



**Shivaji University, Kolhapur**  
**Department of Technology**  
**THIRD YEAR B.TECH**  
**Environmental science and Technology**  
 Curriculum Structure  
**Semester – V**

Sr. No.	Subject Code	Subject Title	Contact hours			Credits
			L	T	P	
1	EN311	Water treatment and supply	3	1	-	4
2	EN312	Design of structures	3	-	-	3
3	EN313	Solid Waste Management	3	-	-	3
4	EN314	Green Building Design	3	-	-	3
5	EN315	Water Resource Engineering	3	-	-	3
6	EN 316	Laboratory- I Water treatment and supply	-	-	2	1
7	EN 317	Laboratory-II Design of structures	-	-	2	1
8	EN 318	Laboratory-III Solid Waste Management	-	-	2	1
9	EN 319	Seminar	-	-	4	2
10	AEN 311	Audit Course II Research Methodology	2	-	-	-
<b>Total</b>			17	1	10	21
Total Contact hours per week = 28						

**Semester –VI**

Sr. No.	Subject Code	Subject Title	Contact hours			Credits
			L	T	P	
1	EN321	Wastewater Treatment and disposal	3	1	-	4
2	EN322	Environmental Management Systems	3	-	-	3
3	EN323	Earth and Environment	3	-	-	3
4	EN324	GIS and Remote Sensing	3	-	-	3
5	EN325	Industrial safety and Hazards	3	-	-	3
6	EN326	Laboratory- I Wastewater Treatment and disposal	-	-	2	1
7	EN327	Laboratory-II GIS and Remote Sensing	-	-	2	1
8	EN328	Laboratory-III Industrial safety and Hazards	-	-	2	1
9	EN329	Mini Project	-	-	4	2
10	AEN321	Audit Course II Presentation and Communication Technique	2	-	-	-
<b>Total</b>			17	1	10	21
Total Contact hours per week = 28						

**Note :** 1. Tutorials and Practical shall be conducted in batches with batch strength not exceeding 18 students.

2. There will be an industrial training for 21 days after semester VI. This will cover the study of that reputed industry from standpoint of Environmental engineering principles. The report of the training is required to be submitted by the students.



Semester V  
Shivaji University, Kolhapur  
**Department of Technology**

Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester V)

**WATER TREATMENT AND SUPPLY (EN 311)**

Teaching Scheme: L: 3 hrs/week

Credits: 4

: T: 1 hrs/week

**UNIT 1 Sources, Water Demand and Intake**

**(6 Hours)**

Sources of water, Quantity and quality of sources, Demand of water, Factors affecting demand, Fluctuations in demand and effect, Design period, Population forecast, Intake works.

**UNIT 2 Water Quality and Treatment**

**(11 Hours)**

Physical, chemical and biological water Quality parameters, Drinking water quality standards. Concepts of water treatment, Coagulation and Flocculation processes, stability of colloids and destabilization, Coagulants: Types, selection Design of rapid and slow mixers. Sedimentation, Solids separation theory, Types of sedimentation tanks, design of clarifiers. Introduction to depth filtration, filtration processes, principal mechanisms of filtration, design and operation of slow sand, rapid sand filters. Disinfection, modes of disinfection, mechanisms, factors influencing, ideal disinfectant, chemistry of chlorination.

**UNIT 3 Specific treatment of water**

**( 6 Hours)**

Water softening by Chemical precipitation, Ion exchange. Introduction to TDS removal by Reverse osmosis, Electrodialysis Taste and odour removal

**UNIT 4 Sequence of treatment and waste handling in water treatment (6 Hours)**

Sequencing of treatment units for various qualities of surface and ground water. Sources of wastes and their disposal in water treatment. Salient features of rural water supply.

**UNIT 5 Conveyance of water**

**(4 Hours)**

Transmission of water, Pumping and Gravity mains, Choice of pipe materials, Forces acting on pressure pipes, Economic size of conveying main. Corrosion: Process, Types and Control measures

**UNIT 6 Water Distribution System**

**( 6 Hours)**

Water distribution system: Methods of distributing water, System configurations, Basic system requirements, Analysis: Hydraulic analysis, Head balance method, Quantity balance method, Equivalent pipe concept, Design of distribution systems, Maintenance: Requirements, Leak detection. Service reservoirs: Necessity, Location, Head and capacity requirement.

**REFERENCE BOOKS:**

1. Ronald Droste, "Theory and Practice of water and Wastewater treatment" Wiley Publication.
2. Peavy, Rowe and Technological "Environmental engineering"
3. Weber, "Physico-chemical processes of water purification"
4. Metcalf Eddy, "Wastewater Engineering treatment and reuse"
5. S.K. Garg, "Water supply and Engineering"



Shivaji University, Kolhapur  
**Department of Technology**

Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester V)

**Design of structures (EN 312)**

Teaching Scheme: L: 3 hrs/week

Credits: 3

**Section I**

**A) Design of Reinforcement Concrete Structures (LSM)**

**UNIT 1 Introduction to Limit state method**

**(4Hours)**

**a) Introduction:** Stress strain behavior of concrete and steel, Behavior of RCC, Permissible stresses in steel and concrete, Design philosophies, Various limits states, Characteristics strength and Characteristic load, Load factor, Partial safety factors.

