

University of Pune

S.Y.B.Sc. Environmental Science Revised Syllabus 2014-15 Course Design

Paper	Semester	Course No.	Course Title	Marks Distribution			
				Internal	University	Subtotal	Total
I	I	EVS – 201	Ecology & Ecosystem.	10	40	50	100
	II	EVS – 201	Biological Diversity & its Conservation.	10	40	50	
II	I	EVS – 202	Natural Resources, Energy & their Management.	10	40	50	100
	II	EVS – 202	Pollution Control & Environmental Technology.	10	40	50	
III	I & II	EVS – 203	Practical Course Based on EVS - 201 & EVS - 202	20	80	100	100

EQUIVALENCE

Revised Course (2014-15)			Previous Course (2009-10)			
Semester	Course Code	Course Name		Semester	Course Code	Course Name
I	EVS: 201	Ecology & Ecosystem	»	I	ENV: 201	Ecology & Ecosystem
I	EVS: 202	Natural Resources, Energy & their Management.		F.Y. Term II	ENV: 101	Life Science: Natural Resources
II	EVS: 201	Biological Diversity & its Conservation.		II	ENV: 201	Biological Diversity
II	EVS: 202	Pollution Control & Environmental Technology.		III (T.Y.)	ENV: 303	Water Quality
				III (T.Y.)	ENV: 303	Air & Soil Quality
I & II	EVS: 203	Practical Course Based on EVS: 201 & EVS: 202		I & II	ENV: 203	Practical Course Based on ENV: 201 & ENV: 202

EXAMINATION

- Pattern of Examination-
 - i) Theory Papers – Semester Pattern
Internal Exam + University Exam (10 + 40) marks.
 - ii) Practical Paper – Annual Pattern
Internal Exam + University Exam (20 + 40) marks.
- Pattern of the question paper (University Exam)-
 - i) Semester Theory Paper Maximum Marks – 40.
 - Q1) 1 mark X 10 10 marks.
 - Q2) 5 marks X 2 10 marks.
 - Q3) 5 marks X 2 10 marks.
 - Q4) 10 marks X 1 10 marks.
 - ii) Annual Practical Paper Maximum Marks – 80.
 - Q1) 10 marks.
 - Q2) 10 marks.
 - Q3) 10 marks.
 - Q4) 10 marks.
 - Q5) 10 marks.
 - Q6) 3 marks X 5 15 marks.
 - Q7) 5 marks X 3 15 marks.
- Setting of question paper / Pattern of question paper –
 - i) Semester Theory Papers (EVS – 201 & EVS – 202): Maximum Marks – 40.
 - Q1) Answer the following in 1 – 2 lines 10
 - a)
 - b)
 - c)
 - d)
 - e)
 - f)
 - g)
 - h)
 - i)
 - j)
 - Q2) Write short notes on any two of the following 10
 - a)
 - b)
 - c)

d)

Q3) Answer any two of the following 10

a)

b)

c)

d)

Q4) Answer any one of the following 10

a)

b)

ii) Annual Practical Paper (EVS – 203) Maximum Marks – 80.

Q1) Determine the rate of Atmospheric Dustfall / Respirable Particulate Matter from the collected samples. Comment on the result (10)

OR

Determine the Optimum Dose of Alum Required for / Turbidity of the given water sample. Comment on the result (10)

Q2) Determine the Dissolved Oxygen / Residual Chlorine from the given water sample. Comment on the result (10)

OR

Determine the concentration of Nitrate / Phosphate from the given water sample. Comment on the result (10)

Q3) Determine the concentration of Soluble Salts in / Lime Requirement of the given soil sample. Comment on the result (10)

OR

Determine the amount of Available Nitrogen / Potassium from the given soil sample. Comment on the result (10)

Q4) Determine the Primary Productivity of grassland community, from the given data. Comment on the result (10)

OR

Determine the Minimum Area & Number of Quadrats Required to sample the community, from the given vegetation data. Comment on the result..... (10)

Q5) Determine the Total Chlorophyll Content from the plants in Clean / Polluted Environment. Comment on the result (10)

OR

Determine the Frequency, Abundance & Density of the plant species, from the given List Count Quadrat data of a grassland community / Line & Belt Transect data of a terrestrial- aquatic transitional community. Comment on the result (10)

