



**M. C. E. Society's**

**Abeda Inamdar Senior College**

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

### **Program Objectives:**

1. To develop conscience towards social responsibility, human values and sustainable development through curriculum delivery and extra-curricular activities
2. To develop scientific temperament with strong fundamental knowledge of the subject
3. To develop analytical thinking and problem-solving skills needed for various entrance and competitive examinations and Post Graduate Studies
4. To train students in laboratory skills and handling equipment along with soft skills needed for placement

### **Program Outcomes:**

- 1) The students will graduate with holistic development.
- 2) The students will be qualified to continue higher studies in their subject.
- 3) The students will be eligible to appear for various competitive examinations and pursue higher education.
- 4) The students will be able to apply for the jobs with a minimum requirement of B.Sc. Program.

### **Program Specific Objectives and Outcomes**

#### **Program Specific Objectives:**

The B.Sc. Environmental Science Program will enable the students;

PSOB-1. To develop basic understanding of Fundamentals of Environmental Science as a discipline.

PSOB-2. To bring sensitization towards the environment and also increase student competency & employability.

PSOB-3. To inculcate a sense of responsibility among students about various principles and laws of environment

PSOB-4. To encourage students about applicability of knowledge and Interdisciplinary approach in day to day life.

#### **Program Specific Outcomes:**

After successful completion of B.Sc. Environmental Science Course, student

will have:

PSOC-1. Fundamental and Advanced knowledge of theory and practical courses in Environmental science.

PSOC-2. Students will understand about how the subject knowledge helps in solving various social, economic and environment related problem

PSOC-3. Knowledge about various Environmental laws, ISO series, EMS, Standards and Ethics required to peruse higher education in the field.

PSOC-4. Knowledge about Environmental (Resource, Energy) Management, Monitoring, introductory aspects of Environmental Biotechnology and Microbiology

PSOC-5. Skills in laboratory techniques and experience in instrument handling



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**Syllabus for S.Y.B. Sc. Environmental Science**  
**2022-23 (CBCS – Autonomy 21 Pattern)**

<b>Course/ Paper Title</b>	Ecological Studies
<b>Course Code</b>	21SBEV231
<b>Semester</b>	III
<b>No. of Credits</b>	2 (36 Lectures of 50 minutes)

**Aims & Objectives of the Course**

<b>Sr. No.</b>	<b>Objectives</b>
1.	To ensure 'well variedness' with the basic concepts of Ecology and to integrate ecological informatics with social science
2.	To integrate People-Planet-Profit and merging Ecological and Social sciences
3.	To bring sensitization towards the environment and also increase student competency & employability.
4.	To inculcate sense of environmental responsibility among students and trans-disciplinary approach
5.	To understand the concept of Carrying capacity of nature and the interrelationship of all forms of life with environment.

**Expected Course Specific Learning Outcomes**

<b>Sr. No.</b>	<b>Learning Outcome</b>
1.	Students will understand the multidisciplinary nature of the subject and thus the Scope of study
2.	Students will understand the importance of ecological studies

<b>3.</b>	Students will understand the various types of ecosystems with structural and functional characteristics
<b>4.</b>	Students will understand the levels of ecological organizations, Community and Population ecology, cycling of nutrients and the concept of flow of Energy

## Syllabus

Unit No.	Title with Contents	No. of Lectures
<b>I</b>	<p><b>1. Introduction to basics of Ecology</b>            Basic concepts, Principals, Scope            Definitions: Ecology, Landscape, Habitat, Ecozones, Biosphere, Ecosystems, Ecosystem stability, Autecology, Synecology, Population, Community, Biome &amp; Ecosystem Ecology</p> <p><b>2. Levels of Organisation –</b>            i. Biological / Ecological Spectrum.            ii. Ecological Hierarchy by Baret et al.</p> <p><b>3. Ecological Classification based on –</b>            i. Taxonomic Affinity (From Kingdom to Species Level Ecology).            ii. Habitat Types (Terrestrial &amp; Aquatic Ecology).</p> <p><b>4. Ecology of Individuals</b>            Ecological niche; types of niche -- Eltonian niche, Hutchinsonian niche, Fundamental niche, Realized niche, Multidimensional niche , Trophic niche</p>	<b>06</b>
<b>II</b>	<p><b>1. Concept of the Ecosystem</b></p> <p><b>2. Macro ecosystems</b>—Forest, Grassland, Desert, Ocean, Pond</p> <p><b>3. Micro-ecosystems</b>—River, Streams, Estu ary, Mountains</p> <p><b>4. Ecosystem Structural attributes –</b> Abiotic &amp; Biotic Components.</p> <p><b>5. Ecosystem Function : Functional attributes-</b>            i. Food Chain – Grazing &amp; Detritus.            ii. Food Web &amp; Ecosystem Stability</p>	<b>08</b>