**b) I.S. Specification:** regarding spacing of reinforcement in slab, cover to reinforcement in slab, beam column & footing, minimum reinforcement in slab, beam & column, lapping, anchoring effective span for beam, & slab.

**UNIT 2**

**(6Hours)**

**a) Limit state of collapse (flexure):** Analysis and Design of Singly, Doubly Reinforced rectangular sections, singly reinforced T and L beams.

**b) Shear, Bond and Development Length (LSM):** Nominal Shear stress in R.C. Section, design shear strength of concrete, Maximum shear stress, Design of shear reinforcement, Minimum shear reinforcement, forms of shear reinforcement. Bond and types of bond, Bond Stress, check for bond stress, Development length in tension and compression, anchorage value for hooks 90° bend and 45° bend Standard Lapping of bars, check for development length.

**UNIT 3**

**(6 Hours)**

**a) Design of slabs:** One way, Two way with different support conditions as per IS: 456, Cantilever slab

**b) Design of staircases:** Types of staircases, Design of Simply Supported and Dog legged staircases

**UNIT 4**

**(4 Hours)**

**a) Column:** Analysis and Design of axially and eccentrically (uni-axial) loaded circular and rectangular columns, Interaction diagram, Circular column with helical reinforcement

**b) Footing:** Design of isolated rectangular column footing with constant depth subjected to axial load and moment

Section II

**B) Design of Steel Structures (LSM)**

**UNIT 1 Introduction to Design of Steel Structures (5 Hours)**

**a) Introduction to Design of Steel Structures:** Permissible stresses, factor of safety, Methods of design, Types of connections, various types of standard rolled sections, Types of loads and load combinations.

**b) Design of Connections:** Types of riveted, bolted, welds, connection. Analysis and design of axially & eccentrically loaded connections.

**UNIT 2 (4 Hours)**

**a) Tension Members:** Common sections, net effective area of angle, tees and flats. Load carrying capacity, connection of section to gusset using weld / bolts. Design of Tension members, splices

**b) Compression Members Struts:** Common sections used, effective length and slenderness ratio, permissible stresses, Load carrying capacity, connection of section to gusset using weld / bolt.

**UNIT 3 (5 Hours)**

**a) Roof Truss:** Types of steel roof truss and its selection criteria: Calculation of panel point load for Dead load; Live load and wind load as per I.S. 875-1987 Analysis and Design of steel roof truss. Design of Angle purlin as per I.S. Arrangement of members at supports.

**b) Compression Members Columns:** Simple and built up section, lacing, battening, column subjected to axial force and bending moment, column splices.

**UNIT 4 (5Hours)**

**a) Beams:** Laterally supported & unsupported beams, design of simple beam, built up beams using flange plates. Curtailment of flange plates. Secondary and main beam arrangement, beam to beam connections

**b) Column Bases:** Slab base, Gusseted base and moment resisting bases, Design of anchor bolts, design of pedestal.

**Note:** Use of IS 456-2000, IS 800-2007, IS 875, and steel table is permitted for theory examinations.

**A) RECOMMENDED BOOKS (Design of R.C. Structures)**

1. Dr. V. L. Shah & Late Dr. S. R. Karve Limit State Theory & Design of Reinforced Concrete Structures Publications
2. N. C. Sinha & S. K. Roy Fundamentals of Reinforced Concrete S. chand & Company,
3. N. Krishna Raju R. N. Pranesh Reinforced concrete Design ( IS 456- 2000) Principles & Practice  
New AgeInternational
4. S.U.Pillai & Devdas Menon Reinforced concrete Design Tata Mcgraw Hill.
5. P. C. Varghase Limit State Design of Reinforced Concrete Prentice Hall of India,

**I.S. Codes: (Design of R.C. Structures)**

1. IS 456:2000 - Plain and Reinforced concrete code of Practice.
2. SP16- Design Aids for reinforced concrete to IS 456.
3. I.S. 875 (Part 1-5) - 1987 code of practice of design loads for Buildings and structures.  
Part 1 - Dead load  
Part 2 - Imposed (live) load  
Part 3 - Wind load
4. SP 24 - Explanatory Handbook on IS 456
5. IS 1343-1980 - Indian Standard code of (Reaffirmed 1990) Practice for Prestressed concrete.
6. SP34 : 1987 - Handbook on concrete reinforcement and Detailing.
7. IS 13920-1993 DUCTILE detailing of R. C. Building subjected to Scrim forces.

**B) RECOMMENDED BOOKS (Design of Steel Structures)**

1. Design of Steel Structures by S. K. Duggal, Tata Mc Graw Hill publishing company Ltd., New Delhi.
2. Design of Steel Structures, Vol.I & Vol.II by Ram Chandra, Standard Book House, New Delhi.
3. Design of Steel Structures, by Dayaratnam, Wheeler Publishing, New Delhi.
4. Design of Steel Structures, by Dr. N. Subramanian, Oxford University Press, New Delhi.
5. Design of Steel Structures, by B.C.Punmia, Jain & Jain Laxmi Publication, New Delhi.
6. Design of Steel Structures, by A.S.Arya and J.L.Ajamani, Nemchand and Bros., Roorkee.
7. Design of Steel Structures, by Vazirani & Ratwani.
8. Design of Steel Structures by- E.H.Gaylord and C.N. Gaylord, Mc Graw Hill, New York.
9. Design in Structural Steel Vol.-I by-J.E.Lothers, Prentice Hall New Jersey.
10. Design of Steel Structures by L.S. Negi, Tata Mc Graw Hill publishing company Ltd., New Delhi.

