



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-II Semester-II
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), NCfR, 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 today's 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.

Anekant Education Society's
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. Rupali Gaykwad	Expert from SPPU
10.	Dr. Rachana Ingavale	Expert from other University
11.	Dr. Asawari Jadhav	Expert from other University
12.	Dr. Ganesh Kadam	Industry Expert
13.	Ms. Sakshi Upadhyay	Student Representative
14.	Mr. Pradip Shikare	Student Representative

**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	--	--	ENV -116-OE Disasters and their Management	ENV-121-VSC: Solid Waste Management	ENG-131-AEC: Functional English - I	CC: YOG/PES /CUL/NS S/NCC-139-CC	22	UG Certificate 44 Credits
		ENV-102-MJM : Fundamentals of Environmental Biology – I			ENV-117-OE: Environmental Management And Safety	ENV-126-SEC: Introduction to lab instruments	ENV-135-VEC: Environmental Education	ENV-137-IKS: Environment , cultural values and society		
	ENV-103-MJM : Environment Science Practical-I							Credit- 2		
		Credits-2+2+2			Credit- 2+2	Credit- 2+2	Credit- 2+2+2			
	II	ENV-151-MJM : Fundamentals of Environmental Science– II	--	ENV-161-MN : Sustainable Development	ENV-166-OE: Ecotourism and Sustainability	ENV-171-VSC : Water quality monitoring	ENG-181-AEC : Functional English – II	CC:YOG/ PES/CUL/ NSS/NCC -189-CC	22	
		ENV-152-MJM : Fundamentals of Environmental Biology – II			ENV-167-OE: Practicing of Ecotourism	ENV-176-SEC : - Sustainable Agricultural Practices	COS-185-VEC: Digital and technological solutions			
		ENV-153-MJM : Environment Science Practical-II				Credit- 2+2		Credit- 2		
		Credit-2+2+2		Credit-2	Credit- 2+2		Credit- 2+2			
	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										

**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)	YOG/PES/CUL/NSS/ NCC-139-CC	To be selected from the Basket	Theory	02
Total Credits Semester-II					22
II	Major Mandatory	ENV-151-MJM	Fundamentals of Environmental Science– II	Theory	02
	Major Mandatory	ENV-152-MJM	Fundamentals of Environmental Biology – II	Theory	02
	Major Mandatory	ENV-153-MJM	Environment Science Practical-II	Practical	02
	Minor	ENV-161-MN	Sustainable Development	Theory	02
	Open Elective (OE)	ENV-166-OE	Ecotourism and Sustainability	Theory	02
	Open Elective (OE)	ENV-167-OE	Practicing of Ecotourism	Practical	02
	Vocational Skill Course (VSC)	ENV-171-VSC	Water quality monitoring	Practical	02
	Skill Enhancement Course (SEC)	ENV-176-SEC	Sustainable agricultural practices	Practical	02
	Ability Enhancement Course (AEC)	ENG-181-AEC	Functional English-II	Theory	02

Value Education Course (VEC)	ENV-185-VEC	Digital and technological solutions	Theory	02
Co-curricular Course (CC)	YOG/PES/CUL/NSS/ NCC-189-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	: II
Course Type	: Major Mandatory (Theory)
Course Code	: ENV-151-MJM
Course Name	: Fundamentals of Environmental Science-II
No. of Credits	: 2
No. of Teaching Hours	: 30

Course Objectives:

1. To understand the basics of Environmental Sciences.
2. To learn about interrelationship and various disciplines in environmental science
3. To make the students aware about conservation and sustainable use of Biodiversity.
4. To make student understood GIS and remote sensing application
5. To make the students aware about the environment and its significance.
6. To improve management of environment and provide satisfactory solutions to environmental issues.
7. Imparting basic knowledge about the environment and its allied problems.
8. Motivating public to participate in environment protection and environment improvement.

Course Outcomes:

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

CO1. Imparts conceptual knowledge of environment, and meteorology

CO2. Students will understand the distinguishing characters and the Energy and its resources.

CO3. Student will know the concept of meteorology and apply their knowledge in day to day life.

CO4. Students will acquire the knowledge about bio resources their conservation and sustainable use of Biodiversity.

CO5. Students will understand the knowledge about Environmental problems and their solutions.

CO6. Discover knowledge in ecological perspective and value of environment.

CO7. Demonstrate a comprehensive understanding of the world's biodiversity and the importance of its conservation.