- Q6) Identification (15)
- a) Identify & comment on the Water Treatment Process (3)
 - b) Identify & comment on the Waste Disposal / Management Method (3)
 - c) Identify & describe the Watershed Management Technique (3)
 - d) Identify & describe the Working Principle of the energy generation (3)
 - e) Identify & comment on the Inter-specific / Intra-specific relations of the organism (3)
- Q7) (15)
- a) Reports of the Study Visits (5)
 - b) Report & verification of e-networking & dissemination of ideas on any environmental issue/s pertaining to the course (5)
 - c) Viva-Voce & Certified Journal (5)

Paper – I, Semester – I, EVS – 201,

Ecology & Ecosystem

(T.L - 48)

Unit No.	Name of the Unit	Content	Lectures
1.	Ecology	<ul style="list-style-type: none">• Introduction & Interdisciplinary nature of Ecology.• Historical Overview of Ecology – From the ecological views of prehistoric man to the current state of ecology as an applied science.• Levels of Organisation –<ol style="list-style-type: none">a) Biological / Ecological Spectrum.b) Ecological Hierarchy by Baret et al.• Ecological Classification based on –<ol style="list-style-type: none">a) Taxonomic Affinity (From Kingdom to Species Level Ecology).b) Habitat Types (Terrestrial & Aquatic Ecology).c) Levels of Organisation (Autecology & Synecology – Population, Community, Biome & Ecosystem Ecology).	08
2.	Ecosystem Structure & Function – Energy Flow	<ul style="list-style-type: none">• Origin of the term.• Concept of the Ecosystem. Macro & Micro-ecosystems ...etc.• Ecosystem Structure – Abiotic & Biotic Components.• Ecosystem Function : Energy Flow –<ol style="list-style-type: none">a) Ecosystem processes involved – Photosynthesis, Respiration, Heterotrophy & Decomposition.b) Food Chain – Grazing & Detritus.c) Food Web & Ecosystem Stabilityd) Ecological Energetics –<ol style="list-style-type: none">i) Energy Input.ii) Energy Flow – Single Channel & Y shaped models.e) Productivity of Ecosystem –<ol style="list-style-type: none">i) Primary Production – GPP & NPP.ii) Secondary Production.iii) Net Ecosystem / Community Production.iv) Standing Crop (Biomass).f) Ecological Pyramids – of Number, Biomass & Energy.	08
3.	Ecosystem Function : Nutrient Cycling	<ul style="list-style-type: none">• Concept of –<ol style="list-style-type: none">a) Macro & Micro-nutrients.b) Nutrient Cyclingc) Biogeochemical Cycles.• Biogeochemical Cycles –<ol style="list-style-type: none">a) Gaseous Cycles – Hydrological, Carbon & Nitrogen Cycles.b) Sedimentary Cycles – Phosphorus & Sulphur Cycles.c) Human Impact on Biogeochemical Cycles.• Cycling of Organic Nutrients.• Cycling of Non-essential Elements.• Ecosystem Nutrient Cycling Model – Intra-system Cycling &	08

		<p>Extra-system Transfers.</p> <p>a) Nutrient Inputs. b) Biotic Accumulation of Nutrient. c) Nutrient Outputs. d) Recycling Pathways.</p> <ul style="list-style-type: none"> • Nutrient Budget. 	
4.	Population Ecology	<ul style="list-style-type: none"> • Introduction & Basic Concepts. • Population Characteristics – <ul style="list-style-type: none"> a) Size & Density. b) Dispersion – Random, Aggregate & Uniform. c) Natality (Potential & Realised). d) Fecundity e) Mortality (Potential & Realised). f) Survivorship Curves. g) Age & Sex Structure. • The Concept of Carrying Capacity. • Population Growth – <ul style="list-style-type: none"> a) Growth Curves – Exponential & Logistic. b) Population Fluctuation. c) Biotic Potential & Environmental Resistance. d) Population Regulation – Concept of Density Dependent & Density In-dependent Controls. 	08
5.	Community Ecology	<ul style="list-style-type: none"> • Characteristics of Community - Species Diversity, Growth form & Structure, Dominance, Succession, Trophic Structure, Ecological Niche, Ecotone & Edge Effect. • a) Community Composition & Structure. b) Zonation & Stratification in an aquatic & a terrestrial ecosystem. • Characters used in Community Structure- <ul style="list-style-type: none"> a) Analytical Characters – <ul style="list-style-type: none"> i) Quantitative. ii) Qualitative. b) Synthetic Characters. • Inter-specific & Intra-specific Relationships. 	08
6.	Ecological Succession	<ul style="list-style-type: none"> • Causes of Succession. • Trends of Succession. • Basic Types – Primary, Secondary, Autogenic, Allogenic ...etc. • Mechanism of Succession – <ul style="list-style-type: none"> a) Nudation. b) Invasion. c) Competition, Co-action & Reaction. d) Stabilisation (Climax). • Models of succession – <ul style="list-style-type: none"> a) Hydrosere. b) Lithosere. 	08

Paper – I, Semester – II, EVS -201,

Biological Diversity & its Conservation.