**I.S. Codes: (Design of Steel Structures)**

1. IS 800:2007 – Indian Standard code of Practice for use of structural steel in general building construction, BIS – New Delhi
2. I.S. 875 (Part 1-5) - 1987 code of practice of design loads for Buildings and structures.  
Part 1 - Dead load  
Part 2 - Imposed (live) load  
Part 3 - Wind load
3. IS Handbook No. 1- Properties of structural Steel Rolled section.
4. Steel table.



Shivaji University, Kolhapur  
**Department of Technology**

**Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester V)**

**SOLID WASTE MANAGEMENT (EN313)**

**Teaching Scheme: L: 3 hrs/week**

**Credits: 3**

**UNIT 1 Solid waste**

**(6 Hours)**

Classification, source and type based. Solid waste management: Objectives, Functional elements. Waste generation: factors affecting, waste characteristics.

**UNIT 2 Waste Storage and collection**

**(6 Hours)**

General considerations for waste storage at source, collection systems. Transfer station: Meaning, Necessity.

**UNIT 3 Solid waste processing**

**(6 Hours)**

Necessity, component separation, drying and dewatering. Concepts of reduction at source and recycling.

**UNIT 4 Composting of solid waste**

**(6 Hours)**

Principles, Factors affecting, Energy recovery from solid waste: Parameters affecting, Biomethanation, Pyrolysis, Incineration

**UNIT 5 Landfills**

**(6 Hours)**

Definition, Essential components, Site selection, Landfilling methods, leachate control.

**UNIT 6 Introduction to Hazardous and biomedical waste management (6 Hours)**

Indian scenario: Present scenario and measures to improve system for different functional elements of solid waste management system.

**REFERENCES:**

- 1) Government of India publication, "Manual on municipal solid waste management"
- 2) George Tchobanoglous, "Integrated solid waste management"
- 3) A. D. Bhide, "Solid waste management"
- 4) Pavoni, "Solid waste management handbook"



Shivaji University, Kolhapur  
**Department of Technology**

Thir Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester V)

**GREEN BUILDING DESIGN (EN 314)**

Teaching Scheme: L: 3 hrs/week

Credits: 3

**UNIT 1 Sustainable Site Selection Orientation**

**(6 Hours)**

Sustainable Site Selection Orientation, Building envelop, Building plan layout, Design of Doors and windows, Natural ventilation, Solar energy, Use of solar energy for water heating, Solar concentrators, Solar photovoltaic panels, Direct and indirect lighting, comparison of various lighting devices- electric tubes, incandescent lamps, CFL and LED lamps, Indirect lighting devices -Light Tubes, Fibre optic, Fresnel lense

**UNIT 2 Passive and Active Architecture**

**(6 Hours)**

Passive and Active Architecture, Natural ventilation and air conditioning, Hybrid system of active and passive refrigeration and air conditioning. Concept of Embodied Energy, Embodied energy of various common building materials, Thermal properties of building components, Thermal storage, emmissivity, reflectivity, Selection of materials and surface treatment for improvement in thermal comfort with minimum energy input. Energy audit of building

**UNIT 3 Green Rating of building**

**(6 Hours)**

Green Rating of building, LEED criteria, USGBS, CIII-Godrej Green rating, CDM and Carbon trading, Environmental clearance of buildings.

**UNIT 4 Water Efficiency,**

**(6 Hours)**

Water Efficient Landscaping Rain water harvesting, potable water and borewell recharging methods, Minimisation of water use, Dual flush, waterless urinals, smart controlled water taps, Segregation and treatment of wastewater, Various treatment technologies like septic tank, Anaerobic filter, CWTS, biogas plants advanced treatment options like carbon bed, reverse osmosis, electrodialysis, ion exchanger, recycling of treated wastewater for different non potable purpose, Domestic solid waste – Segregation, earthworm composting other options.

**UNIT 5 Indoor Environmental**

**(6 Hours)**

Indoor Environmental Quality ,Low- VOC Emitting Materials - Adhesives & Sealants, Paints & Coatings, Carpet Systems, Composite Wood & Agro-fiber Products like coconut, jute, bamboo and their use as interiors

**UNIT 6 Recycling of Building materials**

**(6 Hours)**

Existing Walls, Floors & Roof, Interior Non-Structural Elements. Construction Waste Management, Materials Reuse, Recycled Content, Use of fly ash, foundry sand and other inert solid wastes in buildings Life cycle analysis, Construction phase, operation phase, demolition, Impact on environment and land use.