Topics and Learning Points

Teaching Hours

UNIT 1: Energy and Environment

10

- 1.1 Introduction to Renewable and non-renewable sources of energy, Sun as source of energy: solar radiation and its spectral characteristics.
- 1.2 Fossil fuels: classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas, Nuclear reactor/ Nuclear energy, effects of fossil fuels on Environment.
- 1.3 Gross-calorific value and net-calorific value.
- 1.4 Principles of generation of hydro-power, tidal energy, ocean thermal energy conversion, wind power, geothermal energy, solar energy (solar collectors, photo-voltaic modules, solar ponds).
- 1.5 Bioenergy: Introduction and uses of bioenergy.

UNIT 2: Meteorology

10

- 2.1 Definition, Concept and importance
- 2.2 Meteorological parameters – Pressure, temperature, precipitation, humidity, mixing ratio, saturation mixing ratio, radiation and wind velocity, lapse rate, environmental lapse rate.
- 2.3 Wind roses
- 2.4 Climograph

UNIT – 3: Introduction to GIS and Remote Sensing

10

- 3.1 Introduction to GIS and Remote sensing
- 3.2 Components and Types of GIS Data, Digital image processing and ground truthing.
- 3.3 Application of remote sensing and GIS in land cover/land use planning and management (urban sprawling, vegetation study, forestry, natural resource).

References:

1. Cunningham W.P. & Saigo S.W. (1997) ‘**Environmental Science: A Global Concern**’ WCB, McGraw Hill
2. Tyler M.G. Jr. (1997) ‘**Environmental Science**’ Wadsworth Publ. Co

10

3. Benny Joseph (2005) '**Environmental Studies**' Tata McGraw Hill Publ. Co. Ltd.
4. **Perspectives in Environmental Studies:** Anubha Kaushik, C.P.Kaushik (New Age International(P) Limited, Publishers)
5. **Environmental Science and Engineering:** Dr.N.Arumugam,Prof.V.Kumaresan(Saras Publication, Kottar, Dist. Kanyakumari)
6. Environmental Geography-Savindra Singh, Prayog pustak Bhavan
7. A manual on Conservation of soil & water-UNDA, Scientific Publisher Rs.- 450/-
8. Environmental Remote sensing - F. Mark Danson, Wiley Publisher
9. A text book of Environmental Science- Vidya Thakur, Scientific Publisher Rs- 250/
10. Sustainable Energy and Environment: An Earth System Approach- edited by Sandeep Narayan Kundu, Muhammad Nawaz, apple academic press.
11. Climatology: D.S.Lal (Sharda Pustak Bhawan,Allahabad)
12. Environmental Geography : Savindra Singh (Pravalika Publications,Prayagraj)
13. Physical Geography: Savindra Singh (Pravalika Publications,Prayagraj)
14. Environmental Science: Enger Smith, Smith, W. M. C. Brown (Company Publishing)
15. Introduction to Environmental Studies: Turk & Turk
16. Fundamentals of Environmental Science :G. S. Dahliwal, G. S. Sangha, P. K. ralhan(Kalyani Publishers, New Delhi)
17. Environmental Science and Engineering: Dr.N.Arumugam,Prof.V.Kumaresan(Saras Publication, Kottar, Dist. Kanyakumari)
18. Perspectives in Environmental Studies: Anubha Kaushik, C.P.Kaushik (New Age International(P) Limited, Publishers)

Mapping of Program Outcomes with Course Outcomes

Programme Outcomes (POs)									
Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2							3	
CO 2		3							
CO 3		3							
CO 4				2			2		
CO 5					3				
CO 6			3						2
CO 7						2			

Justification for the mapping

PO1: Disciplinary Knowledge

CO1: Impart conceptual knowledge of the environment and meteorology, contributing to disciplinary knowledge.

PO2: Critical Thinking and Problem Solving

CO2: Understand the distinguishing characteristics of energy and its resources, showcasing critical thinking skills.

CO3: Apply the concept of meteorology in day-to-day life, demonstrating critical thinking and problem-solving abilities.

PO3: Social competence:

CO6: 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: Acquire knowledge about bioresources, their conservation, and the sustainable use of biodiversity, reflecting research-related skills and a scientific temper.

PO5: Trans-disciplinary Knowledge

CO5: Understand the knowledge about environmental problems and their solutions from a trans-disciplinary perspective.

PO6: Personal and Professional Competence

CO7: Demonstrate a comprehensive understanding of the world's biodiversity and the importance of its conservation, contributing to personal and professional competence.

