



**Anekant Education Society's**  
**Tuljaram Chaturchand College, Baramati.**  
*(Autonomous)*  
(Faculty of Science & Technology)

**F.Y.B.Sc. (Environmental Science) Semester-I**  
**For Department of Environmental Science**  
**Tuljaram Chaturchand College, Baramati.**

## Programme Specific Outcomes (PSOs)

**PO1: Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work.

**PO2: Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.

**PO3: Social competence:** Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibit thoughts and ideas effectively in writing and orally

**PO4: Research-related skills and Scientific temper:** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.

**PO5: Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem

**PO6: Personal and professional competence:** Performing dependently and also collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self- motivation and adaptability skills and commit to professional ethics.

**PO7: Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.

**PO8: Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

**PO9: Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Anekant Education Society's  
**TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE & COMMERCE,**  
**BARAMATI.**  
**AUTONOMOUS**  
**F.Y.B.Sc. Scheme of Course Structure (Faculty of Science)**  
**Department: Environmental Science (2022- 2023)**

<b>Class</b>	<b>Semester</b>	<b>Paper Code</b>	<b>Title of Paper</b>	<b>No. of Credits</b>
F.Y.B.Sc.	I	USES111	Fundamentals of Environmental Science – I	2
		USES112	Fundamentals of Environmental Biology – I	2
		USES113	Practical based on USES111 & USES112	2
	II	USES121	Fundamentals of Environmental Science – II	2
		USES122	Fundamentals of Environmental Biology – II	2
		USES123	Practical based on USES121 & USES122	2

**SYLLABUS**  
**FIRST YEAR B.Sc. ENVIRONMENTAL SCIENCE**  
**ACADEMIC YEAR 2022-2023**  
**SEMESTER - I**  
**DEPARTMENT OF ENVIRONMENTAL SCIENCE**

**A. Learning objectives:**

- To learn basic characteristics of environment.
- To make the students aware about the environment and its significance.
- To learn about interrelationship and discipline in environment science.
- To make the students aware about resources.

**B. Learning outcomes :**

On completion of this subject, students will able to:

- Imparts conceptual knowledge of environment, their adaptations and interrelationship.
- Students would understand the knowledge about components of environment.
- Students will understand the knowledge about Environmental problems and their solutions.
- Study of biodiversity and apply that knowledge in day to day life.
- Students will acquire knowledge about bioresources.

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**PAPER CODE: USES111****PAPER - I: FUNDAMENTALS OF ENVIRONMENTAL SCIENCE - I****Credit -2: No. of Lectures 36.****Course Outcomes:****By the end of the course, students will be able to:**

- CO1.** Students would understand the knowledge about components of environment.
- CO2.** Students will understand the knowledge about Environmental problems and their solutions.
- CO3.** Discover knowledge in ecological perspective and value of environment.
- CO4.** Demonstrate a comprehensive understanding of the world's biodiversity and the importance of its conservation.
- CO5.** Understand the significance of various natural resources and its management.
- CO6.** Students develop critical-thinking skills, analyze real-world problems, and understand the power of narrative to create sustainable solutions for local and global communities.
- CO7.** To explore environmental issues, engage in problem solving, and take action to improve the environment.

**Unit I: Introduction:**

Definition, principles and scope of Environmental Science, Interrelationship of ecology with other disciplines, Multidisciplinary and dynamic nature of environmental science. 06

**Unit II: Components of Environment**

**Lithosphere:** Definition; Significance Types of rocks; weathering, Process of soil formation: Soil profile; Physical properties of soil, Chemical properties of soil, Soil micro flora, Types of soil. 06

**Hydrosphere:** Definition, significance, Distribution of water in world and India, Physical properties of water; Chemical properties of water, Hydrological cycle, Stoichiometry. 06

**Atmosphere:** Definition, Significance Composition of Atmosphere; Physico:-chemical structure of atmosphere: Troposphere, Stratosphere, Mesosphere, Ionosphere, Exosphere. 06