	<p><b>a. Ecological Energetics –</b></p> <ul style="list-style-type: none"> <li>i. Energy Input.</li> <li>ii. Energy Flow – Single Channel &amp; Y shaped models.</li> </ul> <p><b>b. Productivity of Ecosystem –</b></p> <ul style="list-style-type: none"> <li>i. Primary Production – GPP &amp; NPP.</li> <li>ii. Secondary Production.</li> <li>iii. Standing Crop (Biomass).</li> </ul> <p><b>c. Ecological Pyramids – of Number, Biomass &amp; Energy with examples</b></p>	
<p><b>III</b></p>	<p><b>1. Ecosystem Nutrient Cycling and Succession</b></p> <ul style="list-style-type: none"> <li><b>i. Concept of –</b> <ul style="list-style-type: none"> <li>a) Macro &amp; Micro-nutrients, deficiency syndrome, Functions</li> <li>b) Nutrient Cycling—Biogeochemical Cycles –           <ul style="list-style-type: none"> <li>• <b>Gaseous Cycles</b> – Hydrological, Carbon &amp; Nitrogen Cycles.</li> <li>• <b>Sedimentary Cycles</b> – Phosphorus &amp; Sulphur Cycles.</li> </ul> </li> </ul> </li> </ul> <p><b>2. Human Impact on Biogeochemical Cycles.</b></p> <p><b>3. Ecological succession</b></p> <ul style="list-style-type: none"> <li>i. <b>Causes</b> of Succession.</li> <li>ii. <b>Basic Types</b> – Primary, Secondary, Autogenic, Allogenic ...etc.</li> <li>iii. <b>Mechanism</b> of Succession –       <ul style="list-style-type: none"> <li>a) Nudation.</li> <li>b) Invasion.</li> <li>c) Competition, Co-action &amp; Reaction.</li> <li>d) Stabilisation (Climax).</li> </ul> </li> <li>iv. <b>Models</b> of succession –Hydrosere and Lithosere.</li> </ul>	<p><b>08</b></p>

<p><b>IV</b></p>	<p><b>1. Population Ecology</b></p> <ul style="list-style-type: none"> <li>i. Introduction &amp; Basic Concepts.</li> <li>ii. Population Characteristics – <ul style="list-style-type: none"> <li>a) Size &amp; Density.</li> <li>b) Dispersion – Random, Aggregate &amp; Uniform.</li> <li>c) Natality (Potential &amp; Realised).</li> <li>d) Fecundity</li> <li>e) Mortality (Potential &amp; Realised).</li> <li>f) Survivorship Curves.</li> <li>g) Age &amp; Sex Structure.</li> <li>h) Life Table and Viability analysis</li> </ul> </li> </ul> <p><b>2. The Concept of Carrying Capacity.</b></p> <p><b>3. Population Growth –</b></p> <ul style="list-style-type: none"> <li>a) Growth Curves – Exponential &amp; Logistic.</li> <li>b) Population Fluctuation.</li> <li>c) Biotic Potential &amp; Environmental Resistance.</li> </ul>	<p><b>08</b></p>
<p><b>V</b></p>	<p><b>1. Community Ecology and Succession</b></p> <ul style="list-style-type: none"> <li>i. <b>Characteristics of Community</b> - Species Diversity, Growth form &amp; Structure, Dominance, Succession, Trophic Structure, Ecological Niche, Ecotone &amp; Edge Effect.</li> </ul> <p><b>2. Characters used in Community Structure-</b></p> <ul style="list-style-type: none"> <li>i. Analytical Characters – Quantitative and Qualitative.</li> <li>ii. Synthetic Characters.</li> </ul> <p><b>3. Inter-specific Relationships---</b> Commensalism, Parasitism, Mutualism, Symbiosis, Predation, Amensalism, Neutralism</p> <p><b>4. Intra-specific Relationships---</b> Association, Aggregation, Social Life, Territoriality</p>	<p><b>06</b></p>

## References:

- 1) Understanding Environment; Chokkar K. B., Pandya M. & Raghunathan M.; Centre for Environment Education; Sage Publication, New Delhi.
- 2) Ecology – Principles & Applications; Chapman J. L. & Reiss M. J.; Cambridge University Press.
- 3) Fundamentals of Ecology; Odum P.E.; Natraj Publishers; Dehradun; 3 Edt..
- 4) Ecology, Environment & Resource Conservation; Singh J.S., Singh S.P. & Gupta S.R.; Annamaya Publishers; New Delhi.
- 5) Ecology & Environment; Sharma P.D.; Rastogi Publication; Meerut; 11 Rev. Edt..
- 6) Environment Science; Tyler M.G.; Wadsworth Publishing Co.; 1997.
- 7) Perspective in Environmental Studies; Kaushik & Kaushik; New Age International Pvt. Ltd. Publishers.
- 8) Environmental Science; Santra S.C.; New Central Book Agency (P) Ltd.; 2 Edt..
- 9) Manual for Field Ecology; Mishra R.
- 10) Gurevitch, J., Scheiner, S. M., & Fox, G. A. 2002. The Ecology of Plants. Sinauer associates incorporated
- 11) Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders.