PO7: Effective Citizenship and Ethics:

CO4: Acquire knowledge about bioresources, their conservation, and the sustainable use of biodiversity, contributing to effective citizenship and ethical considerations.

PO8: Environment and Sustainability:

CO1: Impart conceptual knowledge of the environment and meteorology, emphasizing environmental sustainability.

PO9: Self-directed and Life-long Learning

CO6: Discover knowledge in an ecological perspective and recognize the value of the environment, fostering self-directed and life-long learning.

**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** : II**Course Type** : Major Mandatory (Theory)**Course Code** : ENV-152-MJM**Course Name** : Fundamentals of Environmental Biology-II**No. of Credits** : 02**No. of Teaching Hours** : 30**Course Objectives:**

1. To understand the basics of Environmental Biology.
2. To learn about interrelationship and various disciplines in ecosystem and its importance.
3. To make the students aware about conservation and sustainable use of Biodiversity.
4. Understanding evolution helps us solve biological problems that impact our lives.
5. To understand the distribution of biotic and abiotic factors of living things in the environment.
6. Gain an understanding of how various nutrients are cycled through ecosystems.
7. Explain core concepts in ecology and summarize our ecological understanding of environmental problems

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: Ecology and Environment****10**

- 1.1 Major ecological types of India, Population ecology: Characteristics of population, concept of carrying capacity,
- 1.2 Keystone species
- 1.3 Ecological Adaptations in plants and animals under various environmental conditions
- 1.4 Biomes Concept: classification and distribution.

UNIT 2: Biodiversity and its conservation**10**

- 2.1 Biodiversity: Introduction, Concept and Importance of Biodiversity
- 2.2 Biodiversity Hotspot,
- 2.3 Values of Biodiversity,
- 2.4 IUCN red list and Endemic species of India,
- 2.5 Conservation of Biodiversity: In-situ and Ex-Situ Conservation Methods.

UNIT 3: Introduction to Environmental Microbiology**10**

- 3.1 Introduction, Classification of microbes.
- 3.2 Micro-organisms and their association with man, animals and plants,
- 3.3 Role of microbes in bioremediation & Seco-restoration
- 3.4 Useful and harmful microbes.

References:

- 01. Fundamentals of Ecology:** Eugene P. Odum, (Natraj Publishers, Dehradun.)
- 02. Principles of Ecology:** P. S. Verma, V. K. Agarwal (S. Chand and Co. New Delhi)
- 03. Environmental Biology:** P. D. sharma (Rastogi Publications, Meerut)
- 04. Ecology and Environment:** P. D. sharma (Rastogi Publications, Meerut)
- 05. Principles of Environmental Biology:** P. K. G. Nair (Himalaya Publishing House, New Delhi)
- 06. Environmental Biology:** M. P. Aroras (Himalaya Publishing House, New Delhi)
- 07. Environmental Science:** Enger Smith, Smith, W. M. C. Brown (Company Publishing)
- 08. Principles of Soil Science:** Watt K. E. F. (1973), (McGraw Hill Book Company, New Delhi)
- 09. Introduction to Environmental Studies:** Turk & Turk
- 10. Ecology and Field Biology:** Robert Leo Smith (Harper Collins college publication)
- 11. General Ecology:** H. D. Kumar (Vikas Publishing house, New Delhi)
- 12. Elements of Ecology:** Brijgopal, N. Bharadwaj (Vikas Publishing house, New Delhi)

13. Fundamentals of Environmental Science: G. S. Dahliwal, G. S. Sangha, P. K. ralhan (Kalyani Publishers, New Delhi)

14. Environmental Ecology: Bill Freedman (Academic Press, New York)

15. Concepts of Ecology: N. Arumugam (Saras Publication, Kottar, Dist. Kanyakumari)

16. Plant Ecology: P. L. Kochhar

Books:

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

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							
CO3			3						
CO4				2	3			3	
CO5				2					
CO6				3		3			
CO7							2	3	

Justification for the mapping

PO1: Disciplinary Knowledge:

CO1: Acquire comprehensive knowledge about bioresources, strengthening disciplinary knowledge.

PO2: Critical Thinking and Problem solving:

CO2: Apply the study of biodiversity in day-to-day life, showcasing critical thinking skills.

PO3: Social competence:

CO3: Impart conceptual knowledge of the environment, emphasizing adaptations and interrelationships, contributing to social competence.

PO4: Research-related skills and Scientific temper:

CO4: Utilize interdisciplinary approaches, integrating ecology, economics, ethics, and policy, to devise solutions to environmental problems, reflecting research-related skills and a scientific temper.

