface and well tests, Analysis of Pumping Test Data – II: Unsteady flow towards a well – Non equilibrium equations – Thesis solution – Jacob and Chow's simplifications, Leak aquifers.

### Unit – IV

Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

### Unit – V

Artificial Recharge of Ground Water: Concept of artificial recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Ground water along with Case studies, Saline Water Intrusion in aquifer: Occurrence of saline water intrusions, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion.

### TEXT BOOKS:

1. Ground water Hydrology by David Keith Todd, John Wiley & Son, New York.
2. Groundwater by H.M.Raghunath, Wiley Eastern Ltd.

### REFERENCES :

1. Groundwater by Bawvwr, John Wiley & sons.
2. Groundwater Syatem Planning & Managemnet – R.Willes & W.W.G.Yeh, Printice Hall.
3. Applied Hydrogeology by C.W.Fetta, CBS Publishers & Distributers

## EEV-053-Design of Structure

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>1</b>	<b>0</b>

### UNIT 1

Introduction to working stress method and Limit state method of design. Design of singly & doubly reinforced rectangular beams and T- beams by using working stress method and Limit state method.

### UNIT 2

Design of one way and two way slabs by limit state method. Serviceability limit states, control of deflection & cracking.

### UNIT 3

Design of shear by Limit state method, minimum & maximum shear reinforcement. Shear strength of beams with & without shear reinforcement. Anchorage bond & flexures bond. Development length.

### UNIT 4

Design of short column by limit state design under axial compression. Assumptions, Minimum eccentricity , Column with helical reinforcement. Short column under axial load & Uniaxial bending. Design of long column.

### UNIT 5

Design of staircases in buildings. Design of a footing for a wall and a single column. Combined rectangular and trapezoidal footing.

### Reference:

1. IS : 456 – 2000
2. Reinforced Concrete – limit state Design by A.K. Jain, Nem Chand & Bros Roorkee.
3. Reinforced Concrete design by B.C. Purmia.
4. Plain & reinforced concrete vol. I & III by O.P. Jain & Jai Krishna, Nem Chand & Bros.
5. Reinforced Concrete structures by R. Park & Pandey

## EEV061-063: Departmental Elective-VI

### EEV-061- Water Power Engineering

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>1</b>	<b>0</b>

#### Unit – 1

Water Power Introduction: Source of Energy, Status of hydro power in the World. Hydro – Power Place of Hydro Power in a Power system, Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization

factor, diversity factor, load duration curve, firm power, secondary power, prediction of load illustrative examples.

## **Unit – 2**

**Type of Hydro-Power Plants –I** Classification of Hydel Plants, run of river plants, general arrangement of run of river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage illustrative examples.

## **Type of Hydro Power Plants –II**

Basic features historical development, advantages of pumped storage plants, types of pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, topography reservoirs and water conveyance, power house, efficiency of P-S plants, illustrative example.

## **Unit – 3**

Water Conveyance General. Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative example, Introduction, water hammer, resonance in penstocks, channel surges, surge tanks illustrative examples. Intakes, type of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels.

## **Unit - 4**

Turbines Introduction, main types of turbines , hydraulic features, turbine size, constructional features of turbines, layout arrangements, hydraulic of turbines, basic flow equations, draft tubes, cavitations in turbines, governing of turbines, turbine model testing characteristics of turbines, illustrative examples.

## **Unit - 5 Power House Planning**

**General.** (A) surface power stations, power house structure, power house dimensions, lighting and ventilation, variations in design of power house (B) underground power station, history, location of U.G power station, Types of U.G power station, advantages of U.G power house, components of U.G power house, types of layout, limitations of U.G power house structural design of power house, Tidal phenomenon, tidal power- basis principle, historical development, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

### **Reference Text:**

1. Water Power Engineering by M.M. Dandekar and K.N. Sharma, Vani Educational Books
2. Irrigation and water resources Engg. By G.L. Asawa New age international publishers.
3. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. lal (Laxmi Publications Private Limited)

## **EEV-062- Integrated Watershed Management**

<b>L</b>	<b>T</b>	<b>P</b>
3	1	0

### **UNIT-I**

**INTRODUCTION:** Concept of watershed development, objectives of watershed development, need for watershed development in India, Integrated and multidisciplinary approach for

watershed management.,

#### UNIT-II

**WATER HARVESTING: CHARACTERISTICS OF WATERSHED:** size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds, Rainwater Harvesting, catchment harvesting, harvesting structures, soil moisture conservation, check dams, artificial recharge, farm ponds, percolation tanks,

#### UNIT-III

**PRINCIPLES OF EROSION:** Types of erosion, factors affecting erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion, Universal soil loss equation, **MEASURES TO CONTROL EROSION:** Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rockfill dams, brushwood dam, Gabion.