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**Syllabus for S.Y.B.Sc. Environmental Science**  
**2022-23 (CBCS – Autonomy 21 Pattern)**

<b>Course/ Paper Title</b>	Natural Resource Conservation and its Management
<b>Course Code</b>	21SBEV232
<b>Semester</b>	III
<b>No. of Credits</b>	2 (36 Lectures of 50 minutes)

**Aims & Objectives of the Course**

<b>Sr. No.</b>	<b>Objectives</b>
1.	To understand the Concept of Natural Resources & its Importance
2.	To understand Generation, Extraction and impacts of Natural Resources by Human activities on the Earth's Environment
3.	To encourage Sustainable Management of Natural Resources & Minimize depletion of Natural Resources
4.	To understand Management of Resources with Case studies

**Expected Course Specific Learning Outcomes**

<b>Sr. No.</b>	<b>Learning Outcome</b>
1.	To Understand effective Natural Resource Management strategies
2.	To inculcate values for Conservation Natural Resources

3.	To understand Sustainable Management of Resources in everyday life
4.	To train students to Conserve and Protect Natural Resources

### Syllabus

Unit No.	Title with Contents	No. of Lectures
<b>I</b>	<p><b>Introduction to Resources</b></p> <ol style="list-style-type: none"> <li>1. Definition and Meaning of Natural Resources</li> <li>2. Classification of Natural Resources based on Origin , Recovery rate, Natural &amp; Artificial, Material &amp; Energy Resources</li> <li>3. Importance &amp; Scope of Natural Resources</li> <li>4. Regenerative &amp; Assimilative Capacity of the Earth</li> <li>5. Man' s interaction with Natural Resources               <ol style="list-style-type: none"> <li>i. As important resource</li> <li>ii. Waste sink</li> <li>iii. Cultural significance</li> </ol> </li> <li>6. Problems and Degradation of Natural Resources</li> <li>7. Resource Management &amp; Conservation Methods – Concept of Sustainability ,Science &amp; Development, Framework for Resource Management Strategies, Approaches in Resource Management- Ecological, Economic, Ethnological approach, Principles &amp; Strategies of Energy Conservation, Indian Renewable Energy Programme</li> </ol>	<b>06</b>
<b>II</b>	<p><b>Forest Resources &amp; Mineral Resources</b></p> <p>Forest Resources</p> <ol style="list-style-type: none"> <li>1. Functions and importance of Forest resources</li> <li>2. Human Interaction with Forest – Over exploitation , Deforestation( Causes &amp; Effects)</li> <li>3. Forest Management in India –JFM, EDP, Protected areas, Social Forestry , Laws related to Forest Management in India</li> </ol>	<b>06</b>

	<p>4. Case studies related to –Timber extraction, Dam construction on tribal people</p> <p><b>Mineral Resources</b></p> <ol style="list-style-type: none"> <li>1. Mineral resources definition with examples</li> <li>2. Importance and application of Mineral Resources</li> <li>3. Overexploitation of Mineral Resources</li> <li>4. Mining , types of mining –Land mining &amp; Ocean Mining</li> <li>5. Mining &amp; its impact on Ecosystem with case studies</li> <li>6. Conservation of Mineral Resources</li> </ol>	
<b>III</b>	<p><b>Food Resources &amp; Water Resources</b></p> <p>Food Resources</p> <ol style="list-style-type: none"> <li>1. World Food Problems , Food security</li> <li>2. Green Revolution in India –Concept, Impact in India, positive and negative impacts</li> <li>3. Agricultural intensification</li> <li>4. Introduction to Hybrid varieties, Genetically Modified Crops</li> <li>5. Effects of Modern Agricultural Technologies</li> <li>6. Chemical Fertilizer &amp; Pesticide Problems in Water , Soil &amp; Environment</li> <li>7. Organic Farming, Bio pesticides , Bio fertilizers , Crop Rotation , Traditional Agricultural Methods etc</li> </ol> <p><b>Water Resources</b></p> <ol style="list-style-type: none"> <li>1. Water Resources &amp; Its Distribution on Earth Use and Over utilization of Surface &amp; Groundwater , Pollution</li> <li>2. Water Crisis in World &amp; India</li> <li>3. Conflicts over Water in World &amp; India –Case studies</li> <li>4. Conservation &amp; Management of Water Resources <ol style="list-style-type: none"> <li>i. Traditional Methods of Water Conservation</li> <li>ii. Rain water Harvesting &amp; Ground water Recharge</li> <li>iii. Water shed Management- Concept</li> </ol> </li> </ol>	<b>08</b>
<b>IV</b>	<p><b>Land &amp; Wild life , Marine Resources</b></p> <p>Land Resources</p> <ol style="list-style-type: none"> <li>1. Importance of Soil</li> </ol>	<b>08</b>