CO5: Be proficient in ecological field methods, including wildlife survey, biodiversity assessment, mathematical modeling, and ecological system monitoring, showcasing research-related skills and a scientific temper.

CO6: Apply the scientific method and quantitative techniques to describe, monitor, and understand environmental systems, emphasizing scientific temper.

PO5: Trans-disciplinary knowledge

CO4: Use interdisciplinary approaches, such as ecology, economics, ethics, and policy, to devise solutions to environmental problems, emphasizing trans-disciplinary knowledge.

PO6: Personal and professional competence

CO6: Apply the scientific method and quantitative techniques to describe, monitor, and understand environmental systems, contributing to personal and professional competence.

PO7: Effective Citizenship and Ethics:

CO7: Evaluate current environmental issues and problems, including solutions and management practices, fostering effective citizenship and ethical considerations.

PO8: Environment and Sustainability:

CO1: Acquire knowledge about bioresources to contribute to environmental sustainability.

CO4: Utilize interdisciplinary approaches to devise solutions to environmental problems, emphasizing environmental sustainability.

CO7: Evaluate environmental issues, solutions, and management practices, contributing to environmental sustainability.

PO9: Self-directed and Life-long learning:

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

**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	: II
Course Type	: Major Mandatory (Practical)
Course Code	: ENV-153-MJM
Course Name	: Environment Science Practical-II
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 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.

Topics and Learning Points

1. Measurement of Atmospheric Humidity by Hair-Hygrometer.
2. Measurement of light by Lux Meter.
3. Study of land use planning and management.
4. Study of economical and medical values of plant species in local area.
5. To Study the basics of Geographical Information System
6. Study of satellite image and interpret it.
7. Preparation of Media (Broth, Agar and Slant).
8. Classification of microorganisms by gram staining method.
9. Study of local terrestrial ecosystem
10. Draw the simple wind rose from given data and interprets the graph using given information.
11. Draw the Climograph from given data and interpret it.
12. Preparation of digital herbarium
13. Case study related to invasive species.
14. 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

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

CO6					2				
CO7			3			3			3

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 disciplinary knowledge framework.

PO2: Critical Thinking and Problem solving:

CO2: Understand the significance of various natural resources and their management, demonstrating critical thinking and problem-solving skills.

CO3: Evaluate hazards and risks for effective critical thinking and problem-solving in the context of risk assessment.

PO3: Social competence:

CO5: Understand a variety of ecosystems in their own locality, contributing to social competence in environmental awareness.

CO7: Provide opportunities for students to work in research labs, bio-fertilizer industries, and explore bio-entrepreneurship, enhancing social competence.

PO4: Research-related skills and Scientific temper:

CO4: Use a variety of laboratory techniques for chemical experiments and procedures, showcasing research-related skills and a scientific temper.

PO5: Trans-disciplinary knowledge

CO6: Describe the ecological value and consumptive use of ecosystems, integrating trans-disciplinary knowledge.

PO6: Personal and professional competence

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

PO7: Effective Citizenship and Ethics:

CO1: Demonstrate a comprehensive understanding of the world's biodiversity and its conservation, contributing to effective citizenship and ethical considerations.

PO8: Environment and Sustainability:

CO5: Understand the variety of ecosystems in their own locality, emphasizing environmental sustainability.

PO9: Self-directed and Life-long learning:

CO7: Provide opportunities for students to work in research labs, bio-fertilizer industries, and explore bio-entrepreneurship, fostering self-directed and life-long learning.

**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	: II
Course Type	: Minor (Theory)
Course Code	: ENV-161-MN
Course Name	: Sustainable Development
No. of Credits	: 02
No. of Teaching Hours	: 30

Course Objectives:

1. Students will be able to define sustainability and identify major sustainability challenges.
2. Students will have an understanding of the carrying capacity of ecosystems as related to providing for human needs.
3. Students should demonstrate a capacity to address 21st century national and international environmental as well as cultural challenges.
4. Students should develop the means to indicate how sustainability issues are impacting their immediate social, economic, and political environment.
5. Students should recognize and advocate for civic engagement and inclusive practices for applying sustainability principles to local issues.
6. Students should learn ethical principles of sustainability and how they are connected to practical issues of social justice, and environmental-economic equity.
7. Students should develop proficiency in finding and using reliable data and documentation for support of their sustainability projects.

Course Outcomes:

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

CO1. Students will be able to define sustainability and identify major sustainability challenges.