(T.L - 48)

Unit No.	Name of the Unit	Content	Lectures
1.	Biological Diversity – Ecosystem Diversity	(Biological Diversity) <ul style="list-style-type: none">• The Concept, Definition & Scope.• Levels – Ecosystem, Species & Genetic.• Biodiversity at Local, National & International level. (Ecosystem Diversity) <ul style="list-style-type: none">• Classification of Ecosystem –<ol style="list-style-type: none">a) Udvardy’s Classification.b) Bailey’s Classification.c) Olsen’s Classification.d) Holdridge’s Classification.• Major Ecosystem types of India with their physical & biological characteristics.• Major Ecosystem types of the World with their physical & biological characteristics.	08
2.	Species Diversity	<ul style="list-style-type: none">• Number of Species –<ol style="list-style-type: none">a) Species Inventory.b) Latest estimates for major groups of Plants, Animals & Microbes.• Measuring Species Diversity – Species Richness, Species Abundance, Species Evenness.• Factors affecting global distribution of Species Richness – Lattitudinal, Altitudinal, Rainfall gradients ...etc.• Endemism –<ol style="list-style-type: none">a) The Concept.b) Types with Examples.c) Endemism in India.• Centers of Diversity –<ol style="list-style-type: none">a) The Concept.b) Centers of Diversity : Analyses at Global Level –<ol style="list-style-type: none">i) Myer’s Hot-spots.ii) IUCN’s Centers of Plant Diversity.iii) Megadiversity Centers / Countries.iv) Diversity Zones.c) Western Ghat as a Hot-spot.d) India as a Megadiversity Country.	08
3.	Genetic Diversity	<ul style="list-style-type: none">• Meaning & Introduction to Genetic Variations in Species.• Nature & Origin of Genetic Variations.• Factors affecting Genetic Diversity.• Measurement of Genetic Diversity –<ol style="list-style-type: none">a) Based on DNA & Chromosomes.b) Molecular Marker Techniques.• Transgenic Organisms.	08

4.	Agro-biodiversity	<ul style="list-style-type: none"> • Introduction – meaning & significance. • Origin & Evolution of Agrobiodiversity – <ul style="list-style-type: none"> a) Domestication. b) Dispersal & Diversification. • Centers of Agrobiodiversity – <ul style="list-style-type: none"> a) Vavilov’s Centers. b) Harlan’s Domestication Area. • Diversity in Domesticated Species – <ul style="list-style-type: none"> a) Variations since the first domestication to the present. b) Land Races, Advanced Cultivars, Wild Relatives of Cultivated Plants & Feral Plants. 	08
5.	Significance & Threat to Biodiversity	<p>(Significances)</p> <ul style="list-style-type: none"> • Ecological Significances – Contribution of Biodiversity to various Eco- Services. • Non Ecological Significances – Nutritional, Medicinal, Aesthetic, Cultural, Commercial Values ...etc. <p>(Threats)</p> <ul style="list-style-type: none"> • Threats with suitable Examples – <ul style="list-style-type: none"> a) Large Scale Dev. Projects – Habitat Destruction & Fragmentation. b) Change in Natural Habitat. c) Changing Agri. & Forestry Practices. d) Invasion by Introduced Species. e) Over-exploitation. f) Env. Pollution. g) Global Climate Change. h) Loss of Traditional Knowledge. i) Nature of Legal & Mgmt. System – Human Wildlife Conflict. j) Genetically Modified Organisms ...etc. 	08
6.	Biodiversity Conservation	<ul style="list-style-type: none"> • Conservation Methods – In-situ & Ex-situ methods with Example. • National Conservation Efforts – <ul style="list-style-type: none"> a) The laws – Environment Protection Act, Fisheries Act, Forest Act, Wildlife Act, Biodiversity Act ...etc. b) Involving People’s Participation – NBSAP, PBR ...etc. c) Involving Community Participation – JFM, EDP ...etc. d) People’s Movement – Silent Valley Movement, Beej Bachao Andolan ...etc. • International Conservation Efforts – <ul style="list-style-type: none"> a) IUCN – The World Conservation Union. b) CBD. c) CITES. d) Convention on Wetlands of International Importance. e) World Heritage Convention. • Traditional Methods of Conservation – Sacred Groves / Ponds / Species, Periodic restrictions on resource harvesting ...etc. • Need & Awareness. 	08