	<ol style="list-style-type: none"> <li>2. Soil Erosion –Causes Water &amp; Wind Erosion &amp; Consequences of Soil Erosion</li> <li>3. Soil Degradation- Pollution, Use of Fertilizers, Heavy metals, Plastic Pollution</li> <li>4. Soil Conservation Methods</li> <li>5. Sustainable Agriculture</li> </ol> <p><b>Wild Life Resources</b></p> <ol style="list-style-type: none"> <li>1. Meaning and Definition of Wild life</li> <li>2. Importance of Wildlife, Causes &amp; Threat to Wildlife</li> <li>3. Protection &amp; Conservation of Wild life –Laws, Protected Areas</li> </ol> <p><b>Marine Resources</b></p> <ol style="list-style-type: none"> <li>1. Fisheries &amp; other Marine Resources</li> <li>2. Threat to Coastal and Marine Resources</li> <li>3. Conservation of Marine Resources</li> </ol>	
<p><b>V</b></p>	<p><b>Energy Resources</b></p> <ol style="list-style-type: none"> <li>1. Classification of Energy Resources</li> <li>2. Introduction to waste to energy</li> <li>3. Energy Crisis, Energy Scenario in World &amp; India</li> <li>4. Conventional Energy Resources –Coal, Oil, Natural Gas, Nuclear Energy &amp; their impacts on Environment</li> <li>5. Non-Conventional Energy Resources – Solar energy, Wind Energy, Hydro -electricity , Tidal energy , Ocean Thermal energy, Wave energy, Bioenergy- Biomass gasification &amp; Biomass Programme, Energy Plantation program, Biogas, Bio -Ethanol, Biodiesel</li> <li>6. Principles of Energy Management –Energy Audit</li> </ol>	<p><b>08</b></p>

## References:

- 1) Owen , O .S Chiras ,D.D & Reganold, J.P ,1988 .Natural Resource Conservation – Management for Sustainable Future (7<sup>th</sup> Edition ).Prentice Hall
- 2) Craig ,J.R ,Vaughan .D.J & Skinner .B.J. 1996 .Resources of the Earth :Origin, Use, and Environmental impacts (2nd Edition), Prentice Hall, New Jersey
- 3) Freeman, A.M .2001.Measures of value and Resources : Resources for Future .Washington DC.
- 4) Freeman, A.M 2003. Millennium Ecosystem Assessment : Conceptual Framework .Island Press
- 5) Ginley , D.S & Cahen ,D.2011 .Fundamentals of Materials for Energy and Environmental Sustainability ,Cambridge University Press
- 6) Klee, G.A ,1991, Conservation of Natural Resources , Prentice Hall Publication
- 7) Miller, T.G ,2012, Environmental Science ,Wadsworth Publishing Co.
- 8) Ramade, F. 1984, Ecology of Natural Resources , John Wiley & Sons Ltd.
- 9) Tiwari ,G.N & Ghosal .M.K , 2005, Renewable Energy Resources: Basic Principles and Applications ,Narosa Publishing House



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## **Syllabus for S.Y.B. Sc. Practical Course on Ecological studies and Resource**

### **Conservation**

**2022-23 (CBCS – Autonomy 21 Pattern)**

<b>Course/ Paper Title</b>	Practical Course on Ecological studies and Natural Resource Conservation
<b>Course Code</b>	21SBEV233
<b>Semester</b>	III
<b>No. of Credits</b>	2

### **Aims & Objectives of the Course**

<b>Sr. No.</b>	<b>Objectives</b>
1.	To understand the concept like Rain water harvesting, Watershed management, water and energy audit.
2.	To understand the importance of social media for dissemination of information about various current environmental issues.
3.	To know the importance of practical's from ecological point of view.

### **Expected Course Specific Learning Outcomes**

<b>Sr. No.</b>	<b>Learning Outcome</b>
1.	To know the importance of Shannon- Simpsons diversity index in understanding the phytosociology
2.	To learn about vegetation sampling methods.
3.	To create awareness about current environmental issues and their socio-economic aspects/impacts