CO2. Interdisciplinary Students will have an understanding of the carrying capacity of ecosystems as related to providing for human needs.

CO3. Students will be able to apply concepts of sustainable development to address sustainability challenges in a global context.

CO4. Students will identify, act on, and evaluate their professional and personal actions with the knowledge and appreciation of interconnections among economic,

environmental, and social perspectives.

CO5. Students will be able to demonstrate an understanding of the nature of systems.

CO6. Students will have an understanding of their social responsibility as future professionals and citizens.

CO7. Students will be able to accommodate individual differences in their decisions and actions and be able to negotiate across these differences.

Topics and Learning Points

	Teaching Hours
UNIT 1: Introduction	10
1.1 Sustainable Development: Definition, concept and Principles	
1.2 Strategies for Sustainable Development,	
1.3 Sustainability and Human Development.	
1.4 Sustainable Development Goals	
UNIT 2: Environmental Conservation and Sustainability	10
2.1 Technical Skills in Environment and Sustainability,	
2.2 Criticisms in Sustainability	
2.3 Sustainable Forest Management,	
2.4 Challenges in Energy, Food and Agriculture.	
UNIT 3: Recent Trends in Sustainability	10
3.1 Ecological and Carbon Footprint for Sustainability Measurement,	
3.2 Appropriate Technology and Sustainability Science	
3.3 Consumption and Production Patterns	
3.4 Sustainable Transport	

References:

- 1) Chauturvedi .P.(2003), Energy, Environment and Sustainable Development, Concept Publishing Company, New Delhi
- 2) Environment and Sustainable Development by M.H. Fulekar, Bhawana Pathak, R K Kale, Springer Nature (2013).
- 3) Sustainable Development in Digital Era by Dr. Aparna Mishra, Dr. Vikas Dahiya, Dr. Kamini Tandon, JSR Publishing House LLP; (2019).
- 4) The Age of Sustainable Development by Jeffrey D. Sachs and Ban Ki –moon, Columbia University Press (2015).
- 5) Target 3 Billion: Innovative Solutions Towards Sustainable Development by APJ Abdul Kalam, Srijan Pal Singh, Penguin India (2011)

Mapping of Program Outcomes with Course Outcomes

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

Justification for the mapping

PO1: Disciplinary Knowledge:

CO3: Apply concepts related to disasters to enhance disciplinary knowledge.

PO2: Critical Thinking and Problem solving:

CO1: Develop strategies for warnings, reduced vulnerability, or the prevention of disasters, demonstrating critical thinking and problem-solving skills.

CO2: Create plans to modify the causes of disasters or mitigate their effects on people, property, and infrastructure, showcasing critical thinking abilities.

PO3: Social competence:

CO7: Acquire knowledge and skills in 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: Create a monitoring and evaluation plan for disaster response, demonstrating personal and professional competence.

PO7: Effective Citizenship and Ethics:

CO1: Develop strategies for warnings, reduced vulnerability, or the prevention of disasters, contributing to effective citizenship and ethical considerations.

PO8: Environment and Sustainability:

CO2: Create plans to modify the causes of disasters or mitigate their effects on people, property, and infrastructure, emphasizing environmental sustainability.

PO9: Self-directed and Life-long learning:

CO4: Analyze the relationship between development and disasters, fostering self-directed and life-long learning.

**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	: II
Course Type	: Open Elective (Theory)
Course Code	: ENV-166-OE
Course Name	: Ecotourism and Sustainability
No. of Credits	: 02
No. of Teaching Hours	: 30

Course Objectives:

1. Familiarity with problems related to the selection, measurement, monitoring and evaluation of sustainable development indicators;
2. The difference between alternative and traditional tourism;
3. Assessing the negative and positive impacts of tourism as a result of tourism development;
4. Explaining the role and importance of quality control in achieving sustainable tourism development.
5. To understand tourism in sustainable way.
6. To develop basic understanding of biodiversity and its conservation among the students.
7. To introduce them with local culture, environment, ecology, history and geography

Course Outcomes:

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

- CO1.** The sustainability of tourism;
- CO2.** Factors affecting tourism;
- CO3.** Characteristics of sustainable tourism;
- CO4.** Degradation phenomena with impact on tourism;
- CO5.** Compilation of tourist guides;
- CO6.** Multiplication of government expenditures for sustainable tourism, etc.
- CO7.** Grow Future business approach from ecotourism.