**Unit III: Man & Biosphere:**

Definition of Biosphere, Components of biosphere, Biodiversity, Concept of Holocene, Holocene Climate Optimum, Characteristics and causes of the Anthropocene, Human influence

on environment, Current Environmental issues: Greenhouse effect, Global warming, Climate change etc. 06

#### **Unit IV: Role of Environmental Education**

Concept of Environmental Education, History and nature of education in India, environmental challenges, Awareness and action through environmental education, Role of NGOs and Government in environmental education, importance of community Participation. 06

#### **References:**

- 01. Fundamentals of Ecology:** Eugene P. Odum, (Natraj Publishers, Dehradun.)
- 02. Climatology:** D.S.Lal (Sharda Pustak Bhawan, Allahabad)
- 03. Environmental Geography :** Savindra Singh (Pravalika Publications, Prayagraj)
- 04. Physical Geography:** Savindra Singh (Pravalika Publications, Prayagraj)
- 05. Disaster Management:** Savindra Singh (Pravalika Publications, Prayagraj)
- 06. Principles of Ecology:** P. S. Verma, V. K. Agarwal ( S. Chand and Co. New Delhi)
- 07. Environmental Biology:** P. D. sharma ( Rastogi Publications, Meerut )
- 08. Ecology and Environment:** P. D. sharma ( Rastogi Publications, Meerut )
- 09. Principles of Environmental Biology:** P. K. G. Nair (Himalaya Publishing House, New Delhi)
- 10. Environmental Biology:** M. P. Arora (Himalaya Publishing House, New Delhi )
- 11. Environmental Science:** Enger Smith, Smith, W. M. C. Brown (Company Publishing)
- 12. Principles of Soil Science:** Watt K. E. F. (1973), (McGraw Hill Book Company, New Delhi)
- 13. Introduction to Environmental Studies:** Turk & Turk
- 14. Ecology and Field Biology:** Robert Leo Smith ( Harper Collins college publication )
- 15. General Ecology:** H. D. Kumar ( Vikas Publishing house, New Delhi )
- 16. Elements of Ecology:** Brijgopal, N. Bharadwaj ( Vikas Publishing house, New Delhi )
- 17. Fundamentals of Environmental Science :** G. S. Dahliwal, G. S. Sangha, P. K. ralhan( Kalyani Publishers, New Delhi )
- 18. Environmental Ecology :** Bill Freedman ( Academic Press, New York )
- 19. Concepts of Ecology :** N. Arumugam ( Saras Publication, Kottar, Dist. Kanyakumari )
- 20. Plant Ecology :** P. L. Kochhar
- 21. Environmental Science and Engineering:** Dr.N.Arumugam, Prof.V.Kumaresan( Saras Publication, Kottar, Dist. Kanyakumari )
- 22. Perspectives in Environmental Studies:** Anubha Kaushik, C.P.Kaushik (New Age International(P) Limited, Publishers)

**Mapping of Program Outcomes with Course Outcome**

<b>Programme Outcomes (POs)</b>									
<b>Course Outcomes</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO1</b>	3							2	
<b>CO2</b>	3							2	
<b>CO3</b>	3			2					
<b>CO4</b>	3			2					
<b>CO5</b>	3							2	
<b>CO6</b>		3							2
<b>CO7</b>			3				2		

**Justification for the mapping****PO1: Disciplinary Knowledge:**

CO1, CO2, CO3, CO4, CO5 These course outcomes collectively contribute to students' understanding of the components of the environment, environmental problems and solutions, ecological perspectives, and the importance of biodiversity and its conservation, as well as the significance of natural resources and their management.

**PO2: Critical Thinking and Problem solving:**

CO6. Is specifically designed to develop critical-thinking skills in students, helping them analyze real-world problems and understand the narrative's power to create sustainable solutions for local and global communities.

**PO3: Social competence:**

CO7. Involves students exploring environmental issues, engaging in problem-solving and taking action to improve the environment. This directly contributes to developing social competence as students work on environmental challenges collaboratively.