## Syllabus

Unit No.	Title with Contents	Practical Sessions
1	Measurement of Primary Productivity of grassland by Harvest Method.	Field + Laboratory.
2	Estimation of Total Chlorophyll from plants in Clean & Polluted Environment.	Laboratory.
3	Study of grassland vegetation by List Count Quadrat Method to determine the Frequency, Density & Abundance.	Field + Laboratory
4	Determination of Frequency & Abundance of Species across terrestrial – aquatic transitional zone, by Line Transect Method.	Field + Laboratory
5	Determination of Density of species across terrestrial – aquatic transitional zone by Belt Transect Method.	Field + Laboratory
6	Field visit to study Watershed Mgmt. Techniques. ( Hivre Bazaar / Ralegaon Siddhi)	Visit.
7	Continuation of the use of Social Media for e-networking & dissemination of ideas on Environmental Issues Pertaining to the Course.	---
8	Identification of advanced cultivars in the Local market	Visit.
9	Field visit to study Rain water Harvesting technique	Visit.
10	Determination of minimum area and number of quadrates for vegetation	Field + Laboratory
11	Determination of Shannon Diversity Index of a vegetation ( Data sheet)	Laboratory.
12	Estimation of Importance Value Index from collected vegetation data.	Field + Laboratory
13	Determination of Simpson Diversity Index of a vegetation (Data sheet)	Laboratory.

<b>14</b>	Visit to lake Ecosystem to study ecological succession	Visit
<b>15</b>	To study the process of Energy audit	Laboratory
<b>16</b>	To study the process of water audit	

**References:**

- 1) Manual for Field Ecology; Mishra R.
- 2) Handbook of Methods in Environmental Studies Vol-I &II; Maiti S.K.; ABD Publishers; Jaipur





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### **Syllabus for S.Y.B. Sc. Environmental Science**

**2022-23 (CBCS – Autonomy 21 Pattern)**

<b>Course/ Paper Title</b>	Biological Diversity & Conservation
<b>Course Code</b>	21SBEV241
<b>Semester</b>	IV
<b>No. of Credits</b>	2 (36 Lectures of 50 minutes)

#### **Aims & Objectives of the Course**

<b>Sr. No.</b>	<b>Objectives</b>
<b>1.</b>	To introduce ethical values for protection, preservation and sustainable management of biological diversity
<b>2.</b>	To encourage incitation of sustainable use of the components of biodiversity in students
<b>3.</b>	To bring sensitization towards the biodiversity but also increase Student competency & employability
<b>4</b>	To share the benefits arising from the commercial and other utilization of biodiversity in a fair and equitable way
<b>5.</b>	To impart knowledge about endemic, endangered and rare species for conservation
<b>6.</b>	To embrace the implications of new technological forces for the future of biodiversity, science & management

#### **Expected Course Specific Learning Outcomes**

<b>Sr. No.</b>	<b>Learning Outcome</b>
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1.	Students will explore the complexity of biodiversity.
2.	Students will come to know the importance of the subject in day today's life, thus understanding the basics of threats and importance of biodiversity
3.	Students will learn about certain species' roles in an ecosystem and how life on earth is intrinsically related with conservation of biodiversity.
4.	Students will understand about how the subject knowledge helps in solving various social, economic and environment related problems

## Syllabus

Unit No.	Title with Contents	No. of Lectures
<b>I</b>	<p><b>Introduction to Biological Diversity---</b></p> <ol style="list-style-type: none"> <li>1. The Concept, Definition</li> <li>2. Levels – Ecosystem, Species &amp; Genetic.</li> <li>3. Methods of assessment of Biological diversity</li> </ol> <p><b>Ecosystem Diversity</b></p> <ol style="list-style-type: none"> <li>1. <b>Classification of Ecosystem –</b> <ol style="list-style-type: none"> <li>a) Udvardy's Classification.</li> <li>b) Bailey's Classification.</li> <li>c) Olsen's Classification.</li> <li>d) Holdridge's Classification.</li> </ol> </li> <li>2. <b>Major Ecosystem types of India</b> with their physical &amp; biological characteristics.</li> <li>3. <b>Major Ecosystem types of the World</b> with their physical &amp; biological characteristics.</li> <li>4. <b>Importance of Ecosystem in maintaining Ecological balance</b></li> </ol>	<b>06</b>