Topics and Learning Points

Teaching Hours**UNIT 1: Introduction****10**

- 1.1 Tourism concepts and definitions
- 1.2 Traditional ways & Ecotourism
- 1.3 Threats to tourism
- 1.4 Do's and don'ts of ecotourism

UNIT 2: Types and aspects of tourism**10**

- 2.1 Cultural tourism
- 2.2 Pilgrimage tourism
- 2.3 Agro tourism
- 2.4 Wildlife tourism
- 2.5 Mountain Tourism
- 2.6 Wetland Tourism
- 2.7 Environmental & Commercial aspects of tourism

UNIT 3: Sustainable Eco tourism**10**

- 3.1 Sustainable Tourism
- 3.2 Criteria for Sustainable Global Tourism
- 3.3 Cultural sustainability and lifestyle
- 3.4 Factors influencing tourism

References:

1. Culture, Ecology and Sustainable development' Sukanta K. Chaudhury, Mittal, New Delhi, 2006.
2. Ecology and Tourism Development', Ramesh Chawala, Submit international, New Delhi, 2006.
3. Ecotourism certification, setting standards & Practices, Matha Honey, Island press, Chicago, 2002.
4. Guidelines for Human Environmental Sustainable development, Global environment law, Policy and action plan, Prabhas C Sinha, SBS publications, New Delhi, 2006.
5. Econtourism, KS Pathania and Arun Kumar, Regal, 2008.
6. Weaver, D. (2001), the encyclopedia of ecotourism cabi publication.
7. Fennel, D. A. (2002), ecotourism policy and planning, cabi publishing, USA
8. Sukanta K Chaudhury, cultural, ecology and sustainable development, mittal, DELHI.
9. Ralf Buckley (2004), environment impacts of ecotourism, cabi, LONDON

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			3				2		
CO4		3							
CO5				2					
CO6						2			
CO7					3				3

Justification for the mapping

PO1: Disciplinary Knowledge:

CO1: Explore the sustainability of tourism, deepening disciplinary knowledge in the field.

PO2: Critical Thinking and Problem solving:

CO2: Analyze the factors influencing tourism, demonstrating critical thinking and problem-solving skills.

CO4: Assess degradation phenomena with impacts on tourism, showcasing critical thinking in addressing challenges.

PO3: Social competence:

CO3: Identify and understand the characteristics of sustainable tourism, contributing to social competence in promoting responsible tourism.

PO4: Research-related skills and Scientific temper:

CO5: Develop tourist guides, applying research-related skills and fostering a scientific temper.

PO5: Trans-disciplinary knowledge

CO7: Cultivate a future business approach from ecotourism, emphasizing the trans-disciplinary nature of sustainable tourism.

PO6: Personal and professional competence

CO6: Multiply government expenditures for sustainable tourism, enhancing personal and professional competence in managing and promoting sustainable practices.

PO7: Effective Citizenship and Ethics:

CO3: Understand the characteristics of sustainable tourism, contributing to effective citizenship and ethical considerations in the tourism industry.

PO8: Environment and Sustainability:

CO1: Explore the sustainability of tourism, placing emphasis on environmental considerations.

PO9: Self-directed and Life-long learning:

CO7: Grow a future business approach from ecotourism, fostering self-directed and life-long learning in adapting to evolving trends in sustainable tourism.

**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	: II
Course Type	: Open Elective (Practical)
Course Code	: ENV-167-OE
Course Name	: Practicing of Ecotourism
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

1. To understanding the Techniques of tourism and management.
2. Obtain the basic concept of ecology and environment attains familiarity about the type's alternative tourism.
3. Know about the need and importance of special interest tourism.
4. Familiarize with issues and challenges of ecotourism.
5. Assess the impact of ecotourism on environment.
6. Protecting the environment, helping local communities stay healthy and educating visitors on conservation and protection efforts.
7. Understanding of components of tourism industry and to acquire knowledge and information pertaining to tourism industry.

Course Outcomes:

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

- CO1.** Students understood the fundamentals of disaster and management
- CO2.** Students will learn how ecotourism work over the world.
- CO3.** Interprets and evaluate tourism as phenomenon and as business system.
- CO4.** Contextualize tourism within border cultural, environmental, political and economic dimensions of society.
- CO5.** Apply relevant technology for production and management of tourism experiences.
- CO6.** Develop and evaluate tourism policy and planning initiatives.
- CO7.** Demonstrate commitment to ethical practices of tourism

Topics and Learning Points

1. To study the current practices and prospects of ecotourism
2. To study the ecotourism practices-Planning, Design, Management.
3. Case study on ecotourism.
4. Ecotourism sites in India
5. To study the eco friendly practices for ecotourism
6. To prepare schematic diagram for planning of Pilgrimage tourism/ Agro tourism.
7. Identify four plant species having ecological, economic, and cultural significance as ecotourism attraction.
8. Visit to agriculture garden to understand basics of ecotourism.
9. Visit to wetland site to understand designing of ecotourism.
10. Visit to cultural place to understand management of ecotourism.