Paper – II, Semester – I, EVS – 202,

Natural Resources, Energy & their Management. (T.L - 48)

Unit No.	Name of the Unit	Content	Lectures
1.	Resources	<ul style="list-style-type: none">• Meaning & Definition.• Classification of Resources:<ol style="list-style-type: none">a) Natural Vs Artificial Resources.b) Material Vs Energy Resources.c) Biotic / Biological Vs Abiotic / Non-biological Resources.d) On the basis of its Renewability with-in the Human Time Scale as – Non-renewable, Potentially renewable & Perpetual Resources.• Renewability & Finite Nature of Resources – Regenerative & Assimilative Capacity of the Earth.• Man’s interaction with Natural Resources –<ol style="list-style-type: none">a) As Resource Base.b) As Waste Sink.c) Cultural Significance of Natural Resources.• Importance & Scope of Natural Resources.	08
2.	Forest, Grassland & Wildlife Resources	<p>A) Forest Resource:</p> <ul style="list-style-type: none">• Classification – Old & Second Growth Forests ...etc.• Ecological Significance.• Forest Mgmt. in India – Laws, JFM, EDP, Protected Areas. <p>B) Grassland Resource:</p> <ul style="list-style-type: none">• Classification.• Significance - Ecological & Non-ecological.• Grassland Mgmt. – Prevention from Overgrazing ...etc. <p>C) Wildlife Resource:</p> <ul style="list-style-type: none">• Meaning & Definition.• Significance - Ecological & Non-ecological.• Protection & Conservation of Wildlife – Laws, Protected Areas (In-situ) & Ex-situ methods.	08
3.	Food Resources	<ul style="list-style-type: none">• World Food Problems:<ol style="list-style-type: none">a) Increasing World Food Demand.b) Nutrition Related Problems.c) Food Distribution.• Traditional & Modern Agricultural Systems.• The Green Revolution in India.• Effects of Modern Agriculture:<ol style="list-style-type: none">a) Chemical related Problems – Soil & Under-ground Water Pollution.b) Change in Land-use Pattern.c) Loss of Genetic Diversity as a result of use of HYV’s & GM Crops.d) Irrigation related Problems – Waterlogging, Salinisation.e) Social changes – Increasing inequity ...etc.• Sustainable Agriculture.	08

4.	Land & Water Resources	<p>A) Land Resource:</p> <ul style="list-style-type: none"> • Significance of the top-most layer. • Soil Erosion – Causes – Water & Wind Erosion of Soil. • Control of Erosion & Soil Conservation Methods. <p>B) Water Resource:</p> <ul style="list-style-type: none"> • Sources / Occurrences & Distribution. • Water Scarcity – the reasons. • Conflicts over water in World & India. • Conservation & Mgmt. – <ul style="list-style-type: none"> a) Traditional Methods. b) Rain-water Harvesting & Ground Water Recharge. c) Water-shed Mgmt. – the concept. 	08
5.	Energy Resources -I	<ul style="list-style-type: none"> • Classification of energy resources: <ul style="list-style-type: none"> a) Exhaustible Vs Inexhaustible. b) Polluting Vs Non-polluting. c) Conventional Vs Non-conventional. • Energy Crisis. Energy Scenario in World & in India. • Conventional Energy Resource – <ul style="list-style-type: none"> a) Coal. b) Oil. c) Natural Gas. d) Nuclear Energy. • Solar Energy – Solar Cells, Solar Heating (Active & Passive), Solar Collectors. • Wind Energy – Location of Wind Generator Site, Wind Energy Converters. 	08
6.	Energy Resources -II	<ul style="list-style-type: none"> • a) Hydro-electric Energy – Impulse & Reaction Turbines. • b) Tidal Energy – Wells Turbine. • c) Wave Energy. • Geothermal Energy. • Bioenergy – <ul style="list-style-type: none"> a) Biomass &, Biomass Programme – Energy Plantation, Wastes. b) Biogas. c) Ethanol. d) Biodiesel. • Energy Management – Energy Audit ...etc. 	08

Paper – II, Semester – II, EVS – 202,

Pollution Control & Environmental Technology.

