**Anekant Education Society's**

# Tuljaram Chaturchand College, Baramati.

***(Autonomous)***

**Four Year Degree Program in Environmental Science**
**(Faculty of Science & Technology)**

## CBCS Syllabus

## B.Sc. (Environmental Science) Part-I Semester-I

## For Department of Environmental Science

## Tuljaram Chaturchand College, Baramati.

## Choice Based Credit System Syllabus (2023 Pattern)

## (As Per NEP 2020)

## To be implemented from Academic Year 2023-2024

# Title of the Programme: B.Sc. (Environmental Science)

## Preamble

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, and ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Environmental Science and related subjects, the Board of Studies in Environmental Science at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of F.Y.B.Sc. Environmental Science which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

In todays rapidly changing world, a Bachelor's degree in Environmental Science offers ample opportunities for individuals passionate about making a positive impact on the environment and understanding the interrelated systems governing the planet. As the global population surges and natural resources dwindle, the need for professionals skilled in environmental management, conservation, and sustainable development has never been more critical. With a strong foundation in critical thinking, problem-solving, and interdisciplinary understanding, Environmental Science graduates can pursue a wide range of rewarding careers in various sectors.

One of the most prominent careers in this field is that of an Environmental Scientist. This role entails conducting research and analysis to identify, monitor, and mitigate environmental hazards, develop sustainable land, water, and waste management practices, and inform public policy on environmental conservation. Industries such as mining, oil and gas, chemical production, and urban development actively seek Environmental Scientists to ensure compliance with environmental regulations and reduce their ecological footprint.

Environmental Consulting is another avenue that combines scientific knowledge and problem-solving abilities to help businesses, nonprofits, and governments develop eco-conscious strategies and innovative solutions to mitigate environmental risks. These consultants play a crucial role in developing and implementing sustainable practices that meet legislative and social expectations. Environmental education and awareness are now more significant than ever. Environmental Science graduates can contribute as educators in schools, colleges, and community organizations, creating environmentally literate citizens that can make informed decisions about the planet's future.

Overall, revising the Environmental Science syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

# Programme Specific Outcomes (PSOs)

***PSO1. Critical Thinking-*** Students will demonstrate an understand major concepts of Environment in association with multidisciplinary subjects such as physics, chemistry and mathematics etc. Understood the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevance in the day-to-day life.

***PSO2. Effective Communication-*** Development of various communication skills such as reading, listening, speaking, etc., which we will help in expressing ideas and views clearly and effectively.

***PSO3. Social Interaction-*** Development of scientific outlook not only with respect to science subjects but also in all aspects related to life.

***PSO4. Effective Citizenship-*** Imbibe moral and social values in personal and social life leading to highly cultured and civilized personality.

***PSO5. Ethics-*** Follow the ethical principles and responsibilities to serve the society.

***PSO6. Environment and Sustainability-*** Understand the issues of environmental contexts and sustainable development.

***PSO7. Self-directed and Lifelong learning-*** Students will be capable of self- paced and self-directed learning aimed at personal development and for improving knowledge/skill development.

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# Tuljaram Chaturchand College, Baramati

***(Autonomous)***

## Board of Studies (BOS) in Environmental Science

**From 2022-23 to 2024-25**

| Sr.No. | Name | Designation |
|---|---|---|
| 1. | Ms. Surashri S. Sonawane | Chairman |
| 2. | Dr. Ajit Telave | Member |
| 3. | Dr. Vitthal Nale | Member |
| 4. | Dr. Yogesh Indulkar | Member |
| 5. | Dr. Arun Magar | Member |
| 6. | Dr. Neeta Dhane | Member |
| 7. | Mr. Abhijit More | Member |
| 8. | Ms. Neeta Sarode | Member |
| 9. | Dr. Rachana Ingavale | Expert from other University |
| 10. | Dr. Asawari Jadhav | Expert from other University |
| 11. | Dr. Ganesh Kadam | Industry Expert |
| 12. | Ms. Dipali Shelar | Student Representative |
| 13. | Ms. Shreya Deokate | Student Representative |

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**Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati (Autonomous)**

## Credit Distribution Structure for B.Sc. First Year 2023 Environmental Science

| Level | Sem | Major | | Minor | GE/OE | VSC, SEC (VSEC) | AEC, VEC, IKS | OJT, FP, CEP, CC, RP | Cum. Cr./ Sem. | Degree/ Cum. Cr. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mandatory | Electives | | | | | | | |
| 4.5 | I | **ENV-101-MJM :** Fundamentals of Environmental Science– I<br>**ENV-102-MJM** : Fundamentals of Environmental Biology – I<br>**ENV-103-MJM** : Environment Science Practical-I<br>Credits-2+2+2 | -- | -- | **ENV -116-OE** Disasters and their Management<br>**ENV-117-OE:** Environmental Management And Safety<br>Credit- 2+2 | **ENV-121-VSC:** Solid Waste Management<br>**ENV-126-SEC:** Introduction to lab instruments<br>Credit- 2+2 | **ENG-131-AEC:** Functional English - I<br>**ENV-135-VEC:** Environmental Education<br>**ENV-137-IKS:** Environment, cultural values and society<br>Credit- 2+2+2 | **CC:** --<br>Credit- 2 | **22** | **UG Certificate 44 Credits** |
| | II | **ENV-151-MJM** : Fundamentals of Environmental Science– II<br>**ENV-152-MJM** : Fundamentals of Environmental Biology – II<br>**ENV-153-MJM** : Environment Science Practical-I<br>Credit-2+2+2 | -- | **ENV-161-MN** : Sustainable Development<br>Credit-2 | **ENV-166-OE:** Ecotourism and Sustainability<br>**ENV-167-OE:** Practicing of Ecotourism<br>Credit- 2+2 | **ENV-171-VSC :** Water quality monitoring<br>**ENV-176-SEC : -** Sustainable Agricultural Practices<br>Credit- 2+2 | **ENG-181-AEC :** Functional English – II<br>**COS-185-VEC:** Digital and Technological Solutions<br>Credit- 2+2 | **CC:** --<br>Credit- 2 | **22** | |
| | **Cum Cr.** | **12** | -- | **2** | **8** | **8** | **10** | **4** | **44** | |

**Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor**

Anekant Education Society's

# Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati (Autonomous)