*Any other relevant practical related to syllabus

References:

1. Culture, Ecology and Sustainable development' Sukanta K. Chaudhury, Mittal, New Delhi, 2006.
2. Ecology and Tourism Development', Ramesh Chawala, Submit international, New Delhi, 2006.
3. Econtourism, KS Pathania and Arun Kumar, Regal, 2008.
4. Weaver, D. (2001), the encyclopedia of ecotourism cabi publication.
5. Fennel, D. A. (2002), ecotourism policy and planning, cabi publishing, USA

Mapping of Program Outcomes with Course Outcomes

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

Justification for the mapping

PO1: Disciplinary Knowledge:

CO1: Students developed a comprehensive understanding of the fundamentals of disaster and management.

CO2: Students gained insights into how ecotourism functions globally.

PO2: Critical Thinking and Problem solving:

CO3: Students critically interpreted and evaluated tourism as both a phenomenon and a business system.

CO4: Students analyzed tourism within the cultural, environmental, political, and economic dimensions of society.

PO3: Social competence:

CO7: Students demonstrated a commitment to ethical practices in the realm of tourism.

PO4: Research-related skills and Scientific temper:

CO6: Students developed and evaluated tourism policy and planning initiatives, showcasing research-related skills and scientific temper.

PO5: Trans-disciplinary knowledge

CO4: Students contextualized tourism within cultural, environmental, political, and economic dimensions, showcasing trans-disciplinary understanding.

PO6: Personal and professional competence

CO5: Students applied relevant technology for the production and management of tourism experiences.

PO7: Effective Citizenship and Ethics:

CO7: Students demonstrated a commitment to ethical practices in the realm of tourism.

PO8: Environment and Sustainability:

CO2: Students learned about the workings of ecotourism, emphasizing environmental and sustainable tourism practices.

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	: II
Course Type	: Vocational Skill Course (Practical)
Course Code	: ENV-171-VSC
Course Name	: Water quality monitoring
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

1. To understand the various techniques for Water sampling and Collection.
2. To understand various techniques used for analysis of Water in laboratory.
3. To understand the working of STP/ ETP for treatment of Water and Waste water.
4. To identify various Phytoplankton's and Zooplanktons as indicators of Water quality.
5. To understand quality of water with standard procedure.
6. To study process and impact of eutrophication on aquatic ecosystem.
7. To remove the impure residuals of the water to make it accessible for drinking.

Course Outcomes:

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

- CO1.** Students understood various water collection and sampling techniques along with analysis.
- CO2.** Students understood techniques employed for analysis of Waste water in Environmental Laboratory.
- CO3.** To help students develop career in ETP and STP.
- CO4.** Students acquire a broad knowledge of water and determining water quality.
- CO5.** Students will be aware about clean and Reusable Water. This is obvious that throwing away even wastewater is harmful to nature.
- CO6.** Students understood about how to analyze and remove pollutants as possible before, is discharged back to the environment.
- CO7.** Students acquire knowledge about harmful phytoplankton and Zooplanktons.

Topics and Learning Points

Teaching Hours

1. Sampling methods for analysis of water samples

2. Study of preliminary treatment of water
3. To study flow chart of drinking water treatment plant.
4. Determination of pH of given water samples
5. Determination of Temperature from water
6. Determination of Turbidity in water by Nephalo turbidometer
7. Determination of Electrical Conductivity of given water samples
8. Estimation of Total Hardness (Ca & Mg) from water
9. Determination of TDS, TSS and TS from given water
10. Study visit to Waterbody restoration site
11. To study bio-indicators from Eutrophic Lake
12. Visit to drinking water treatment plant
13. Study Visit to Environmental Laboratory

*Any other relevant practical related to syllabus

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	3			3					
CO3						2			
CO4	2								
CO5						2	2	3	
CO6		3						3	

CO7									
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Justification for the mapping

PO1: Disciplinary Knowledge:

CO1: Students gained proficiency in various water collection and sampling techniques and their subsequent analysis.