Shivaji University, Kolhapur  
**Department of Technology**

**Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester V)**

**WATER RESOURCE ENGINEERING (EN 315)**

**Teaching Scheme: L: 3 hrs/week**

**Credits: 3**

**UNIT 1 Introduction to Hydrology ( 5 Hours)**

Scope and Importance of Hydrology; Hydrological Cycle; Precipitation and its measurements: Precipitation, forms and types, different methods of measurement, Rain Gauge Network, Determination of average precipitation over the catchments. Abstraction Losses: Evapo-Transpiration – definition, measurements and factors affecting evapo-transpiration, Infiltration – Process of infiltration, factors affecting infiltration, infiltration indices

**UNIT 2 Runoff and its Measurements ( 5 Hours)**

- a. Runoff: - Factors Affecting Runoff, Rainfall Runoff relationship, Catchments Yield Calculations.
- b. Stream Gauging: - Selection of Site, Common Methods of Discharge Measurement, Area-Velocity Method, Area Slope Method, S.W.F.; Other Modern Methods.
- c. Hydrograph: - Base Flow, Separation of Base Flow, Unit Hydrograph – Theory, Assumptions and Limitations, Derivation and use of Unit Hydrograph, S – Curve Hydrograph.

**UNIT 3 Water and Watershed Management ( 5 Hours)**

- a) National & state level policies on water management roles & responsibilities of govt. agencies /farmers, equitable water distribution, co-operative water user's organization, warabandi, assessment of canal revenue, water tariffs, land use & water mgt. practices in arid/semiarid zones of India, urban water mgt.
- b) watershed concept, need of watershed development, factors affecting, effects & controlling soil erosion, role of forests in soil conservation, rainwater mgt, techniques for rainwater & GW harvesting, conjunctive use of surface & ground water, Role of NGOs

**UNIT 4 River Basin Development ( 13 Hours)**

River basins of India, concept of basin development, types of rivers, meandering Phenomenon, river training works, geomorphological characteristics of basin, Interlinking of rivers & interbasin water transfer, water quality & river pollution, Ganga Action Plan, river flood management

**Occurrence of groundwater :** Groundwater flow concepts, Aquifers and types, Darcy's Law and Hydraulic Potential, Steady state one-dimensional flow,

**Well hydraulics:** Steady state well hydraulics for confined and unconfined aquifers, Well loss and specific capacity, Yield of open well, Groundwater recharge, Effect of recharge well



**UNIT 5 Contaminants in groundwater**

**( 5 Hours)**

Sources of contaminants in groundwater Contamination of groundwater, Contaminant plumes in aquifer, Transport of reactive and non reactive contaminants in groundwater, Advection and dispersion, Sorption and diffusive mass transfer, Control of groundwater pollution, Pump and treat system, In-situ methods, Physical, Chemical and Biological parameters for organic & inorganic contaminants polluting groundwater.

**UNIT 6 Water logging & Salinity**

**( 5 Hours)**

Causes (Natural & artificial), effects, remedial measures, soil efflorescence, drainage arrangement, Mgt.of Saline & alkaline soils.

Wetland: Concept, types, wetland ecosystem, planning & pollution abatement, and conservation.

**MINIMUM TEN ASSIGNMENTS FROM FOLLOWING BASED ON ABOVE THEORY**

1. Plotting of mass curve & rainfall hyetograph.
2. Determination average annual rainfall
3. Determination of abstraction losses.
4. Derivation of Unit hydrograph.
5. Derivation of storm hydrograph.
6. Hydraulic design of an earthen dam/ bandhara.
7. Design of rain water harvesting for residential building system.
8. Field visit to wetland & preparation of report.
9. Field visit to watershed & preparation of report.
10. Study of urban water management.
11. Well hydraulics.
12. GW contaminants study.

**REFERENCE BOOKS -**

1. V. T. Chaw, "Applied Hydrology"
2. Jay rami Reddy, "Engineering Hydrology"
3. K. Subramanya, "Engineering Hydrology"
4. H. M . Raghunath, "Engineering Hydrology"
5. Dr. P.N.Modi (Standard Book House), "Water Resources Engg."
6. J.V.S.R. Murthy (New Age International ), "Watershed Management in India"
7. Ghanshyam Das , (PHI) "Hydrology and Soil Conservation"
8. R. S. Varshney, "Water resources systems"
9. K. Subramanya, "Hydrology"
10. Freeze and Cherry, "Ground water"
11. Larry Mays,"Water Resources Engineering"
12. Todd,"Groundwater Engineering"
13. Masters, "Environmental Science and Engineering"
14. Paul, DeBarry, "Watershed processes assessment and management"
15. H.M. Raghunath, "Groundwater Engineering"



Shivaji University, Kolhapur  
**Department of Technology**  
Final Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VII)

**Laboratory-I**

**WATER TREATMENT AND SUPPLY (EN 316)**

Teaching Scheme: P: 4 hrs/week

Credits: 2

Evaluation Scheme IOE, EOE

Journal consisting of study of at least Eight Experiments, Visit report, eight assignments



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Final Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VII)

**Laboratory-II**

**Design of structures (EN 317)**

Teaching Scheme: P: 2 hrs/week

Credits: 1

Evaluation Scheme EOE

Practical consist of at least twelve Sketches (book) based on theoretical course above.