<p><b>II</b></p>	<p><b>Species diversity</b></p> <ol style="list-style-type: none"> <li>1. <b>Species Diversity</b> at Local , National and International Level</li> <li>2. Special features and Latest estimates for major groups of Plants, Animals &amp; Microbes.</li> <li>3. <b>Measuring Species Diversity</b> – Species Richness, Species Abundance and Species Evenness.</li> <li>4. <b>Factors</b> affecting global distribution of Species Richness – Latitudinal, Altitudinal, Rainfall gradients, temperature...etc.</li> <li>5. <b>Endemism</b> – <ol style="list-style-type: none"> <li>a) The Concept.</li> <li>b) Types with Examples</li> <li>c) Endemism in India</li> </ol> </li> <li>6. <b>Centers of Diversity</b> – <ol style="list-style-type: none"> <li>a) The Concept.</li> <li>b) Centers of Diversity : Analyses at Global Level –</li> </ol> </li> <li>7. <b>Concept of hotspot</b> <ol style="list-style-type: none"> <li>5. Myer’s Hot-spots.</li> <li>6. Mega-diversity Centers / Countries.</li> <li>7. Western Ghat and North eastern Himalayas as a Hot-spot.</li> </ol> </li> <li>8. <b>India as a Mega-diversity Country</b></li> </ol>	<p><b>08</b></p>
<p><b>III</b></p>	<p><b>Genetic Diversity</b></p> <ol style="list-style-type: none"> <li>1. <b>Definition &amp; Introduction</b> to Genetic Variations in Species</li> <li>2. <b>Nature &amp; Origin</b> of Genetic Variations</li> <li>3. <b>Factors</b> affecting Genetic Diversity</li> <li>4. <b>Measurement of Genetic Diversity</b> – <ol style="list-style-type: none"> <li>a) Based on DNA &amp; Chromosomes.</li> <li>b) Molecular Marker Techniques.</li> </ol> </li> <li>5. <b>Transgenic Organisms.</b></li> <li>6. <b>Diversity in Domesticated Species</b> – <ol style="list-style-type: none"> <li>a) Variations since the first domestication to the present.</li> </ol> </li> </ol>	<p><b>06</b></p>

	<ul style="list-style-type: none"> <li>b) Land Races,</li> <li>c) Advanced Cultivars,</li> <li>d) Wild Relatives of Cultivated Plants &amp; Feral Plants.</li> </ul>	
<b>IV</b>	<p><b>Significance &amp; Threat to Biodiversity</b></p> <p><b>(Significances)</b></p> <ul style="list-style-type: none"> <li>1. Ecological Significances – Contribution of Biodiversity to various Eco-Services.</li> <li>2. Non Ecological Significances – Nutritional, Medicinal, Aesthetic, Cultural, Commercial Values ...etc.</li> <li>3. Optional Values, Use of microorganism in remediation of pollution</li> </ul> <p><b>(Threats)</b></p> <ul style="list-style-type: none"> <li>4. Threats with suitable Examples – <ul style="list-style-type: none"> <li>a) Large Scale Dev. Projects – Habitat Destruction &amp; Fragmentation.</li> <li>b) Changing Agriculture &amp; Forestry Practices.</li> <li>c) Invasion by Introduced Species.</li> <li>d) Over-exploitation.</li> <li>e) Environment Pollution.</li> <li>f) Global Climate Change.</li> <li>g) Loss of Traditional Knowledge.</li> <li>h) Nature of Legal &amp; Mgmt. System – Human Wildlife Conflict.</li> </ul> </li> </ul>	<b>06</b>
<b>V</b>	<ul style="list-style-type: none"> <li><b>1. Conservation Methods</b> – In-situ &amp; Ex-situ methods with Examples</li> <li><b>2. National Conservation Efforts</b> – <ul style="list-style-type: none"> <li>a) The laws – Environment Protection Act 1986, Forest Act 1927, Wildlife Act 1972, The Biodiversity Act 2002</li> <li>b) Involving People’s Participation – NBSAP, PBR</li> <li>c) Involving Community Participation – JFM, EDP</li> <li>d) People’s Movement – Silent Valley Movement, Beej Bachao Andolan</li> </ul> </li> </ul>	<b>10</b>

	<p><b>3. International Conservation Efforts –</b></p> <p>a) IUCN – The World Conservation Union.  b) CBD.  c) CITES.</p> <p><b>4. Traditional Methods of Conservation –</b>  Sacred Groves / Ponds / Species, Periodic restrictions on resource harvesting...etc.</p> <p><b>5. Need &amp; Awareness.</b></p> <p><b>6. Ethics of Conservation –</b> Values of Biodiversity (Economic &amp; Legal), Biopiracy, Hybridized plants, GM crops (benefits &amp; criticism), , Ethical and Conservation issues related to uses of biodiversity, Global Conservation Issues</p>	
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## Reference Books

- 1) Gaston, K J. & Spicer, J.I. 1998. Biodiversity: An Introduction. Blackwell Science, London, UK.
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- 11) Ecology – Principles & Applications; Chapman J. L. & Reiss M.J.; Cambridge University Press.