CO2: Students acquired insights into techniques employed for wastewater analysis in an Environmental Laboratory.

CO4: Students developed a comprehensive understanding of water and its quality determinants.

PO2: Critical Thinking and Problem solving:

CO6: Students applied critical thinking to understand how to analyze and remove pollutants before discharge into the environment.

PO4: Research-related skills and Scientific temper:

CO1: Students developed research-related skills in water collection, sampling, and analysis.

CO2: Students applied scientific temper to understand techniques for the analysis of wastewater.

PO6: Personal and professional competence

CO3: Students were prepared to develop a career in ETP and STP.

CO5: Students became aware of the importance of clean and reusable water, considering the environmental impact of wastewater.

PO7: Effective Citizenship and Ethics:

CO5: Students became aware of the importance of clean and reusable water, considering the environmental impact of wastewater.ethical communication.

PO8: Environment and Sustainability:

CO5: Students became aware of the importance of clean and reusable water, considering the environmental impact of wastewater.

CO6: Students applied knowledge on how to analyze and remove pollutants before discharge to contribute to environmental sustainability.

**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	: II
Course Type	: Skill Enhancement Course (Practical)
Course Code	: ENV-176-SEC
Course Name	: Sustainable Agricultural Practices
No. of Credits	: 2
No. of Lectures	: 60

Course Objectives:

- 1) To understand how to make best use of the resources available.
- 2) To understand minimize use of non-renewable resources.
- 3) To understand how to protect and enhance the environment and natural resources.
- 4) To study to protect the economic viability of farming operations
- 5) To understand Protection of health and safety of farm workers, local communities and society.
- 6) To understand sustainable water and soil conservation practices
- 7) To study management of farm waste.

Course Outcomes:

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

- CO1.** Students understood various cropping methods.
- CO2.** Students understood modern agriculture practices
- CO3.** Students understood management of farm waste in sustainable way.
- CO4.** Students understood organic farming practices
- CO5.** Learners will be aware about soil & water conservation
- CO6.** Knowledge on working of urban farming techniques.
- CO7.** Students will have opportunity to work in bio fertilizer industry and can also be bio-entrepreneurs.

Topics and Learning Points

1. To study of crop rotation method for farming.
2. To study methods of preparation of compost.
3. To study of vermicomposting of agricultural waste.
4. Estimation of soil moisture from given soil sample.
5. Preparation of bio-fertilizers- Neem formulation, BGA use
6. Preparation of bio-pesticides.
7. To study mulching procedure of farming.
8. To study drip & sprinkler irrigation system.
9. Demonstration of preparation of hydroponics farming.
10. Demonstration of practicing of no tillage farming.
11. Demonstration of preparation of vertical farming.
12. Planning of urban agriculture by terrace gardening.
13. Study visit to any nursery to understand their sustainable practices.

References:

1. Best Practices in Sustainable Agricultural Practices, Shroffs Foundation Trust 2016
2. Sustainable Agriculture, Ram Swaroop, Meena SCIENTIFIC PUBLISHERS (INDIA), 2019
3. A scheme and training manual on good agriculture practices for fruits and vegetables

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			3		
CO4				2					
CO5					3			3	
CO6			2						
CO7						2			

Justification for the mapping

PO1: Disciplinary Knowledge:

CO1: Acquire disciplinary knowledge by understanding various cropping methods.

PO2: Critical Thinking and Problem solving:

CO2: Apply critical thinking skills to comprehend modern agriculture practices.

PO3: Social competence:

CO6: Gain knowledge on working urban farming techniques, contributing to social competence in sustainable agriculture.

PO4: Research-related skills and Scientific temper:

CO3: Understand the management of farm waste in a sustainable way, reflecting research-related skills

and a scientific temper.

CO4: Comprehend organic farming practices, showcasing a scientific temper.

PO5: Trans-disciplinary knowledge

CO5: Increase awareness about soil and water conservation from a trans-disciplinary perspective.

PO6: Personal and professional competence

CO7: Provide students with opportunities to work in bio-fertilizer industries and explore bio-entrepreneurship, enhancing personal and professional competence.

PO7: Effective Citizenship and Ethics:

CO3: Understand the management of farm waste in a sustainable way, contributing to effective citizenship and ethical considerations.

PO8: Environment and Sustainability:

CO5: Increase awareness about soil and water conservation, emphasizing environmental sustainability.

PO9: Self-directed and Life-long learning:

CO2: Apply critical thinking skills to comprehend modern agriculture practices, fostering self-directed and life-long learning.