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Final Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VII)

**Laboratory-III**

**SOLID WASTE MANAGEMENT (EN318)**

Teaching Scheme: P: 2 hrs/week

Credits: 1

Evaluation Scheme IOE



A journal consisting Experiments, Visit report, assignment  
Shivaji University, Kolhapur

## Department of Technology

Final Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VII)

### SEMINAR (EN 417)

Teaching Scheme: P: 4 hrs/week

Credits: 2

Evaluation Scheme IOE

The topic of seminar shall be based on any area of Environmental Engineering & preferably considering new ideas, concepts, technologies & developments in the field of Environmental Sciences & Technologies. At least two oral presentations and submission of report in soft & hard copies is expected.



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## Department of Technology

Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VI)

### RESEARCH METHODOLOGY (EN 327)

Teaching Scheme: L: 2 hrs/week

Credits: --

UNIT-1 Introduction to Research Methodology

(4 Hours)

Objective of Research, Types of Research, Research Methods and Methodology, Scientific method of Research, Research Process

UNIT-2 Research Problem

(4 Hours)

Research Problem and Selection of Research Problem, Need for defining the Problem, Techniques for defining a Problem, Development of hypothesis

UNIT-3 Research Design

(4 Hours)

Meaning and Need of Research Design, Features of a good Research Design, Types of Research Design-Exploratory, Descriptive and Experimental Research

UNIT-4 Referencing Information Sources

(4 Hours)

Using secondary sources of information: using an Encyclopedia, bibliography card, Translation card catalogue information, periodic indexes and usage, compiling a preliminary bibliography; Referencing documentation sources: styles of footnotes, endnotes etc., model bibliography entries

UNIT-5 Sampling Design

(4 Hours)

Census and Sample survey, Implication of Sample design, Steps in Sampling Characteristics of a good Sample design, Types of Sample design

**UNIT-6 Scaling Techniques & Data Collection**

**(6 Hours)**

Attitude Measurement and Measurement in Research, Measurement Scales, Scaling, Scale Classification Bases, Concept of important Scaling Techniques;  
Data Collection: Primary and Secondary data, Observation Method, Survey Method, Collection of data through Questionnaire and Schedule distinction, Selection of appropriate method of Data Collection

**Processing Operations and Report Writing:** Processing Operations, Problem in Processing, Types of Analysis, Application of some Multivariate tools of data analysis  
Report Writing: Writing and Formulating of Reports, Steps in Report Writing, Types of Report

**REFERENCES:**

1. C.R.Kothari "Research Methodology" New Age International (P) Ltd.
2. D.K.Bhattachary "Research Methodology";; Excel Books
3. Goodday &Hack "Research Methodology"



Semester VI  
Shivaji University, Kolhapur  
**Department of Technology**

Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VI)

**WASTEWATER TREATMENT AND DISPOSAL (EN 321)**

Teaching Scheme: L: 3 hrs/week

Credits: 4

: T: 1 hrs/week

**UNIT 1 Components of wastewater**

**(6 Hours)**

Flows, wastewater sources and flow rate, Variations in flow rates and strength, wastewater constituents, Characteristic of Municipal waste water. Quantity of storm water, Ground water infiltration, Sewerage system, Types of sewers, Collection system, Appurtenances, Design of sanitary and storm water sewers.

**UNIT 2 Sewage and Sludge**

**(4 Hours)**

Pumping Location, Capacity, Types of pumps, Pumping station design.

**UNIT 3 Treatment of wastewater**

**(5 Hours)**

Physical unit operations- Screening, Flow equalization, Grit removal, Primary sedimentation, Oil and Grease trap, Chemical Precipitation.

**UNIT 4 Biological treatment**

**(9 Hours)**

Objectives and fundamentals of biological treatment, types of biological treatment processes. Microbial growth kinetics.

**Activated sludge process:** Configurations and variations, Process design and operating parameters, Operational problems, Trickling filter: Classification, Process design considerations, Operational problems. Secondary clarification

**UNIT 5 Fundamentals of anaerobic treatment**

**(4 Hours)**

General design considerations, types of anaerobic reactors. Sludge treatment and disposal – characteristics, thickening, digestion and disposal, Design and operation of digesters, Types of anaerobic digester and their selection.

**UNIT 6 Design and operation**

**(11 Hours)**

Oxidation pond aerobic and anaerobic Lagoons, aerated lagoon, Oxidation ditch, Septic tank.

**Alternate treatment process:** Selection of alternate treatment process flow sheets, Concept of recycling of sewage.

**Disposal of waste water:** Stream pollution, Self Purification, DO sag curve, Streeter Phelp's Equation, Stream classification, disposal on land, effluents standards for stream and land disposals.