(T.L - 48)

Unit No.	Name of the Unit	Content	Lectures
1.	Control Of Air Pollution	<ul style="list-style-type: none">• At source reduction:<ul style="list-style-type: none">a) Raw material changes.b) Process / Operational changes.c) Equipment modification / replacement.• Air Pollution control technology: Principle -<ul style="list-style-type: none">a) Condensation.b) Absorption.c) Adsorption.d) Filtration.e) Electrostatic Precipitation.f) Gravity Settling.g) Wet scrubbing.• Control of emissions from automobiles.<ul style="list-style-type: none">a) Redesigned engines.b) Catalytic converters ...etc.	08
2.	Control Of Water Pollution	<ul style="list-style-type: none">• Segregation & Re-utilisation of Domestic Waste Water – Gray & Black Water.• Waste Water Treatment:<ul style="list-style-type: none">a) Primary Treatment – Screening, Grit removal, Sedimentation etc.b) Secondary Treatment -<ul style="list-style-type: none">• Aerobic Method- i) Activated Sludge Process. ii) Trickling Filter.• Anaerobic Method.c) Tertiary Treatment – Disinfection (Chlorination).d) Advanced Treatments – Carbon Adsorption, Reverse Osmosis, Ion exchange.Bioremediation.	08
3.	Control Of Noise Pollution	<ul style="list-style-type: none">• Noise Control Techniques -<ul style="list-style-type: none">a) Sound Insulation.b) Sound Absorption.c) Vibration Damping.d) Vibration Isolation.e) Active Noise Control/ Noise Cancellation.• Control at Source -<ul style="list-style-type: none">a) Selection & Maintenance of machines.b) Control over vibrations.• Control in Transmission Path - Installation of barriers / enclosures ...etc.• Control at Reciever -<ul style="list-style-type: none">a) Using protective equipments.b) Job rotation to reduce exposure ...etc.	08

4.	Control Of Solid Waste Pollution	<ul style="list-style-type: none"> • a) Material Separation - Separation Techniques. • b) Processing – Recovery, Recycling and Reuse. • Mechanical Volume and Size Reduction - <ul style="list-style-type: none"> a) Dewatering and Drying . b) Volume Reduction / Compaction. c) Size Reduction/ Shredding. • Disposal/Management Options - <ul style="list-style-type: none"> a) Uncontrolled Dumping/ Non Engineered Disposal. b) Sanitary Landfill. c) Composting. d) Incineration. e) Pyrolysis. f) Injection Wells. g) Gasification/ Bio Gasification. h) Ocean Dumping. 	08
5.	Control Of Soil Pollution	<ul style="list-style-type: none"> • Biological Methods: <ul style="list-style-type: none"> a) To reduce dependency on chemicals – Use of Biofertilizers & Biopesticides, Conservational Tillage, Mixed Cropping, Crop rotation, Biological Pest Mgmt., Organic Farming ...etc. b) Bio / Phyto-remediation of contaminated sites. • Chemical Methods: <ul style="list-style-type: none"> a) Ex-situ - Acid Leaching. b) In-situ - pH correction using Lime or Gypsum. • Physical / Mechanical Methods: <ul style="list-style-type: none"> a) Ex-situ - Heavy metal immobilization through Vitrification. b) In-situ – Soil Vapour Extraction. 	08
6.	Control Of Thermal & Nuclear Pollution	<ul style="list-style-type: none"> • Control of Thermal Pollution - <ul style="list-style-type: none"> a) Cooling Ponds. b) Spray Ponds. c) Cooling Towers (Wet And Dry Cooling Towers). d) Direct Conversion of Heat into Electricity. e) Other Uses (Heating Of Buildings, Heating Swimming Pools, Desalination...etc.). • Control of Nuclear Pollution – <ul style="list-style-type: none"> a) Control of release & exposure. b) Proper Treatment & Disposal of Nuclear Waste. c) Protection to Workers. 	08

Paper-III, EVS- 203,

Practical Course Based on EVS 201 & EVS 202.

(Any 24 Practical to be Conducted.)