**PO4: Research-related skills and Scientific temper:**

CO3 involves students discovering knowledge in an ecological perspective, CO4 requires them to demonstrate a comprehensive understanding of the world's biodiversity. Both these outcomes contribute to research-related skills and a scientific temper.

**PO7: Effective Citizenship and Ethics:**

CO7. Which involves taking action to improve the environment, directly aligns with the development of effective citizenship and ethical considerations.

**PO8: Environment and Sustainability:**

CO1 and CO2 cover the knowledge about components of the environment and environmental problems and solutions.

CO5. Focuses on the significance of various natural resources and their management.

**PO9: Self-directed and Life-long learning:**

CO6. Which involves developing critical-thinking skills and understanding narrative power, contributes to students becoming self-directed learners prepared for life-long learning.

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**PAPER CODE: USES112****PAPER - II: FUNDAMENTALS OF ENVIRONMENTAL BIOLOGY - I****Credit -2: No. of Lectures 36.****Course Outcomes:****By the end of the course, students will be able to:**

- CO1.** Students will acquire knowledge about bioresources.
- CO2.** Study of biodiversity and apply that knowledge in day to day life.
- CO3.** Imparts conceptual knowledge of environment, their adaptations and interrelationship.
- CO4.** Use interdisciplinary approaches such as ecology, economics, ethics and policy to devise solutions to environmental problems.
- CO5.** Be proficient in ecological field methods such as wildlife survey, biodiversity assessment, mathematical modeling and monitoring of ecological systems.
- CO6.** Apply the scientific method and quantitative techniques to describe, monitor and understand environmental systems.
- CO7.** Evaluate current environmental issues and problems including the solutions and management practices that have been used or offered to address these issues and problems.

**Unit- I: Origin of Life and evolution:**

Introduction to Biology, branches, scope and importance. The origin of Life; Evolution of Life through the geological time i.e. – Eras, Periods, Epochs; Chemical evolution, Events of ‘Explosions’ and ‘Mass Extinctions’& Paleontological Evidences for these, Geological time scale,. 09

**Unit -II: Ecology & Ecosystem:**

Ecology and its types: Behavioral ecology, Population ecology, Community ecology, Landscape ecology. Structure & function of ecosystem, Ecological pyramids, Food chain, Food web Basis of Ecosystem classification. Types of Ecosystem: Terrestrial e.g. Desert (hot and cold), forest, rangeland, Aquatic e.g. wetlands, lotic, lentic, estuarine,(mangrove),Oceanic ecosystems. 09

**Unit -III: Ecology and Environment**

Major ecological types of India, Population ecology: Characteristics of population, concept of carrying capacity, population growth and regulations. Population fluctuations, dispersion and metapopulation. Concept of ‘r’ and ‘k’ species. Keystone species. Community ecology: Definition, community concept, types and interaction – predation, herbivory, parasitism and allelopathy. Biological invasions. 09



**Unit -IV: Ecological adaptation and Bioresources:**

Introduction, Ecological Adaptations under various environmental conditions –

In plants- hydrophytes, mesophytes, epiphytes, xerophytes & halophytes.

In animals- mimicry, vestigiality etc.

Bioresources- Definition, Bioindicator, Biopesticides, Biofertilizers, Biofuels, Biosensors. 09