**REFERENCE BOOKS**

1. Ronald Droste, "Theory and Practice of water and Wastewater treatment"
2. Peavy, Rowe and Tchnologous, "Environmental engineering"
3. Metcalf Eddy, "Wastewater Engineering treatment and reuse"
4. Sincero and Sincero, "Environmental Engineering"
5. Peavey, H.S.Rowe, D.R., and Tchobanoglous, "Environmental Engineering", McGraw-Hill Book Company.
6. Viessman W. and Hammer M.J. "Water supply and pollution Control", Harper Collins College publishers.
7. Hammer M.J. "Water and Waste water Technology", Prentice-Hall of India P.Ltd.
8. Manual on sewerage and sewage Treatment-Government of India Publication.
9. Masters. G.M. "Introduction to Environmental Engineering and Science".
10. Metcalf & Eddy, "Waste Water Engg. Treatment & Disposal", Tata McGraw Hill



Shivaji University, Kolhapur  
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Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VI)

**ENVIRONMENTAL MANAGEMENT SYSTEMS (EN 322)**

**Teaching Scheme: L: 3 hrs/week**

**Credits: 3**

**UNIT 1 Introduction to EIA**

**( 6 Hours)**

Definition Evaluation of EIA in India, Rapid and Comprehensive. EIA, EIS,. Need for EIA Studies, Baseline data. Step – by – step Procedure for conducting EIA, Advantages and Limitations of EIA. Hierarchy in EIA, Statutory Requirements in EIA.

**UNIT 2 Objectives and Scope of EIA**

**( 4 Hours)**

Contents of EIA. Methodologies and Evaluation Techniques of EIA, their selection for Specific Projects. Status of EIAs in India.

**UNIT 3 Environmental auditing**

**( 6 Hours)**

Definitions and concepts, Scope and Objectives, Types of audit, Accounts audit, Environmental audit statement, Audit programs in India , Auditing program in major polluting industries

**UNIT 4 Environmental Impact Statements (EIS)**

**( 6 Hours)**

Environmental management plan: Definition, Importance, Development, Structuring, Monitoring, Cost aspects. Strategy for siting of Industries.

**UNIT 5 Environmental ethics**

**( 4 Hours)**

Ethics in society, Environmental consequences, Responsibility for environmental degradation, Ethical theories and codes of Ethics, Changing attitudes.

**UNIT 6 ISO and ISO 14000 series**

**( 10 Hours)**

Introduction, Areas covered in the series of standards, Necessity of ISO certification. Environmental management system: Evolution, Need, Elements, Benefits, ISO 14001 requirements, Steps in ISO 14001 certification,.

**Environmental appraisals :** Environmental Labelling, Life-Cycle Assessment.

**REFERENCE BOOKS:**

1. L.W.Canter, "Environmental Impact Assessment" McGraw Hill Inc. (1996),
2. Jain R. K, "Environmental Impact Analysis" Urban & Stacey,.
3. Anjaneyulu, "Environmental Impact Assessment Methodologies". B.S. Publications, Hyderabad. (2002)
4. Ministry of Environment and Forests, "Guidelines for EIA of Developmental Projects", Government of India.
5. CPCB, "Environmental auditing"
6. Mhaskar, "Environmental audit"
7. ISO standards.
8. Environment management centre web site.



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**Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VI)**

**EARTH AND ENVIRONMENT (EN 323)**

**Teaching Scheme: L: 3 hrs/week**

**Credits: 3**

**UNIT-1 Understanding the Earth**

**( 8 Hours)**

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**

**( 8 Hours)**

Renewable biological resources, wildlife conservation/management, fisheries, Forestry, energy resources, energy consumption, scarcity and conservation.

**UNIT-3 Mineral resources**

**( 8 Hours)**

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**

**( 6 Hours)**

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**

**( 6 Hours)**

Historical perspective of growing environmental concerns.

**REFERENCES:**

1. John H Seinfeld and Spyros N.Pandis, "Atmospheric Chemistry and Physics"
2. Jacobson, "Atmospheric pollution: History, Science and Regulation".
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.
7. Barry R. J. and Chorley. P.J.: "Atmosphere, weather and Climate", Roulledge London and Newyork, 1998.
8. Chirtchfield J.H.: "General climatology", prentice hall, India, New Delhi -1993.
9. Lal D.S.: "Climatology", Chaitan publication 2002.
10. Mather G. R.: "Climatology", MC graw Hill, New York 1974.



11. Trewartha G.T.: "An Introduction to climate", International Student's edition MC graw Hill, New York 1974.
12. Barry, R.G. and Chorley P.J. : "Atmosphere, Weather and Climate"
13. Critchfield, J.H. : "General Climatology"
14. Das, P.K. : "Monsoons"
15. India Met. Deptt. : "Climatological Tables of Observatories in India"
16. Lal, D.S. : "Climatology"
17. Lydolph, P.E. : "The Climate of the Earth"
18. Menon, P.A. : "Our Weather"
19. Peterson, S. : "Introduction to Meteorology"



Shivaji University, Kolhapur  
**Department of Technology**  
Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VI)  
**GIS AND REMOTE SENSING (EN 324)**

Teaching Scheme: L: 3 hrs/week

Credits: 3

**UNIT-1 Fundamentals of GIS**

**( 6 Hours)**

Definition, Components, spatial data, thematic characteristics, rasters and vectors, databases and database management.

**UNIT-2 Data input and Editing**

**(6 Hours)**

Data stream, data encoding, map digitization and conversion, data analysis, network and surface analysis in GIS, analytical modeling, forms of GIS output, decision support systems, GIS project design and management.

**UNIT-3 GIS applications:**

**( 6 Hours)**

Forestry, Bio-diversity, Environment, Soil resource management, Hydrological modeling, Public utilities (water distribution, sewerage, solid waste management).