## Course Structure for F. Y. B. Sc. Environmental Science (2023 Pattern)

| Sem | Course Type | Course Code | Course Name | Theory/ Practical | Credits |
|---|---|---|---|---|---|
| I | Major Mandatory | ENV-101-MJM | Fundamentals of Environmental Science– I | Theory | 02 |
| | Major Mandatory | ENV-102-MJM | Fundamentals of Environmental Biology – I | Theory | 02 |
| | Major Mandatory | ENV-103-MJM | Environment Science Practical-I | Practical | 02 |
| | Open Elective (OE) | ENV -116-OE | Disaster and their Management | Theory | 02 |
| | Open Elective (OE) | ENV-117-OE | Environmental Management and Safety | Practical | 02 |
| | Vocational Skill Course (VSC) | ENV-121-VSC | Solid Waste Management | Theory | 02 |
| | Skill Enhancement Course (SEC) | ENV-126-SEC | Introduction to lab instruments | Practical | 02 |
| | Ability Enhancement Course (AEC) | ENG-131-AEC | Functional English-I | Theory | 02 |
| | Value Education Course (VEC) | ENV-135-VEC | Environmental Education | Theory | 02 |
| | Indian Knowledge System (IKS) | ENV-137-IKS | Environment, Cultural Values and Society | Theory | 02 |
| | Co-curricular Course (CC) | -- | To be selected from the Basket | Theory | 02 |
| | **Total Credits Semester-I** | | | | **22** |
| II | Major Mandatory | ENV-151-MJM | Fundamentals of Environmental Science– II | Theory | 2 |
| | Major Mandatory | ENV-152-MJM | Fundamentals of Environmental Biology – II | Theory | 2 |
| | Major Mandatory | ENV-153-MJM | Environment Science Practical-II | Practical | 2 |
| | Minor | ENV-161-MN | Sustainable Development | Theory | 2 |
| | Open Elective (OE) | ENV-166-OE | Public Initiatives for Environmental Management | Theory | 2 |
| | Open Elective (OE) | ENV-167-OE | Introduction to Physico-chemical quality of Water/Soil | Practical | 2 |
| | Vocational Skill Course (VSC) | ENV-171-VSC | Water treatment technology | Practical | 2 |
| | Skill Enhancement Course (SEC) | ENV-176-SEC | Sustainable Agricultural Practices | Practical | 2 |
| | Ability Enhancement | ENG-181-AEC | Functional English-II | Theory | 02 |

| | | | | | |
|---|---|---|---|---|---|
| | Course (AEC) | | | | |
| | Value Education Course (VEC) | ENV-185-VEC | Digital and Technological Solutions | Theory | 02 |
| | Co-curricular Course (CC) | -- | To be selected from the Basket | Theory | 02 |
| | **Total Credits Semester-II** | | | | **22** |
| | **Cumulative Credits Semester I + Semester II** | | | | **44** |

# CBCS Syllabus as per NEP 2020 for F.Y. B.Sc. (2023 Pattern)

Name of the Programme : B.Sc. Environmental Science
**Program Code** : USENV
**Class** : F.Y. B.Sc.
**Semester** : I
**Course Type** : Major Mandatory (Theory)
**Course Code** : ENV-101-MJM
**Course Name** : Fundamentals of Environmental Science-I
**No. of Credits** : 2
**No. of Teaching Hours** : 30

## Course Objectives:

1. To learn basic characteristics of environment.
2. To make the students aware about the environment and its significance.
3. To learn about interrelationship and discipline in environment science.
4. To improve management of environment and provide satisfactory solutions to environmental issues.
5. Imparting basic knowledge about the environment and its allied problems.
6. Motivating public to participate in environment protection and environment improvement.
7. Recognize, describe, and quantitatively describe Earth systems, including the land, water, sea, and atmosphere, and how these function collectively to support life on Earth.

## 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.

## Topics and Learning Points

**Teaching Hours**

**UNIT 1: Introduction and components of Environment** **10**

1.1 Definition, principles and scope of Environmental Science
1.2 Multidisciplinary and dynamic nature of environmental science
1.3 Components of Environment: Lithosphere
1.4 Hydrosphere
1.5 Atmosphere

**UNIT 2: Man & Biosphere** **10**

2.1 Definition and Components of Biosphere
2.2 Concept of Holocene, Holocene Climate Optimum
2.3 Characteristics and causes of the Anthropocene
2.4 Human influence on environment
2.5 Current Environmental issues

**UNIT – 3: Role of Environmental Education** **10**

3.1 Concept of Environmental Education
3.2 History and nature of education in India
3.3 environmental challenges
3.4 Awareness and action through environmental education,
3.5 Role of NGOs and Government in environmental education, importance of community Participation.

## References:

1. Fundamentals of Ecology: Eugene P. Odum, (Natraj Publishers, Dehradun.)
2. Climatology: D.S.Lal (Sharda Pustak Bhawan,Allahabad)
3. Environmental Geography : Savindra Singh (Pravalika Publications,Prayagraj)

4. Physical Geography: Savindra Singh (Pravalika Publications,Prayagraj)
5. Disaster Management: Savindra Singh (Pravalika Publications,Prayagraj)
6. Principles of Ecology: P. S. Verma, V. K. Agarwal ( S. Chand and Co. New Delhi)
7. Environmental Biology: P. D. sharma ( Rastogi Publications, Meerut )
8. Ecology and Environment: P. D. sharma ( Rastogi Publications, Meerut )
9. 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 Outcomes**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 |
| CO 1 | 3 | 2 | | | | | | | 2 |
| CO 2 | 3 | 2 | | | | | | | |
| CO 3 | 3 | | | 2 | | | | | |
| CO 4 | 3 | | | 2 | | | | | |
| CO 5 | | | | | | | | 3 | |
| CO 6 | | 2 | 3 | | 2 | 2 | | | |
| CO 7 | | | 3 | | | | 3 | 3 | |

**Justification for the mapping**

**PO1: Disciplinary Knowledge**

CO1: Attain a profound comprehension of the fundamental components that constitute the environment.
CO2: Acquire in-depth knowledge concerning environmental issues and devise effective solutions to address them.
CO3: Explore and assimilate knowledge through an ecological lens, recognizing the intrinsic value of the environment.
CO4: Demonstrate a holistic understanding of global biodiversity and recognize the paramount importance of conserving it.

**PO2: Critical Thinking and Problem Solving**
CO1: Apply critical thinking to comprehend the intricate components of the environment.
CO2: Utilize critical thinking to identify and address environmental problems effectively.
CO6: Develop critical-thinking skills to analyze environmental issues and devise sustainable solutions.

**PO3: Social competence:**
CO6: Demonstrate personal and professional competence in addressing environmental challenges.
CO7: Engage in social competence by actively participating in environmental problem-solving and improvement initiatives.

**PO4: Research-related skills and Scientific temper:**
CO3: Conduct research within an ecological perspective, emphasizing the value of the environment.
CO4: Demonstrate a scientific temper in understanding global biodiversity and its conservation.

**PO5: Trans-disciplinary Knowledge**
CO6: Apply trans-disciplinary knowledge to analyze and solve environmental problems.