**References:**

1. Ambashta R.S. & Ambashta N.K (1999) 'A Textbook of Plant Ecology' CBS Publ. & Distributers, New Delhi
2. Chapman J.L. & Reiss M.J. (1995) 'Ecology: Principles and Applications' Cambridge University Press
3. Cunningham W.P. & Saigo S.W. (1997) 'Environmental Science: A Global Concern' WCB, McGraw Hill
4. Sharma P.D. 'Elements of Ecology'
5. Tyler M.G. Jr. (1997) 'Environmental Science' Wadsworth Publ. Co
6. Vashista P.C. 'Textbook of Plant Ecology'
7. Smith R.L. 'Ecology and Field Biology'
8. Benny Joseph (2005) 'Environmental Studies' Tata McGraw Hill Publ. Co. Ltd.
9. 'Patterns in the Living World' – Biology-an Environmental approach, John Murray, London
10. 'Diversity Among Living Things' Biology-an Environmental approach, John Murray, London
11. Bell P.R. & Woodcock Christopher (1973) 'The Diversity of Green Plants' Edward Arnold Ltd.
12. Wilson N. Stewart (1983) 'Paleobotany and the Evolution of Plants' Cambridge University Press
13. 'Perspectives in Environmental Studies: Anubha Kaushik, C.P.Kaushik (New Age International(P) Limited, Publishers)
14. 'Environmental Science and Engineering: Dr.N.Arumugam,Prof.V.Kumaresan( Saras Publication, Kottar, Dist. Kanyakumari )
15. 'Environmental Biology: P. D. sharma ( Rastogi Publications, Meerut )
16. 'Ecology and Environment: P. D. sharma ( Rastogi Publications, Meerut )

**Mapping of Program Outcomes with Course Outcomes**

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3							2	
CO2	3							2	1
CO3	3			2				2	

<b>CO4</b>		3		2	1		2	2	1
<b>CO5</b>	3			2				2	
<b>CO6</b>	3	2		1				2	1
<b>CO7</b>		3					2		

### Justification for the mapping

#### **PO1: Disciplinary Knowledge:**

CO1. Focuses on bioresources,

CO2. Involves the study of biodiversity.

CO3. Imparts conceptual knowledge of the environment.

CO5. Involves proficiency in ecological field methods.

CO6. Applies the scientific method to understand environmental systems. All of these contribute to disciplinary knowledge in environmental science.

#### **PO2: Critical Thinking and Problem solving:**

CO4 involves using interdisciplinary approaches for problem-solving.

CO6 applies the scientific method and quantitative techniques,

CO7 evaluates current environmental issues and problems, collectively contributing to critical thinking and problem-solving skills.

#### **PO4: Research-related skills and Scientific temper:**

CO3. Involves imparting conceptual knowledge,

CO4. Involves interdisciplinary approaches,

CO5. Involves ecological field methods,

CO6. Applies the scientific method. These collectively contribute to research-related skills and a scientific temper.

#### **PO5: Trans-disciplinary knowledge:**

CO4. Involves using interdisciplinary approaches such as ecology, economics, ethics, and policy. This directly contributes to trans-disciplinary knowledge by integrating different disciplines in addressing environmental problems.

#### **PO7: Effective Citizenship and Ethics:**

CO4. Involves using interdisciplinary approaches, including ethics, to devise solutions to environmental problems.

CO7 involves evaluating current environmental issues and problems, considering solutions and management practices, contributing to effective citizenship and ethical considerations.

#### **PO8: Environment and Sustainability:**

CO1. Focuses on bioresources,

CO2. Involves the study of biodiversity,

CO3. Imparts conceptual knowledge of the environment,

CO4. Uses interdisciplinary approaches for problem-solving,

CO5. Involves ecological field methods, and

CO6. Applies the scientific method. Together, they address the broader Program Outcome related to Environment and Sustainability.

**PO9: Self-directed and Life-long learning:**

CO2. Involves applying knowledge of biodiversity in day-to-day life.

CO4. Involves using interdisciplinary approaches.

CO6. Involves applying the scientific method and quantitative techniques. These outcomes collectively contribute to students' ability to engage in self-directed and life-long learning by applying knowledge and skills beyond the classroom.