Sr. No.	Description	Practical Type	Practical Sessions
1.	Sampling of Atmospheric Dust by Gravity Settling to measure the rate of Dustfall.	Field + Laboratory.	02
2.	Sampling & Determination of Respirable Particulate Matter. (Respirable Dust Sampler)	Field + Laboratory.	02
3.	Determination of Optimum Dose of Alum (Coagulant) required for water.	Laboratory.	01
4.	Determination of Turbidity of water. (Turbidimeter / Nephelometer)	Laboratory.	01
5.	Determination of Residual Chlorine from treated water.	Laboratory.	01
6.	Determination of Dissolved Oxygen in water.	Laboratory.	01
7.	Determination of Nitrate from water. (UV Spectrophotometer)	Laboratory.	01
8.	Determination of Inorganic Phosphate from water. (Colorimeter)	Laboratory.	01
9.	Visit to Water / Waste Water Treatment Plant.	Visit.	01
10.	Determination of Soluble Salts from Soil.	Laboratory.	01
11.	Determination of Available Nitrogen from soil.	Laboratory.	01
12.	Determination of Available Potassium from soil. (Flame Photometer)	Laboratory.	01
13.	Determination of Lime required for Acidic soil.	Laboratory.	01
14.	Visit to Soil Survey Department.	Visit.	01
15.	Visit to Municipal Land-fill.	Visit.	01
16.	Field visit to study Watershed Mgmt. Techniques.	Visit.	01
17.	Study of the Working Principle of Solar Collectors. (Demonstration)	Demonstration.	01
18.	Visit to Wind Energy Farm.	Visit.	01
19.	Measurement of Primary Productivity of grassland by Harvest Method.	Field + Laboratory.	01

20.	Estimation of Total Chlorophyll from plants in Clean & Polluted Environment.	Laboratory.	01
21.	Study of grassland vegetation by List Count Quadrat Method to determine the Frequency, Density & Abundance.	Field.	01
22.	Determination of Frequency, Density & Abundance of species in grassland vegetation by List Count Quadrat Method.	Field.	01
23.	Determination of Frequency & Abundance of species across terrestrial – aquatic transitional zone, by Line Transect Method.	Field.	01
24.	Determination of Density of species across terrestrial – aquatic transitional zone by Belt Transect Method.	Field.	01
25.	Visit to Nature Interpretation / Information Centre.	Visit.	01
26.	Visit to National Park / Wildlife Sanctuary to study Wildlife & various Inter-specific & Intra-specific Relations.	Visit.	≥ 01 Day
27.	Continuation of the use of Social Media for e-networking & dissemination of ideas on Environmental Issues Pertaining to the Course.	---	≥ 02

Reference Books

- Understanding Environment; Chokkar K. B., Pandya M. & Raghunathan M.; Centre for Environment Education; Sage Publication, New Delhi.
- An Advanced Textbook on Biodiversity – Principles & Practice; Krishnamurthy K.V.; Oxford & IBH Publishing Co. Pvt. Ltd.; New Delhi.
- Ecology – Principles & Applications; Chapman J. L. & Reiss M. J.; Cambridge University Press.
- Fundamentals of Ecology; Odum P.E.; Natraj Publishers; Dehradun; 3 Edt..
- Ecology, Environment & Resource Conservation; Singh J.S., Singh S.P. & Gupta S.R.; Annamaya Publishers; New Delhi.
- Ecology & Environment; Sharma P.D.; Rastogi Publication; Meerut; 11 Rev. Edt..
- Environment Science; Tyler M.G.; Wadsworth Publishing Co.; 1997.
- Perspective in Environmental Studies; Kaushik & Kaushik; New Age International Pvt. Ltd. Publishers.
- Environmental Science; Santra S.C.; New Central Book Agency (P) Ltd.; 2 Edt..
- Environmental Chemistry, Dey A. K.; New Age International Publishers; 6 Edt..
- Air Pollution; Rao M.N. & Rao H.V.N.; Tata McGraw Hill; New Delhi; 1989.
- Environmental Pollution Control & Environmental Engineering; Rao C. S.; Tata McGraw Hill; New Delhi; 1994.
- Pollution Management; Agarwal S.K.
- Environmental Science; Daniel Chiras.
- Waste Water Engineering, Treatment, Disposal & Reuse; Metcalf & Eddy.
- Manual for Field Ecology; Mishra R.
- Handbook of Methods in Environmental Studies Vol-I &II; Mailti S.K.; ABD Publishers; Jaipur.
- Physico-Chemical Examination of Water, Sewage & Industrial Effluents; Manivasakam N.; Pragati Prakashan; Meerut; 1984.
- Chemical & Biological Methods for Water Pollution Studies; Trivedi R.K. & Goel P.K.; Environmental Publications; Karad; 1986.
- Instrumental Methods of Analysis; Willard; cbspd; 7 Edt..