**PO6: Personal and Professional Competence**
CO6: Demonstrate personal and professional competence by applying critical-thinking skills to address environmental challenges.

**PO7: Effective Citizenship and Ethics:**
CO7: Act as an effective citizen by engaging in problem-solving activities to enhance the environment.

**PO8: Environment and Sustainability:**
CO5: Understand the significance of various natural resources and contribute to their sustainable management.
CO7: Take action to improve the environment, emphasizing sustainability.

**PO9: Self-directed and Life-long Learning**
CO1: Foster self-directed and life-long learning by acquiring comprehensive knowledge of environmental components.

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# CBCS SYLLABUS as per NEP 2020 for F. Y. B.Sc. (2023 Pattern)

**Name of the Programme:** B.Sc. Environmental Science
**Program Code** : USENV
**Class** : F.Y. B.Sc.
**Semester** : I
**Course Type** : Major Mandatory (Theory)
**Course Code** : ENV-102-MJM
**Course Name** : Fundamentals of Environmental Biology-I
**No. of Credits** : 02
**No. of Teaching Hours** : 30

## Course Objectives:

1. Understanding evolution helps us solve biological problems that impact our lives.
2. To understand the distribution of biotic and abiotic factors of living things in the environment.
3. Gain an understanding of how various nutrients are cycled through ecosystems.
4. Explain core concepts in ecology and summarize our ecological understanding of environmental problems
5. Summarize changes in economics, policy, and education that promote sustainability
6. Relate the features of human populations to different types of environmental degradation
7. To provide a course of basic comparative physiology, introducing students to the principles of normal biological function in a wide range of organisms.

## 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.

## Topics and Learning Points

**Teaching Hours**

**UNIT 1: Origin of Life and evolution** **10**

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

**UNIT 2: Ecology & Ecosystem:** **10**

2.1 Ecology and its types
2.2 Structure & function of ecosystem, Ecological pyramids Food chain.
2.3 Food web Basis of Ecosystem classification.
2.4 Types of Ecosystem: Terrestrial e.g. Desert (hot and cold), forest, rangeland,
2.5 Aquatic e.g. wetlands, lotic, lentic, estuarine (mangrove), Oceanic ecosystems.

**UNIT 3: Ecology, Ecological adaptation and Bioresources** **10**

3.1 Introduction, Ecological Adaptations under various environmental conditions –in plants and in animals
3.2 Types and interaction – predation, herbivory, parasitism and allelopathy.
3.3 Concept of 'r' and 'k' species, Keystone species.
3.4 Biological invasions, Succession.
3.5 Bioresources-Definition,Bioindicator,Biopesticides,Biofertilizers,Biofuels, Biosensors

## 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**

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

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**
CO1: Acquire comprehensive knowledge about bioresources to strengthen disciplinary knowledge.

**PO2: Critical Thinking and Problem solving:**
CO2: Apply the study of biodiversity in day-to-day life, showcasing critical thinking skills.
CO4: Utilize interdisciplinary approaches, including ecology, economics, ethics, and policy, to develop solutions for environmental problems.

**PO3: Social competence:**
CO2: Apply knowledge of biodiversity to enhance social competence in addressing environmental

challenges.

**PO4: Research-related skills and Scientific temper:**
CO3: Impart conceptual knowledge of the environment, including adaptations and interrelationships.
CO5: Proficiently employ ecological field methods such as wildlife survey, biodiversity assessment, mathematical modeling, and ecological system monitoring, reflecting research-related skills and a scientific temper.

**PO5: Trans-disciplinary knowledge**
CO4: Use interdisciplinary approaches, integrating ecology, economics, ethics, and policy, to address environmental problems and enhance trans-disciplinary knowledge.
**PO6: Personal and professional competence**
CO6: Apply the scientific method and quantitative techniques to describe, monitor, and understand environmental systems, demonstrating personal and professional competence.

**PO7: Effective Citizenship and Ethics:**
CO7: Evaluate current environmental issues and problems, including solutions and management practices, promoting effective citizenship and ethical considerations.

**PO8: Environment and Sustainability:**
CO1: Acquire knowledge about bioresources to contribute to environmental sustainability.
CO3: Impart conceptual knowledge of the environment, emphasizing adaptations and interrelationships to support environmental sustainability.
CO5: Be proficient in ecological field methods, contributing to biodiversity assessment and ecological system monitoring for sustainable environmental practices.

**PO9: Self-directed and Life-long learning:**
CO1: Foster self-directed and life-long learning by acquiring comprehensive knowledge about bioresources.

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## CBCS Syllabus as per NEP 2020 for F.Y. B.Sc. (2023 Pattern)

**Name of the Programme:** B.Sc. Environmental Science

**Program Code** : USENV
**Class** : F.Y. B.Sc.
**Semester** : I
**Course Type** : Major Mandatory (Practical)
**Course Code** : ENV-103-MJM
**Course Name** : Environment Science Practical-I
**No. of Credits** : 02
**No. of Teaching Hours** : 60

### Course Objectives:

1. To learn that adaptation allows organisms to survive and reproduce in their natural environment.
2. Understand the importance of environment by accessing its impacts on the human world.
3. To understand basic nature of soil.
4. To understand the environmental significance of water quality.
5. To understand the different types of ecosystems.
6. Develop an ability to handle the apparatus carefully and the resources wisely.
7. Develop scientific understanding of physical world.

### Course Outcomes:

**By the end of the course, students will be able to:**

**CO1.** Demonstrate a compressive 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 verity of laboratory techniques to safely conduct chemical experiments and procedures.
**CO5.** To understand verity 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.

## Topics and Learning Points

1. To study the lab safety rules.
2. To study the basics of chemical preparation.
3. To study of Soil Profile & Soil Texture.
4. Determination of Soil and water pH and Electric Conductivity.
5. Determination of water holding capacity of a given soil sample.
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. Estimation of dissolved oxygen from water by Winkler's method.
10. Estimation of carbon sequestration of college campus area.
11. To study the ecological adaption: Hydrophytes, Mesophytes, Epiphytes, Xerophytes, etc.
12. To study of preparation of Biofertilizers.
13. Study of vegetation by quadrate method.
14. Estimation of NPP, GPP and R.
15. Visit of any ecosystem and submission of Excursion report is compulsory at the time of practical examination.

*Any other relevant practical related to syllabus

## References:

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 | | | | | | 3 | | |
| **CO2** | | | | | 2 | | | 3 | |
| **CO3** | | 2 | | | | | | | |
| **CO4** | | 2 | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CO5** | | | 3 | | | | | 3 | |
| **CO6** | | | | 2 | | | | | |
| **CO7** | | | | | | 2 | | | 2 |

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**
CO1: Demonstrate a comprehensive understanding of the world's biodiversity and emphasize the importance of its conservation within the realm of disciplinary knowledge.