**UNIT-4 Concepts of remote sensing**

**(6 Hours)**

Energy sources and Radiation principles, spectral characteristics of earth's surface and of atmosphere. Sensors and their characteristics; Radiometers, cameras, multispectral scanners and microwave systems. Aerial and satellite platforms.

**UNIT-5 Optical, infrared and microwave imagery**

**(6 Hours)**

Analysis of imagery, Visual and machine interpretation of imagery, Ground truth data, Digital image processing.

**UNIT-6 Application of remote sensing**

**(6 Hours)**

Land use and Land cover mapping, biodiversity, forestry and agriculture, soil erosion, water resources, wetland mapping, Wild life ecology, Environmental assessment, Environmental management, Urban and regional planning, Monitoring natural disasters.

**REFERENCES:**

- 1) Lillesand and Kiefer "Remote Sensing and Image Interpretation"
- 2) Introduction to the physics and techniques of Remote Sensing.



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**INDUSTRIAL SAFETY AND HAZARDS (EN 324)**

Teaching Scheme: L: 3 hrs/week

Credits: 3

**UNIT-1 Safety**

**(2Hours)**

Concept and Need of Safety, Safety and Industries - Definition, Various Hazards in Industries, Need of Industrial Safety, Safety Department and its Role

**UNIT-2 Introduction to Risk Assessment & Management**

**(4 Hours)**

Safety Management Systems, OSHAS 18001 management system and Auditing, , Product Safety

**UNIT-3 Accidents in Industries**

**(4Hours)**

Definition and Various Causes, Accident Theory, Cost of Accidents, Accident Prevention Techniques, Accident Investigation and Reporting, Accident Statistics

**UNIT-4 Safety in Industries**

**(8Hours)**

Safe Design and Layout of Plants and Equipments, Machine Guarding, Safe Storage & Handling of Hazardous chemicals, MSDS, Good House Keeping  
**Job Safety Analysis:** Safety Checklists, Safety Inspections, Confined Space Entry, Work Permit System, Lock Out- Tag Out System

**UNIT-5 Occupational Health and Industrial Hygiene**

**(8 Hours)**

Definition, Objectives, Need, Chronic and Acute Effects, Various Limits of Exposure-, LD50, LC50, TLV(TWA), STEL, OSHA Limits etc. Effects of Various Physical, Chemical and Biological Hazards Present in Industries on Human Health. (6)  
**Various Occupational Diseases and Causative Agent:** Occupational Diseases in Various Industries, Various Personal and Work Place Monitoring Systems

**UNIT-6 Various Preventive Methods for Occupational Health Problems (10 Hours)**

Protection of Workers against Harmful Agents and Conditions, LEVs, PPEs, Ergonomics, Health Monitoring and Medicine  
**Legal aspects of Safety:** Safety in Engineering industries, Chemical industries, Construction industries, on site & off site Emergency Management Plan

**REFERENCES:**

1. David L. Goetsch "Occupational Safety and health", Prentice Hall, Ohio
2. Safety manual - EDEL Engineering consultancy Pvt. Ltd.
3. Gayle Woodside "Hazardous Material and Hazardous Waste management", John Wiley & sons Inc.
4. Lee Harrison "Environmental Health and Safety Auditing Handbook" Mac Graw Hill Inc.
5. Health Hazards of the Human Environment - World Health Organization, Geneva, 1972
6. K. Park "Textbook of Preventive and Social Medicine" Banarsidas Bhanot Publishers.
7. Dr. A.H. Hommadi "Industrial and Occupational Safety, Health & Hygiene"
8. K.T. Kulkarni "Introduction to Industrial Safety"



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Final Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VII)

**Laboratory-I**

**WASTEWATER TREATMENT AND DISPOSAL (EN 326)**

Teaching Scheme: P: 2 hrs/week

Credits: 1

Evaluation Scheme EOE/ IOE

**PRACTICALS:**

Practical shall consist of the following:

- A) A Journal containing experiments carried on characterization of Municipal Waste water for pH, BOD, COD, Solids, acidity & Alkalinity.
- B) Design of sewage treatment plant and treatment units based on above theory.
- C) Visit to sewage treatment plant & preparation of report.



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Final Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VII)

**Laboratory-II**

**GIS AND REMOTE SENSING (EN 327)**

Teaching Scheme: P: 2 hrs/week

Credits: 1

Evaluation Scheme IOE

A journal consisting Experiments, Eight assignment



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**Laboratory-III**

**INDUSTRIAL SAFETY AND HAZARDS (EN 328)**

Teaching Scheme: P: 2 hrs/week

Credits: 1

Evaluation Scheme IOE

**PRACTICALS:**

A journal consisting of following -

1. At least six assignments based on above theory
2. At least one industrial visit report on a)  
Industrial Safety  
b) Occupational Health



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**Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester VI)**

**MINI PROJECT (EN 329)**

**Teaching Scheme: P: 4 hrs/week**

**Credits: 2**

**Evaluation Scheme: IOE**

The purpose of this particular exercise is to promote self-study, critical thinking and independent research ability. Students have to initiate their own small conceptual or practical based projects individually or as a team of no more than 2 members. While making this exercise it is expected that the knowledge acquired by them through Research Methodology subject is applied by them

Carrying out mini project work will certainly help the students to for satisfactory and successful complete their major project in the final year.