- 12) Fundamentals of Ecology; Odum P.E.; Natraj Publishers; Dehradun; 3 Edt..
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**M. C. E. Society's**  
**Abeda Inamdar Senior College**  
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**Syllabus for S.Y.B. Sc. Environmental Science**  
**2022-23 (CBCS – Autonomy 21 Pattern)**

<b>Course/ Paper Title</b>	Environmental Pollution & Control Technology
<b>Course Code</b>	21SBEV242
<b>Semester</b>	IV
<b>No. of Credits</b>	2 (36 Lectures of 50 minutes)

**Aims & Objectives of the Course**

<b>Sr. No.</b>	<b>Objectives</b>
<b>1.</b>	To understand various Environmental Pollution Management Techniques with respect to Air, Water, Soil ,Solid waste & Noise Pollution
<b>2.</b>	To impart knowledge and skills in Management with respect to Air, Water, Soil ,Solid waste Management& Noise Pollution

**Expected Course Specific Learning Outcomes**

<b>Sr. No.</b>	<b>Learning Outcome</b>
<b>1.</b>	Able to describe & solutions to address environmental issues including pollution
<b>2.</b>	To develop Environmentalist students and sensitize them towards Environmental issues

<b>3.</b>	Acquiring values and attitudes towards understanding complex environmental economic-social challenges, and participating actively in solving current environmental problems and preventing the future ones
<b>4.</b>	Adopting sustainability as a practice in life, society and industry

### Syllabus

Unit No.	Title with Contents	No. of Lectures
<b>I</b>	<p><b>Control of Air Pollution</b></p> <ol style="list-style-type: none"> <li>1. Air Quality standards by WHO and National Standards</li> <li>2. Air Sampling Techniques</li> <li>3. Plume Behavior</li> <li>4. Control at Source               <ol style="list-style-type: none"> <li>i. Raw Material change</li> <li>ii. Process/Operational changes</li> <li>iii. Equipment Modification /Replacement</li> </ol> </li> <li>5. Air Pollution Control in Industries               <ol style="list-style-type: none"> <li>i. Condensation</li> <li>ii. Absorption</li> <li>iii. Adsorption</li> <li>iv. Filtration</li> <li>v. Electrostatic Precipitation</li> <li>vi. Gravity Settling</li> <li>vii. Wet Scrubbing</li> </ol> </li> <li>6. Control of Emissions from Automobiles               <ol style="list-style-type: none"> <li>i. Redesigned engines</li> <li>ii. Catalytic converters</li> </ol> </li> </ol>	<b>08</b>
<b>II</b>	<p><b>Water Quality Control Technologies</b></p> <ol style="list-style-type: none"> <li>1. Objectives /Purpose of Water Quality Control technology</li> <li>2. Water Sample Collection ( Types of sample, chain of custody, sampling method, number of samples, sample containers, sample volume etc)</li> <li>3. Water Sample Preservation , Handling &amp; Storage , Labeling</li> </ol>	<b>08</b>



	<p>4. Waste Water Treatment</p> <ul style="list-style-type: none"> <li>i. Primary Treatment – Screening ,Grit Removal , Sedimentation</li> <li>ii. Secondary Treatment <ul style="list-style-type: none"> <li>1. Aerobic Treatment – Activated Sludge, Trickling Filters, Rotating Biological Contractors , Oxidation Pond</li> <li>2. Anaerobic Treatment</li> </ul> </li> <li>iii .Tertiary Treatment –Disinfection ( Chlorination ), Biogas</li> <li>iv. .Advanced Treatment – Carbon Adsorption, Reverse Osmosis , Ion Exchange</li> </ul> <p>5. Concept of ZLD ( Zero Liquid Discharge)</p>	
<b>III</b>	<p><b>Control of Solid Waste Pollution</b></p> <ul style="list-style-type: none"> <li>1. Material separation Techniques &amp; Processing – Recovery, Reuse, Recycle</li> <li>2. Mechanical Volume &amp; Size Reduction – <ul style="list-style-type: none"> <li>i. Dewatering &amp; Drying</li> <li>ii. Size Reduction/Shredding</li> </ul> </li> <li>3. Disposal/ Management Techniques- Sanitary Landfill, Composting, Incineration, Pyrolysis , Injection Well, Gasification, Ocean Dumping</li> <li>4 .Hazardous Waste Management – Waste Management Treatment , Storage &amp; Disposal</li> <li>5. Bio-Medical Waste Management Categorization, Segregation , Packaging/ Colour coding and Treatment , Transport &amp; Disposal</li> </ul>	<b>08</b>
<b>IV</b>	<p><b>Control of Soil Pollution</b></p> <ul style="list-style-type: none"> <li>1. Objectives of Soil Pollution Control</li> <li>2. Sampling and Sample units, sample number, frequency , timing , Sampling Methodology <ul style="list-style-type: none"> <li>i. Site selection</li> <li>ii. In filed sampling Techniques</li> <li>iii. Describing the Soil Profile</li> <li>iv. Setting Transect instrument/Equipment used</li> <li>v. Guidelines for handling and storage of samples</li> </ul> </li> </ul>	<b>08</b>