**PO2: Critical Thinking and Problem solving:**
CO3: Evaluate hazards and risks, showcasing critical thinking skills essential for conducting a risk assessment.
CO4: Utilize a variety of laboratory techniques to safely conduct chemical experiments and procedures, demonstrating critical thinking and problem-solving abilities.

**PO3: Social competence:**
CO5: Understand the variety of ecosystems in their own locality, contributing to social competence in environmental awareness.

**PO4: Research-related skills and Scientific temper:**
CO6: Describe the ecological value and consumptive use of ecosystems, showcasing research-related skills and a scientific temper.

**PO5: Trans-disciplinary knowledge**
CO2: Understand the significance of various natural resources and their management from a trans-disciplinary perspective.

**PO6: Personal and professional competence**
CO7: Provide students with opportunities to work in research labs, bio-fertilizer industries, and encourage them to explore bio-entrepreneurship, enhancing personal and professional competence.

**PO7: Effective Citizenship and Ethics:**
CO1: Demonstrate a comprehensive understanding of the world's biodiversity, emphasizing its conservation and contributing to effective citizenship and ethical considerations.

**PO8: Environment and Sustainability:**
CO2: Understand the significance of various natural resources and their management, emphasizing environmental sustainability.
CO5: To understand a variety of ecosystems in their own locality, promoting environmental awareness and sustainability.

**PO9: Self-directed and Life-long learning:**
CO7: Provide students with opportunities to work in research labs, bio-fertilizer industries, and engage in bio-entrepreneurship, fostering self-directed and life-long learning.

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# CBCS Syllabus as per NEP 2020 for F.Y. B.Sc. (2023 Pattern)

**Name of the Programme** : B.Sc. Environmental Science
**Program Code** : USENV
**Class** : F.Y. B.Sc.
**Semester** : I
**Course Type** : Open Elective (Theory)
**Course Code** : ENV-116-OE
**Course Name** : Disasters and their Management
**No. of Credits** : 02
**No. of Teaching Hours** : 30

## Course Objectives:

1. To provide basic conceptual understanding of disasters and its relationship with development.
2. To gain understand approaches of disaster risk reduction and the relationship between vulnerability, disasters, disaster prevention and risk reduction.
3. To reduce the harmful effects of all hazards, including disasters.
4. To understand medical and psycho-social response to disasters.
5. To prevent and control public health consequences of disasters.
6. To enhance awareness of disaster risk management institutional processes in India.
7. To build skills to respond to disasters.

## Course Outcomes:

**By the end of the course, students will be able to:**

**CO1.** Warnings, reduced vulnerability or the prevention of disasters during the next iteration of the cycle.
**CO2.** Plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.
**CO3.** Application of disasters concepts to management.
**CO4.** Analyze relationship between development and disasters.
**CO5.** Preparedness plans for disasters response.
**CO6.** Monitoring and evaluation plan for disaster response.
**CO7.** Emerging first aid at disaster site.

## Topics and Learning Points

**Teaching Hours**

**UNIT 1: Introduction** **10**

1.1 Disasters: Definition, History of disasters; Components of disasters.
1.2 Types of disasters
1.3 Weather parameters: Concept, Role of meteorological parameters in disasters prediction.
1.4 Mitigation and Management techniques of Disaster
1.5 Disaster Management Authority and Planning disaster management at National, State and District levels

**UNIT 2: Natural Disasters and Management** **10**

2.1 Introduction to natural disaster-Earthquake, Flood, Tsunami
2.2 Causative agent
2.3 Environmental effects and recovery
2.4 Management
2.5 Case study on natural disaster

**UNIT 3: Man-made disasters and Management** **10**

3.1 Introduction to man-made disaster – Oil Spill, Forest Fire, Toxic waste
3.2 Causative agents
3.3 Impacts of anthropogenic activities
3.4Management of manmade disasters
3.5 Case study on man-made disaster

## References:

1. Bhattacharya, T. (2012). Disaster Science and Management. Tata McGraw-Hill Education.
2. Collins, L. R. (2000). Disaster management and preparedness. CRC Press.
3. Kapur, A. (2010). Vulnerable India: a geographical study of disasters. SAGE Publications India.
4. Murthy, D. B. N. (2007). Disaster Management: Text and case studies. Deep and Deep Publications.
5. Rajendra Kumar Pandey. (2020). Disaster Management in India. SAGE Publications, Incorporated.

6. Roy, T. (2012). Natural Disasters and Indian History: Oxford India Short Introductions. OUP Catalogue.
7. Sahni, P., Dhameja, A., and Medury, U. (2001). Disaster mitigation: experiences and reflections. PHI Learning Pvt. Ltd..
8. Sharma, S. C. 2008. Disaster Management. Khanna Publishing House. Shrivastava, A. K. (2015). Text book of Disaster Management. Scientific Publishers.
9. Sulphey, M. M. (2016). Disaster management. PHI Learning Pvt. Ltd.

**Mapping of Program Outcomes with Course Outcomes**

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

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**
CO3: Apply concepts related to disasters to enhance disciplinary knowledge in disaster management.

**PO2: Critical Thinking and Problem solving:**
CO1: Develop warnings, reduce vulnerability, and prevent disasters in the next iteration of the cycle, showcasing critical thinking and problem-solving skills.
CO2: Devise plans to modify the causes of disasters or mitigate their effects on people, property, and infrastructure, demonstrating critical thinking and problem-solving abilities.

**PO3: Social competence:**
CO7: Provide emerging first aid at disaster sites, contributing to social competence in disaster response.

**PO4: Research-related skills and Scientific temper:**
CO4: Analyze the relationship between development and disasters, showcasing research-related skills and a scientific temper.

**PO5: Trans-disciplinary knowledge**
CO5: Develop preparedness plans for disaster response from a trans-disciplinary perspective.

**PO6: Personal and professional competence**
CO6: Develop a monitoring and evaluation plan for disaster response, enhancing personal and professional competence in disaster management.

**PO7: Effective Citizenship and Ethics:**
CO1: Develop warnings, reduce vulnerability, and prevent disasters, contributing to effective citizenship and ethical considerations in disaster management.

**PO8: Environment and Sustainability:**
CO2: Devise plans to modify the causes of disasters or mitigate their effects, emphasizing environmental sustainability in disaster response.

**PO9: Self-directed and Life-long learning:**
CO3: Apply disaster concepts to management, fostering self-directed and life-long learning in disaster preparedness and response.