**Project Completion & Assessment**

A 15 to 20-pages report is to be written upon completion of the activity. For team projects, each member has to write his own report. The report should include academic content such as the background, objectives, product/system description, the work done, the achievements and difficulties encountered.

The students will deliver a seminar and will make the demonstration of their work



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**Third Year B. Tech (ENVIRONMENTAL SCIENCE AND TECHNOLOGY) (Semester V)**

**PRESENTATION AND COMMUNICATION TECHNIQUES (AEN 321)**

**Teaching Scheme: L: 2 hrs/week**

**Credits: -**

**UNIT 1 Communication in a Business Organization (05 Hours)**

Internal (Upward, Downward, Horizontal, Grapevine, Problems, Solutions) External Communication, Strategies for conducting successful business meetings, documentation (notice, agenda minutes) of meetings. Introduction to modern communication techniques (for e.g. e-mail, internet, video conferencing etc), Legal & ethical issues in communication (intellectual property rights, patents)

**UNIT 2 Advanced Technical Writing (05 Hours)**

- a. Report – Writing and presentation: Definition and importance of reports. Qualities of Reports, language and style in reports, type of reports, formats (letter, memo, and project-reports), and methods of compiling data. Computer-aids
- b. Technical Paper Writing
- c. Writing Proposals

**UNIT 3 Interpersonal Skills (05 Hours)**

Introduction to emotional intelligence, Motivation, Negotiation and conflict-resolution Assertiveness, Leadership, Team-building, Decision-making, And Time-management.

**UNIT 4 Interview Techniques (05Hours)**

Preparing for job interviews, verbal and non-verbal communication during interview. Observation sessions and role-play techniques may be used to demonstrate interview strategies.

**UNIT 5 Group Discussion (05 Hours)**

Dynamics of Group Behaviour, Techniques for effective participation.

**Assignments:**

**a) Written**

1. Assignments on Communication topics
2. Assignments on Report writing
3. Assignments on Interpersonal Skills

**b) One class test**

- c) Oral:** Practical sessions on Group-discussion / Interview Skills /Project Presentation / Power point Presentation.

## **Break up of IOE Marks**

- a) Assignments Written: 20 marks
  - b) Test: 10 marks
  - c) Performance in Oral: 20 marks
- Total 50 marks

## **Books Recommended:**

### **A. For classroom teaching**

- (i) Fred Luthans, 'Organizational Behavior' McGraw Hill International Edition
- (ii) Lesiker and Petit 'Report writing For Business' McGraw Hill International Edition
- (iii) Huckin and Olsen 'Technical Writing and Professional Communication' – McGraw Hill International Edition
- (iv) Wallace and Masters 'Personal Development for life and Work' (workbook) Thomson Learning
- (v) Herta Murphy 'Effective Business Communication' Herta Murphy  
Herbertwhildebraudt- McGraw Hill

### **B. For Additional Reading:**

- (i) Lewicki, Saunders, Minton 'Essential of Negotiation' McGraw Hill International Edition
- (ii) Hartman Lemay 'Presentation Success' Thomson learning.
- (iii) Kitty O Locker & Kaczmark – 'Business Communication Building Critical Skills' McGraw Hill
- (iv) Vikas Gupta: Comdex Computer Course Kit, IDG Books Pvt, Ltd.
- (v) Heller & Handle: The Essential Manager's Manual – Dorleen Kindercey
- (vi) The Sunday Times 'Creating Success Series'
  - 1. Develop your Assertiveness
  - 2. Make every Minute Count
  - 3. Successful Presentation Skills
  - 4. How to motivate people
  - 5. Team building.



## List of Equivalent Subjects

### B. Tech. Part III Environmental Science and Technology –Sem.-V

Sr. No.	Subjects from prerevised	Equivalent Subjects
1.	Water Supply and Treatment systems	Water treatment and supply No change in the subject content
2.	Analysis and Design of structures	Design of structures of revised B.Tech. part II Environmental Science And Technology
3.	Solid Waste Management	Solid Waste Management No change in the subject
4.	Green Building Design	Green Building Design No change in the subject
5.	Water Resource Engineering	Water Resource Engineering No change in the subject
6	Environmental economics	Research Methodology of revised B. Tech. part III Environmental Science And Technology I
7	Seminar I	Seminar shifted from sem VII

### Sem.-VI

1.	Wastewater Engineering	Wastewater Treatment and disposal - Change in subject name
2.	Environmental Management Systems	Environmental Management Systems No change in the subject content
3.	Earth and Environment	Earth and Environment No change in the subject content
4.	Environmental Geotechnology	GIS and Remote Sensing of revised B.Tech. part II Environmental Science And Technology
5.	Environmental Instrumentation	Industrial safety and Hazards of revised B.Tech. part II Environmental Science And Technology
6	Presentation and Communication	Presentation and Communication No change in the subject content
7	-	Minor Project of revised B.Tech. part III Environmental Science And Technology

#### Note –

New concepts & specialized areas are developing in the field of Environmental Science and technology For acquainting students to them, new subjects are included in the curriculum. Therefore wherever possible an equivalent subjects are given in revised course to the subjects of prerevised course.