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**PAPER CODE: USES113****PAPER - III: PRACTICAL BASED ON USES111 & USES112****Semester –I****Course Outcomes:****By the end of the course, students will be able to:**

- CO1.** Demonstrate a comprehensive understanding of the world biodiversity and the importance of its conservation.
- CO2.** Understand the significance of various natural resources and its management.
- CO3.** Evaluate hazards and risks in order to carry out a risk assessment.
- CO4.** Students will use a variety of laboratory techniques to safely conduct chemical experiments and procedures.
- CO5.** To understand variety of ecosystem of their own locality.
- CO6.** Describe the ecological value and consumptive use of ecosystem.
- CO7.** Students will have opportunity to work in research lab, bio fertilizer industry and can also be bio-entrepreneurs.

1. To study the lab safety rules.
2. To study the basics of chemical preparation.
3. Determination of Soil and water pH and Electric Conductivity.
4. Determination of water holding capacity of a given soil sample.
5. To study of Soil Profile & Soil Texture.
6. Estimation of acidity of given water sample.
7. Estimation of alkalinity of given water sample
8. To determine the hardness of given water sample.
9. To study the ecological adaptation: Hydrophytes, Mesophytes, Epiphytes, Xerophytes, etc.
10. To study of preparation of Biofertilizers.
11. Study of vegetation by quadrat method.
12. Visit of any ecosystem and submission of Excursion report is compulsory at the time of practical examination.

**Reference:**

1. Environmental Science: A Practical Manual Book by G Lakshmi Swarajya and P Prabhu Prasadini (2018)
2. Environmental Chemical Analysis Laboratory Manual, Prepared by Dr. Erik Krogh, Dr. Chris Gill, Shelley Gellein, and Peter Diamente Department of Chemistry, 2018
3. Environmental Chemistry: S. e. Manahan
4. The Chemistry of Our Environment: R. A. Hom

**Mapping of Program Outcomes with Course Outcomes**

Programme Outcomes (POs)									
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3			2					1
CO2	3				2			1	
CO3		3					2		1
CO4		3							1
CO5			3					2	
CO6			3		2				
CO7			3	2		1	1		1

**Justification for the mapping****PO1: Disciplinary Knowledge:**

CO1. Demonstrate a comprehensive understanding of the world biodiversity and the importance of its conservation.

CO2. Understand the significance of various natural resources and its management.

**PO2: Critical Thinking and Problem solving:**

CO3. Evaluate hazards and risks in order to carry out a risk assessment.

CO4. Students will use a variety of laboratory techniques to safely conduct chemical experiments and procedures.

**PO3: Social competence:**

CO5. To understand the variety of ecosystems of their own locality.

CO6. Describe the ecological value and consumptive use of ecosystems.

CO7. Students will have the opportunity to work in research labs, bio-fertilizer industries, and can also be bio-entrepreneurs.

**PO4: Research-related skills and Scientific temper:**

CO1. Demonstrate a comprehensive understanding of the world biodiversity and the importance of its conservation.

CO7. Students will have the opportunity to work in research labs, bio-fertilizer industries, and can also be bio-entrepreneurs.

**PO5: Trans-disciplinary knowledge:**

CO2. Understand the significance of various natural resources and its management.

CO6. Describe the ecological value and consumptive use of ecosystems.

**PO6: Personal and professional competence:**

CO7. Students will have the opportunity to work in research labs, bio-fertilizer industries, and can also be bio-entrepreneurs.

**PO7: Effective Citizenship and Ethics:**

CO3. Evaluate hazards and risks in order to carry out a risk assessment.

CO7. Students will have the opportunity to work in research labs, bio-fertilizer industries, and can also be bio-entrepreneurs.

**PO8: Environment and Sustainability:**

CO2. Understand the significance of various natural resources and its management.

CO5. To understand the variety of ecosystems of their own locality.

**PO9: Self-directed and Life-long learning:**

CO1. Demonstrate a comprehensive understanding of the world biodiversity and the importance of its conservation.

CO3. Evaluate hazards and risks in order to carry out a risk assessment.

CO4. Students will use a variety of laboratory techniques to safely conduct chemical experiments and procedures.

CO7. Students will have the opportunity to work in research labs, bio-fertilizer industries, and can also be bio-entrepreneurs.

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