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## CBCS Syllabus as per NEP 2020 for F.Y. B.Sc. (2023 Pattern)

**Name of the Programme** : B.Sc. Environmental Science
**Program Code** : USENV
**Class** : F.Y. B.Sc.
**Semester** : I
**Course Type** : Open Elective (Practical)
**Course Code** : ENV-117-OE
**Course Name** : Environmental Management and Safety
**No. of Credits** : 02
**No. of Teaching Hours** : 60

### Course Objectives:

1. To understanding the Techniques of disaster management.
2. To identify and measuring the disaster risk.
3. To study natural and anthropogenic hazard.
4. To study techniques of disaster risk assessment.
5. To understand experimentation of disaster management.
6. To control and disaster and their consequences on nature and human being.
7. To study the need of environmental safety.

### Course Outcomes:

**By the end of the course, students will be able to:**

**CO1.** Students understood the fundamentals of disaster and management.

**CO2.** Monitoring and evaluation of safety plan.

**CO3.** Emerging first aid at disaster site.

**CO4.** Disaster prevention at local level.

**CO5.** Mitigation and management techniques for disaster management.

**CO6.** First aid treatment for natural and anthropogenic hazard.

**CO7.** Environment Health, Safety and Management System.

## Topics and Learning Points

1. To study rules while handling chemicals in laboratory.
2. Introduction to first aid treatment for natural and anthropogenic hazard.
3. Demonstration of the fire safety.
4. Demonstration of respiratory personal protective equipments.
5. Demonstration of non respiratory personal protective equipments.
6. Preparation of disaster management plan for flood.
7. Monitoring of Noise level in college campus area.
8. Role of various agencies in Disaster Mitigation – National and State level.
9. Disaster response – Medical support, Rehabilitation, Reconstruction and Recovery.
10. To study disaster prevention at local level (Emergency Basis).
11. Post disaster management for snake bite.
12. To study Pre and post disaster management for LPG gas leakage.
13. Eco friendly practices for safe environment.
14. To study of food adulteration from chemical industry and their health hazard.
15. Visit to any institute for study of fire alarm system.

## References:

1. Handbook for laboratory safety, Benjamin R. Sveinbjornsson and Sveinbjorn Gizurarson (2022)
2. Laboratory Safety Handbook, Fens Laboratory Safety Team, Sabancı University, 2016

**Mapping of Program Outcomes with Course Outcomes**

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

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**
CO1: Acquire fundamental knowledge of disaster and management, emphasizing disciplinary knowledge in the field.

**PO2: Critical Thinking and Problem solving:**
CO2: Apply critical thinking in the monitoring and evaluation of safety plans related to disaster

management.
CO4: Implement critical thinking skills in disaster prevention at the local level.

**PO3: Social competence:**
CO3: Demonstrate social competence through the application of emerging first aid techniques at disaster sites.

**PO4: Research-related skills and Scientific temper:**
CO5: Apply research-related skills and a scientific temper in the development and implementation of mitigation and management techniques for disaster management.

**PO5: Trans-disciplinary knowledge**
CO7: Integrate trans-disciplinary knowledge in understanding Environment Health, Safety, and Management Systems related to disasters.

**PO6: Personal and professional competence**
CO6: Demonstrate personal and professional competence through the application of first aid treatment for both natural and anthropogenic hazards.

**PO7: Effective Citizenship and Ethics:**
CO4: Integrate ethical considerations in disaster prevention at the local level, contributing to effective citizenship.

**PO8: Environment and Sustainability:**
CO7: Apply knowledge of Environment Health, Safety, and Management Systems to promote environmental sustainability in disaster management.

**PO9: Self-directed and Life-long learning:**
CO1: Acquire fundamental knowledge of disaster and management to foster self-directed and life-long learning.

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## CBCS Syllabus as per NEP 2020 for F.Y. B.Sc. (2023 Pattern)

**Name of the Programme** : B.Sc. Environmental Science
**Program Code** : USENV
**Class** : F.Y. B.Sc.
**Semester** : I
**Course Type** : Vocational Skill Course (Theory)
**Course Code** : ENV-121-VSC
**Course Name** : Solid Waste Management
**No. of Credits** : 02
**No. of Teaching Hours** : 30

### Course Objectives:

1) To ensure a proper waste disposal system that protects the environment and public health.
2) To promote environmental management and conservation of resources.
3) Minimize the consumption of natural resources.
4) Reduce, reuse, recycle and recover waste.
5) Provide efficient and economical refuse collection, recycling and disposal services.
6) To reduce the quantity of solid waste disposed off on land by recovery of materials and energy from solid waste.
7) Create awareness among the people regarding the impact of waste on their health and the environment.

### Course Outcomes:

**By the end of the course, students will be able to:**

**CO1.** Understand the characteristic of wastes and the systems, and processes of waste management.

**CO2.** Identify the case specific issues related to pollution potentials of solid wastes.

**CO3.** Address solid waste management practices through a cradle-to-grave approach.

**CO4.** Apply understanding to generate recourses from wastes.

**CO5.** Make appropriate decisions through application of waste management principles.

**CO6.** Make an economical analysis of solid waste management system.

**CO7.** Minimize the production of waste. Proper management practices help minimize the

garbage and scrap that need handling.

## Topics and Learning Points

**Teaching Hours**

**UNIT 1: Introduction to Solid Waste** **10**

1.1 Introduction and Sources
1.2 Municipal solid wastes (MSW)
1.3 Biomedical wastes
1.4 E-waste
1.5 Hazardous wastes
1.6 Principles of solid management

**UNIT 2: Environmental impacts and scientific management** **10**

2.1 Human health effects, ecosystem damage
2.2 Air quality, water quality and soil quality
2.3 Collection & transportation measures; Segregation techniques; Pre- cautions
2.4 Physico-chemical characterization (density, field capacity, particle size, field capacity, pH, organic C, NPK, heat value etc.)
2.5 Composting and Microbial decay, Anaerobic digestion, Incineration, Pyrolysis, Landfill gas recovery

**UNIT 3: Environmental regulations** **10**

3.1 Eco-mark & ISO 14000
3.2 Symbols & color codes
3.3 Solid Waste Management Rules, 2016
3.4 Plastic Waste Management Rules 2016

## References:

1) White P.R. et al, Integrated Solid Waste Management, Lewis Publisher, 1989.
2) Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban
3) Development, Govt. of India, New Delhi, 2000.
4) David L.H.F. and Liptak D. G., Hazardous waste and solid waste, Lewis Publisher, 2000
5) Oberoi N.K, Environmental Management, (2nd Edition) Excel Books, New Delhi, 2003.
6) Asnani, P. U. 2006. Solid waste management. India Infrastructure Report 570.
7) Bagchi, A. 2004. Design of Landfills and Integrated Solid Waste Management. John Wiley & Sons.
8) Blackman, W.C. 2001. Basic Hazardous Waste Management. CRC Press.
9) McDougall, F. R., White, P. R., Franke, M., & Hindle, P. 2008. Integrated Solid Waste Management: A Life Cycle Inventory. John Wiley & Sons.