	<p>vi. Physiochemical &amp; Biological Parameters</p> <p>3 Biological Methods to control Soil Pollution</p> <p>i. To reduce dependency on chemicals-Use of Bio Fertilizers, Bio-Pesticides, Conservational Tillage, Mixed Cropping , Crop Rotation, Biological Pest Management, Organic Farming , Soil Conservational Methods</p>	
<b>V</b>	<p><b>Control of Noise Pollution</b></p> <p>1. Noise Measuring Methods &amp; Instruments</p> <p>2. Noise Control Techniques</p> <p>    i. Sound Insulation</p> <p>    ii. Sound Absorption</p> <p>    iii. Vibration Damping</p> <p>    iv. Active Noise Control/ Cancellation</p> <p>3. Noise Control at Source</p> <p>    i. Selection &amp; Maintenance of Machines</p> <p>    ii. Control over Vibrations</p> <p>    iii. Installations of Barriers/Enclosures</p> <p>    iv. Using Protective Equipment's</p> <p>    v. Noise Proof Walls</p>	<b>04</b>

**References:**

- 1) Environmental Chemistry, Dey A. K.; New Age International Publishers; 6 Edt.. •
- 2) Air Pollution; Rao M.N. & Rao H.V.N.; Tata McGraw Hill; New Delhi; 1989.
- 3) Environmental Pollution Control & Environmental Engineering; Rao C. S.; Tata McGraw Hill; New Delhi; 1994.
- 4) Pollution Management; Agarwal S.K.
- 5) Environmental Science; Daniel Chiras.
- 6) Waste Water Engineering, Treatment, Disposal & Reuse; Metcalf & Eddy.
- 7) Manual for Field Ecology; Mishra R.
- 8) Handbook of Methods in Environmental Studies Vol-I &II; Mailti S.K.; ABD Publishers; Jaipur.
- 9) Physico-Chemical Examination of Water, Sewage & Industrial Effluents; Manivasakam N.; Pragati Prakashan; Meerut; 1984

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- 14) Advanced Air and Noise Pollution Control – L.K Wang & N.C Pereira
- 15) Textbook of Noise Pollution & Its Control – S.C. Bhatia
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- 17) Environmental Pollution Control & Environmental Engineering; Rao C. S.; Tata McGraw Hill; New Delhi; 1994.



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**Syllabus for S.Y.B.Sc. Practical Course on Biodiversity and Pollution Control Technology**  
**2022-23 (CBCS – Autonomy 21 Pattern)**

<b>Course/ Paper Title</b>	Practical Course on Biodiversity and Pollution Control Technology
<b>Course Code</b>	21SBEV243
<b>Semester</b>	IV
<b>No. of Credits</b>	2

**Aims & Objectives of the Course**

<b>Sr. No.</b>	<b>Objectives</b>
1.	To understand the concept like Nature Interpretation Centre, in-situ and Ex-situ conservation, Soil sampling techniques.
2.	To understand the importance of control measures of environmental components like air, soil, water etc.
3.	To know about the various parameters of water and noise pollution

**Expected Course Specific Learning Outcomes**

<b>Sr. No.</b>	<b>Learning Outcome</b>
1.	To know the importance of Shannon- Simpsons diversity index in understanding the phytosociology
2.	To learn about water and soil sampling methods.
3.	To create awareness about importance of various ecosystem form biodiversity point of view.

## Syllabus

Unit No.	Title with Contents	Practical Sessions
1	Study of Water Sampling and Preservation techniques	Field + Laboratory
2	Determination of Optimum Dose of Alum (Coagulant) required for water.	Laboratory.
3	Determination of Turbidity of water. (Turbidometer / Nephelometer)	Laboratory.
4	Determination of Residual Chlorine from treated water.	Laboratory.
5	Determination of Dissolved Oxygen in water by Winkler's method	Laboratory.
6	Determination of Nitrate from water ( Colorimeter)	Laboratory.
7	Determination of Phosphate from water. (Colorimeter)	Laboratory.
8	Determination of Soluble Salts from Soil.	Laboratory.
9	Determination of Available Nitrogen from soil.	Laboratory.
10	Measurement of sounds by DB meter / SLM in silent, industrial, residential and commercial zones and Analysis	Field + Laboratory
11	Visit to Solid waste Dumping Site	Field
12	Study of wetland (source region visit) and its vegetation and seasonal bird diversity.	Field
13	Visit to a sacred grove/Forest / Grassland / Marine ecosystem to assess its biodiversity	Field
14	Visit to Nature Interpretation / Information Centre.	Field
15	Visit to National Park / Wildlife Sanctuary to study Wildlife & various Inter-specific & Intra-specific Relations.	Field + Laboratory
16	Visit to Soil Survey Department.	Field + Laboratory
17	Study of Soil sampling techniques	Field + Laboratory

## References:

- 1) Air Pollution; Rao M.N. & Rao H.V.N.; Tata McGraw Hill; New Delhi; 1989.
- 2) Environmental Pollution Control & Environmental Engineering; Rao, C. S.; Tata McGraw Hill; New Delhi; 1994.
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