#### UNIT-IV

**LAND MANAGEMENT:** Land use and Land capability classification, management of forest, agricultural, grassland and wild land. Reclamation of saline and alkaline soils.

#### UNIT-V

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

#### TEXT BOOKS:

1. Watershed Management by JVS Murthy, - New Age International Publishers.
2. Water Resource Engineering by R.Awurbs and WP James, - Prentice Hall Publishers.

#### REFERENCE:

1. Land and Water Management by VVN Murthy, - Kalyani Publications.
2. Irrigation and Water Management by D.K.Majumdar, Printice Hall of India

### **EEV-063- Transport Phenomena**

#### **Paper Name:**

<b>L</b>	<b>T</b>	<b>P</b>
3	1	0

#### **UNIT 1**

Introduction to transport phenomena, molecular transport mechanisms and general properties, transport with net convective flux, flow turbulence and boundary layer theory.

#### **UNIT 2**

Transport in ducts, heat & mass transfer in duct flow, transport in immersed bodies,

#### **UNIT 3**

Unsteady state transport and agitation.

#### **UNIT 4**

Estimation of transport coefficient, non-Newtonian fluids, rheological characteristics of materials, agitation of non-Newtonian fluids.

## **UNIT 5**

Heat & mass transfer with chemical reaction inside a porous catalyst.

### **REFERENCES:**

1. R. Byron Bird, Warren E. Steward and Edwin N. Lightfoot, Transport Phenomena by
2. Suhas V. Patankar, Dudley Brian Spadding, Heat and Mass Transfer in Boundary Layers, Morgan-Grampian.
3. W.M. Kays, M.E. Crawford, Bernhard Weigand, Convective Heat and Mass Transfer, McGraw Hill
4. Asim K. Dutta, Biological and Bio-Environmental Heat and Mass Transfer, Marcel Dekker.
5. Robert Alber Greenkorn, David P. Kossler, Momentum, Heat and Mass Transfer fundamentals, Marcel Dekker

## **EEV801: Design of Waste Water System**

**L T P**

**3 1 0**

- Unit – 1**      Concept and Scope of Design of wastewater systems, Basic Design Consideration, Principle of Reactor design and process flow sheets.
- Unit -2**      Theory and Design of Biological treatment process and units. Activated sludge process: Nutritional Requirement, Control of filamounds Organism, Sludge Volume Index, Process Design, Design Problems of Activated sludge process
- Unit-3**      Tricking Filters: Filter classification, Design Parameters, NRC formula, Recirculation in tricking filter merits and demerits, operation problem encountered in tricking filters and corresponding remedial measures. Design problems, Theory and Design of Rotatory Biological contactors.
- Unit-4**      Theory and Design of Waste stabilization ponds, aerated lagoons and oxidation ditches, design problems
- Unit-5**      Treatment and Disposal of Sludge: Sludge treatment processes, characteristic of sludge, sludge thickening, Sludge conditioning, Sludge dewatering, Aerobic and anaerobic digestion, Final disposal of sludge.

### **References:**

1. Manual on Sewerage and Sewage disposal-CPHEEO, Govt. of India.
2. Metcalf and Eddy, Wastewater Engineering: Treatment, disposal, and reuse. TMH, New Delhi.
3. Fiar, G.M., and Geyer, J.C., Water and Wastewater engineering, Vol-I & II, John Wiley and sons, New York.

4. Steel, E.W, and Mc Ghee, T.J., Water Supply and Sewerage. Mc Graw Hill Book Co., New York.
5. Hammer, M.J., Water and Wastewater Technology. John Wiley and sons-Inc, New York.
6. Garg, S.K., Water Supply Engineering- Vol-I, Khanna Publishers, New Delhi