10) US EPA. 1999. Guide for Industrial Waste Management. Washington D.C.
11) White, P.R., Franke, M. & Hindle P. 1995. Integrated Solid waste Management: A Lifecycle Inventory. Blackie Academic & Professionals.
12) Zhu, D., Asnani, P.U., Zurbrugg, C., Anapolsky, S. & Mani, S. 2008. Improving Municipal Solid waste Management in India. The World Bank, Washington D.C.

**Mapping of Program Outcomes with Course Outcomes**

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

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**
CO1: Demonstrate understanding of the characteristics of wastes and the systems and processes of waste management, contributing to disciplinary knowledge.

**PO2: Critical Thinking and Problem solving:**
CO2: Identify case-specific issues related to pollution potentials of solid wastes, showcasing critical thinking and problem-solving skills.

**PO3: Social competence:**
CO7: Minimize the production of waste, emphasizing social competence through proper waste management practices to reduce the environmental impact.

**PO4: Research-related skills and Scientific temper:**
CO3: Address solid waste management practices through a cradle-to-grave approach, exhibiting research-related skills and a scientific temper.

**PO5: Trans-disciplinary knowledge**
CO4: Apply understanding to generate resources from wastes, contributing to trans-disciplinary knowledge.

**PO6: Personal and professional competence**
CO5: Make appropriate decisions through the application of waste management principles, showcasing personal and professional competence.

**PO7: Effective Citizenship and Ethics:**
CO7: Minimize the production of waste, highlighting the role of effective citizenship and ethical considerations in waste reduction and proper management.

**PO8: Environment and Sustainability:**
CO3: Address solid waste management practices through a cradle-to-grave approach, emphasizing environmental sustainability.
CO6: Make an economical analysis of solid waste management systems, promoting sustainable economic practices in waste management.

**PO9: Self-directed and Life-long learning:**
CO1: Understand the characteristics of wastes and waste management systems, fostering self-directed and life-long learning.

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## CBCS Syllabus as per NEP 2020 for F.Y. B.Sc. (2023 Pattern)

**Name of the Programme** : B.Sc. Environmental Science
**Program Code** : USENV
**Class** : F.Y.B.Sc.
**Semester** : I
**Course Type** : Skill Enhancement Course (Practical)
**Course Code** : ENV-126-SEC
**Course Name** : Introduction to lab instruments
**No. of Lectures** : 60
**No. of Credits** : 2

### Course Objectives:

1) Understand how to carry out a basic experiment utilizing common laboratory equipment.
2) To minimize the risk of injury or illness to laboratory workers by ensuring that they have the training, information and support needed to work safely in the laboratory.
3) Develop the understanding of procedural knowledge.
4) Develop interest and motivation through laboratory which will lead to development of positive attitude.
5) Develop an ability to express them coherently and logically.
6) An appreciation for the products and influences of science and technology.
7) Develop scientific understanding of the physical world.

### Course Outcomes:

**By the end of the course, students will be able to:**

**CO1.** Developing understanding in designing experiments

**CO2.** Development of skills to avoid hazards.

**CO3.** Make able to write reports of laboratory work.

**CO4.** Lab work develops confidence among the students.

**CO5.** Develop ability to verify theoretical knowledge.

**CO6.** Developing understanding regarding handling of data.

**CO7.** Develop understanding about inferring and predicting.

## Topics and Learning Points

1. Study the lab safety symbols.
2. Introduction to laboratory apparatus.
3. Study the procedure for handling the lab equipment/instrument.
4. Study principle and working of thermometer.
5. To understand calibration of weighing machine.
6. Study principles and working of magnetic stirrer.
7. Understand the principles and working of hot air oven.
8. Study principles and working of centrifuge.
9. Introduction to principles and working of Autoclave.
10. Demonstration of pH meter calibration.
11. To understand calibration of turbidity meter.
12. Study principles and working water bath.
13. Demonstration of EC meter calibration.
14. To study and Demonstration of spectrophotometer.
15. To study principle and working of flame photometer.

## References:

1. Environmental Chemical Analysis Laboratory Manual, Prepared by Dr. Erik Krogh, Dr. Chris Gill, Shelley Gellein, and Peter Diamente Department of Chemistry, 2018
2. The Laboratory Companion: A Practical Guide to Materials, Equipment, and Technique, Gary S. Coyne, Wiley, 2006
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 |
| **CO2** | | 3 | | | | | | 3 | |
| **CO3** | | | 3 | | | | 3 | | |
| **CO4** | | | | | | 3 | | | |
| **CO5** | 3 | | | | | | | | 3 |
| **CO6** | | | | 2 | | | | | |
| **CO7** | | | | | 2 | | | | |

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**
CO5: Develop the ability to verify theoretical knowledge as part of disciplinary knowledge.
**PO2: Critical Thinking and Problem solving:**
CO1: Develop an understanding of designing experiments, fostering critical thinking and problem-solving skills.
CO2: Develop skills to avoid hazards, promoting critical thinking in the context of safety.

**PO3: Social competence:**
CO3: Develop the capability to write reports on laboratory work, contributing to social competence in effective communication.

**PO4: Research-related skills and Scientific temper:**
CO6: Develop an understanding of handling data, enhancing research-related skills and fostering a scientific temper.

**PO5: Trans-disciplinary knowledge**
CO7: Develop an understanding of inferring and predicting, contributing to trans-disciplinary knowledge.

**PO6: Personal and professional competence**
CO4: Lab work develops confidence among students, promoting personal and professional competence.

**PO7: Effective Citizenship and Ethics:**
CO3: Develop the capability to write reports on laboratory work, emphasizing effective citizenship and ethical communication.
**PO8: Environment and Sustainability:**
CO2: Development of skills to avoid hazards, emphasizing environmental sustainability and safety.

**PO9: Self-directed and Life-long learning:**
CO1: Develop an understanding of designing experiments, fostering self-directed and life-long learning skills.
CO5: Develop the ability to verify theoretical knowledge, contributing to ongoing self-directed learning.

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## CBCS Syllabus as per NEP 2020 for F.Y. B.Sc. (2023 Pattern)

**Name of the Programme** : B.Sc. Environmental Science
**Program Code** : USENV
**Class** : F.Y. B.Sc.
**Semester** : I
**Course Type** : Value Education Course (Theory)
**Course Code** : ENV-135-VEC
**Course Name** : Environmental Education
**No. of Credits** : 02
**No. of Teaching Hours** : 30

### Course Objectives:

1. To learn how the natural world works, to understand how humans interact with the environment, and to find ways to deal with environmental problems and live more sustainably.
2. Analyze the interrelationship between living organism and environment.
3. Awareness and sensitivity to the environment and environmental challenges.
4. To prevent pollution, meet compliance obligations and enhance conditions of the environment.
5. Students understand biodiversity in the context of ecosystem dynamics, ecosystem functioning and provision of ecosystem services.
6. To maintain life-supporting systems and essential ecological processes.
7. To provide protection to the ecosystem from degradation and therefore the consumption of resources must be reduced.

### Course Outcomes:

By the end of the course, students will be able to:

**CO1.** Students will realize that people are dependent on intact habitats that sustain the various organisms we need to produce food, medicines, clothing, and other materials.

**CO2.** Demonstrate a comprehensive understanding of the world's biodiversity and the importance of its conservation.

**CO3.** Discover knowledge in ecological perspective and value of environment.

**CO4.** To develop the attitude to take steps for environmental protection. There should be a sense of responsibility among the population to protect the environment.

**CO5.** Environmental Science student are able to acquire knowledge, competent professionals with a strong foundation of Environmental Science and application to be suitable for vital

positions in the academia, industry and government and non-government institutions as skilled manpower.

**CO6.** Develop critical-thinking skills, analyze real-world problems, and understand the power of narrative to create sustainable solutions for local and global communities.

**CO7.** Demonstrate an integrative approach to environmental issues with a focus on sustainability.

## Topics and Learning Points

**Teaching Hours**

**UNIT 1: Introduction to environmental studies** **10**

1.1 Multidisciplinary nature of environmental studies
1.2 Scope and importance
1.3 Concept of sustainability and sustainable development
1.4 Interrelationship of ecology with other disciplines
1.5 Ecology and its types

**UNIT 2: Ecosystems and Biodiversity Conservation** **10**

2.1 Definition, Types, Structure and function of ecosystem
2.2 Energy flow in an ecosystem: food chains, food webs and ecological succession.
2.3 Biogeographic zones of India; biodiversity hot spots
2.4 Endangered and endemic species of India
2.5 Threats to biodiversity

**UNIT 3: Environmental pollution** **10**

3.1 Environmental pollution- types, causes, effects and controls; Air, Water, Soil and Noise pollution
3.2 Nuclear hazards and human health risks
3.3 Solid Waste management- control measures of urban and industrial waste
3.4 Pollution case studies

## References:

1. Dr. P. D Sharma, "Ecology and Environment", Rastogi Publications, New Delhi, 12th Edition, 2015.
2. Erach Bharucha, "Textbook of Environmental Studies for Under Graduate Courses", Orient Black Swan, 2nd Edition, 2013.
3. Benny Joseph, "Environmental Studies", Tata Mc Graw Hill Publishing Co. Ltd, New Delhi, 1 st Edition, 2006.
4. Environmental Biology :P. D. sharma ( Rastogi Publications, Meerut )
5. Principles of Ecology: P. S. Verma, V. K. Agarwal ( S. Chand and Co. New Delhi )

6. Principles of Environmental Biology :P. K. G. Nair ( Himalaya Publishing House, New Delhi)
7. Environmental Biology :M. P. Arora ( Himalaya Publishing House, New Delhi )
8. Environmental Science :Enger Smith, Smith, W. M. C. Brown ( Company Publishing )
9. General Ecology :H. D. Kumar ( Vikas Publishing house, New Delhi )
10. Elements of Ecology :Brijgopal, N. Bharadwaj ( Vikas Publishing house, New Delhi )
11. Fundamentals of Environmental Science :G. S. Dahliwal, G. S. Sangha, P. K. ralhan
12. ( Kalyani Publishers, New Delhi )
13. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
14. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
15. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
16. Sengupta, R. 2003. Ecology and economics : An approach to sustainable development. OUP.
17. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
18. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.

**Mapping of Program Outcomes with Course Outcomes**

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

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**
CO1: Realize the dependence of people on intact habitats, understanding their role in sustaining organisms essential for producing food, medicines, clothing, and other materials.

**PO2: Critical Thinking and Problem solving:**
CO2: Demonstrate a comprehensive understanding of the world's biodiversity and emphasize the importance of its conservation.
CO6: Develop critical-thinking skills to analyze real-world problems and recognize the power of narrative in creating sustainable solutions for local and global communities.

**PO3: Social competence:**
CO3: Discover knowledge in an ecological perspective and recognize the value of the environment, enhancing social competence in environmental awareness.

**PO4: Research-related skills and Scientific temper:**
CO4: Develop an attitude to take steps for environmental protection, fostering a sense of responsibility among the population.
CO5: Acquire knowledge and become competent professionals with a strong foundation in Environmental Science, suitable for vital positions in academia, industry, and government and non-government institutions as skilled manpower.

**PO5: Trans-disciplinary knowledge**
CO7: Demonstrate an integrative approach to environmental issues with a focus on sustainability, reflecting trans-disciplinary knowledge.

**PO6: Personal and professional competence**
CO5: Acquire knowledge and become competent professionals with a strong foundation in Environmental Science, contributing to personal and professional competence.

**PO7: Effective Citizenship and Ethics:**
CO4: Develop an attitude to take steps for environmental protection, emphasizing effective citizenship and ethical considerations.

**PO8: Environment and Sustainability:**
CO1: Realize the dependence of people on intact habitats and understand their role in sustaining organisms, contributing to environmental sustainability.
CO7: Demonstrate an integrative approach to environmental issues with a focus on sustainability.

**PO9: Self-directed and Life-long learning:**
CO2: Demonstrate a comprehensive understanding of the world's biodiversity and emphasize the importance of its conservation, fostering self-directed and life-long learning.

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# CBCS Syllabus as per NEP 2020 for F.Y. B.Sc. (2023 Pattern)

**Name of the Programme** : B.Sc. Environmental Science
**Program Code** : USENV
**Class** : F.Y. B.Sc.
**Semester** : I
**Course Type** : Value Education Course (Theory)
**Course Code** : ENV-135-VEC
**Course Name** : Environmental Education
**No. of Credits** : 02
**No. of Lectures** : 30

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**Mapping of Program Outcomes with Course Outcomes**

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

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|---|---|---|---|---|---|---|---|---|---|
| **CO4** | | | | 3 | | | 2 | | |
| **CO5** | | | | 2 | | 3 | | | |
| **CO6** | | 3 | | | | | | | |
| **CO7** | | | | | 2 | | | 3 | |

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**
CO1: Realize the dependence of people on intact habitats, understanding their role in sustaining organisms essential for producing food, medicines, clothing, and other materials.

**PO2: Critical Thinking and Problem solving:**
CO2: Demonstrate a comprehensive understanding of the world's biodiversity and emphasize the importance of its conservation.
CO6: Develop critical-thinking skills to analyze real-world problems and recognize the power of narrative in creating sustainable solutions for local and global communities.

**PO3: Social competence:**
CO3: Discover knowledge in an ecological perspective and recognize the value of the environment, enhancing social competence in environmental awareness.

**PO4: Research-related skills and Scientific temper:**
CO4: Develop an attitude to take steps for environmental protection, fostering a sense of responsibility among the population.
CO5: Acquire knowledge and become competent professionals with a strong foundation in Environmental Science, suitable for vital positions in academia, industry, and government and non-government institutions as skilled manpower.

**PO5: Trans-disciplinary knowledge**
CO7: Demonstrate an integrative approach to environmental issues with a focus on sustainability, reflecting trans-disciplinary knowledge.

**PO6: Personal and professional competence**
CO5: Acquire knowledge and become competent professionals with a strong foundation in Environmental Science, contributing to personal and professional competence.

**PO7: Effective Citizenship and Ethics:**
CO4: Develop an attitude to take steps for environmental protection, emphasizing effective citizenship and ethical considerations.

**PO8: Environment and Sustainability:**
CO1: Realize the dependence of people on intact habitats and understand their role in sustaining organisms, contributing to environmental sustainability.
CO7: Demonstrate an integrative approach to environmental issues with a focus on sustainability.

**PO9: Self-directed and Life-long learning:**
CO2: Demonstrate a comprehensive understanding of the world's biodiversity and emphasize the importance of its conservation, fostering self-directed and life-long learning.

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**CBCS Syllabus as per NEP 2020 for F.Y. B.Sc.**
**(2023 Pattern)**

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|---|---|
| **Name of the Programme** | **:** B.Sc. Environmental Science |
| **Program Code** | **:** USENV |
| **Class** | **:** F.Y. B.Sc. |
| **Semester** | **:** I |
| **Course Type** | **:** Indian Knowledge System |
| **Course Code** | **:** ENV-137-IKS |
| **Course Name** | **:** Environment, Cultural Values and Society (Theory) |
| **No. of Credits** | **:** 02 |
| **No. of Teaching Hours** | **:** 30 |

## Course Objectives:

1. To know in depth that our existence is impossible if the nature does not exist.
2. Encouraging environmentally responsible behavior, and developing an environmental ethic that promotes an understanding of the ecological interdependence of the social, political, and economic spheres.
3. Individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions.
4. Understanding the extent of our responsibility towards the environment and also identifies our obligation towards it.
5. To promote personal development through spiritual, moral, social and cultural development through a rich range of curricular opportunities.
6. Students will learn why it's important to learn about the cultures of the communities.
7. Increase awareness, appreciation, and inclusion of diverse beliefs and cultural value

## Course Outcomes:

**By the end of the course, students will be able to:**

**CO1.** Know the values of natural resources.

**CO2.** Participate in conservation and preservation of environment discussion and contributing to the country by protecting.

**CO3.** Understand the gender equality and concepts of women status in India.

**CO4.** To provide student with a theoretical understanding of the challenge of sustainability, with an emphasis on cultural perspectives and environmental values.

**CO5.**Learn about the ethical responsibilities of the communities about environmental values.

**CO6.**To develops students skill in and knowledge of philosophical argumentation, historical processes and cultural understanding of environmental problems.

**CO7.** To introduce students to the complexities of interdisciplinary research.

| Topics and Learning Points | Teaching Hours |
|---|---|

**UNIT 1: Bhāratīya Civilization and Development of Bhartiya Knowledge System 10**

Genesis of the land, Antiquity of civilization, On the Trail of the Lost River, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization, Traditional Knowledge System, The Vedas, Main Schools of Philosophy , Ancient Education System, the Takṣaśilā University, the Nālandā University, Alumni, Knowledge Export from Bhārata.

**UNIT 2: Unique Traditional Practices and Applied Traditional Knowledge 10**

Agriculture, animal husbandry, Forest, Sacred Groves, Sacred Water Bodies, Water Mills. Water and Soil Conservation and management Practices, Utilization Practices and Food Preservation Methods. Handicrafts, Wood Processing and Carving, -Fiber Extraction and Costumes. Role of tribal people in environmental conservation.
Community participation in Environmental conservation- Role of communities, Individual-level initiatives to ensure sustainable development, case studies of environmental movements (Chipko Movement, Narmada Bachao Andolan). Role of NGOs and youth, Environmental education and awareness.

**UNIT 3: Women and environment 10**

Women response to environmental degradation, Women and environmental conservation, Prominent women environmentalist, Role of rural women in agricultural and social forestry sector, etc., Role of urban women in climate management, lifestyle choices and resource conservation, etc.

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**Mapping of Program Outcomes with Course Outcomes**

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

**Justification for the mapping**

**PO1: Disciplinary Knowledge:**
CO1: Acquire knowledge about the values of natural resources, emphasizing disciplinary expertise.

**PO2: Critical Thinking and Problem solving:**
CO2: Engage in discussions on the conservation and preservation of the environment, showcasing critical thinking and problem-solving skills while contributing to national efforts.

**PO3: Social competence:**
CO3: Develop an understanding of gender equality and concepts related to women's status in India, contributing to social competence and awareness.

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

CO4: Provide students with a theoretical understanding of sustainability challenges, emphasizing cultural perspectives and environmental values, fostering research-related skills and a scientific temper.

**PO5: Trans-disciplinary knowledge**
CO5: Learn about the ethical responsibilities of communities regarding environmental values, integrating trans-disciplinary knowledge.

**PO6: Personal and professional competence**
CO6: Develop students' skills in and knowledge of philosophical argumentation, historical processes, and cultural understanding of environmental problems, enhancing personal and professional competence.

**PO7: Effective Citizenship and Ethics:**
CO2: Participate in conservation and preservation discussions, contributing to effective citizenship and ethical considerations for environmental protection.

**PO8: Environment and Sustainability:**
CO5: Explore the ethical responsibilities of communities related to environmental values, promoting environmental sustainability.

**PO9: Self-directed and Life-long learning:**
CO7: Introduce students to the complexities of interdisciplinary research, fostering self-directed and life-long learning in the pursuit of environmental understanding.

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- **Three Certificate Courses from MOOCs, SWAYAM from the online mode of learning**

1) **Course Title** **:** Technologies for Clean and Renewable Energy production
**Credit** **:** 2
**Duration** **:** 8 Weeks
**Level** **:** Undergraduate

2) **Course Title** **:** Remote Sensing and GIS
**Credit** **:** 2
**Duration** **:** 8 Weeks
**Level** **:** Undergraduate

3) **Course Title** **:** Ecology and Environment
**Credit** **:** 2
**Duration** **:** 8 Weeks
**Level** **:** Undergraduate

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