Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati.

(Empowered Autonomous)

Three/Four Year Honours / Honours with Research B.Sc. Degree Program

in Environmental Science

(Faculty of Science)

CBCS Syllabus

S.Y.B.Sc. (Environmental Science) Semester-IV

For Department of Environmental Science

NEP 2.0

Choice Based Credit System Syllabus (2024 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2025-2026

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 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

(Empowered Autonomous)

Board of Studies (BOS) in Environmental Science

From 2025-26 to 2027-28

Sr.No.	Name	Designation
1.	Ms. Surashri Sonawane	Chairman
2.	Ms. Aruna Kadam	Member
3.	Prof. Dr. Ajit Telave	Member
4.	Dr. Neeta Dhane	Academic Invitee
5.	Dr. Deepali Nimbalkar	Expert from SPPU
6.	Dr. Asawari Jadhav	Expert from other University
7.	Dr. Rachana Ingavale	Expert from other University
8.	Dr. Ganesh Kadam	Industry Expert
9.	Ms. Bhavana Upadhyay	Alumni
10.	Ms. Vaishnavi Lonkar	Student Representative

Department of Environmental Science

Course and Credit Distribution Structure for B.Sc. (Environmental Science)-2025-2026

Credit Distribution Structure for Three/Four Year Honours/Honours with Research Degree Programme With Multiple Entry and Exit options as per National Education Policy (2024 Pattern as per NEP-2020)

Level/ Difficulty	Sem	Subject DSC-1	Subject DSC-2	Subject DSC-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
4.5/100	I	2(T)+2(P)	2(T)+2(P)	2(T)+ 2(P)	2(T)	2 (T/P)	2(T) (Generic)	2(T)	2(T)	--	22
	II	2(T)+2(P)	2(T)+2(P)	2(T)+2(P)	2(P)	2 (T/P)	--	2(T)	2(T)	2(T	22
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 Continue option: Student will select one subject among the (subject-1, subject 2 and subject 3) as major and other as minor and third subject will be dropped.											

Level/ Difficulty	Sem	Credits Related to Major: Major Core	Major Elective	VSC	FP/OJT/CEP/RP	Minor	--	GE/OE	SEC	IKS	AEC	VEC	CC	Total
5.0/200	III	4(T)+2(P)	--	2 (T/P)	2(FP)	2(T)+2(P)	--	2(T)	--	2(T)	2(T)	--	2(T)	22
	IV	4(T)+2(P)	--	2 (T/P)	2(CEP)	2(T)+2(P)	--	2(P)	2 (T/P)	--	2(T)	--	2(T)	22
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4credits core NSQF course/Internship OR Continue with Major and Minor														
5.5/300	V	8(T)+4(P)	2(T)+2(P)	2 (T/P)	2(FP/CEP)	2(T)	--	--	--	--	--	--	--	22
	VI	8(T)+4(P)	2(T)+2(P)	2 (T/P)	4 (OJT)	--	--	--	--	--	--	--	--	22
Total 3Years		44	8	8	10	18	8	8	6	4	8	4	6	132
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor														
6.0/400	VII	6(T)+4(P)	2(T)+2 (T/P)	--	4(RP)	4(RM)(T)	--	--	--	--	--	--	--	22
	VIII	6(T)+4(P)	2(T)+2 (T/P)	--	6(RP)	--	--	--	--	--	--	--	--	22
Total 4Years		64	16	8	22	22	8	8	6	4	8	4	6	176
Four Year UG Honours with Research Degree in Major and Minor with 176 credits														
6.0/400	VII	10(T)+4(P)	2(T)+2 (T/P)	--	--	4(RM) (T)	--	--	--	--	--	--	--	22
	VIII	10(T)+4(P)	2(T)+2 (T/P)	--	4 (OJT)	--	--	--	--	--	--	--	--	22
Total 4Years		72	16	8	14	22	8	8	6	4	8	4	6	176
Four Year UG Honours Degree in Major and Minor with176 credits														

T = Theory **P** = Practical **DSC** = Discipline Specific Course **OE** = Open Elective **SEC** = Skill Enhancement Course **IKS** = Indian Knowledge System **AEC** = Ability Enhancement Course **VEC** = Value Education Course **CC** = Co-curricular Course **VSC**= Vocational Skill Course **OJT**= On Job Training **CEP**= Community Engagement Project **FP**= Field Project **RP**= Research Project

Course Structure for S. Y. B. Sc. Environmental Science (2024 Pattern) as per NEP 2020

Sem	Course Type	Course Code	Course Title	Theory/ Practical	Credits
III (5.0)	Major Mandatory	ENV-201-MRM	Natural Resources And Management	Theory	02
	Major Mandatory	ENV-202-MRM	Environmental Pollution-I	Theory	02
	Major Mandatory	ENV-203-MRM	Practicals based on ENV-201-MRM and ENV-202-MRM	Practical	02
	Vocational Skill Course (VSC)	ENV-204-VSC	Practical based on Organic farming	Practical	02
	Field Project(FP)	ENV-205-FP	Field Project	Practical	02
	Minor	ENV-206-MN	Man and Environment	Theory	02
	Minor	ENV-207-MN	Basic Practicals in Environmental science	Practical	02
	Open Elective (OE)	ENV-208-OE	Initiatives for Environmental Management	Theory	02
	Subject Specific Indian Knowledge System (IKS)	ENV-209-IKS	Environment, cultural values and Society	Theory	02
	Ability Enhancement Course (AEC)	MAR-210-AEC/ HIN-210-AEC/ SAN-210-AEC		Theory (Any One)	02
	Co-curricular Course (CC)	YOG/PES/CUL/NSS/NCC-211-CC	To be continued from the Semester - II		02
			Total Credits Semester - III		**22**
IV (5.0)	Major Mandatory	ENV-251-MRM	Solid and Hazardous Waste Management	Theory	02
	Major Mandatory	ENV-252-MRM	Environmental Pollution-II	Theory	02
	Major Mandatory	ENV-253-MRM	Practicals based on ENV-251-MRM and ENV-252-MRM	Practical	02
	Vocational Skill Course (VSC)	ENV-254-VSC	Organic farming	Theory	02
	Community Engagement Project(CEP)	ENV-255-CEP	Community Engagement Project (CEP)	Practical	02
	Minor	ENV-256-MN	Basics of Environmental Geoscience and Biology	Theory	02
	Minor	ENV-257-MN	Practical course on Environmental Geoscience and Biology	Practical	02
	Open Elective (OE)	ENV-258-OE	Eco-Friendly Practices	Practical	02
	Skill Enhancement Course (SEC)	ENV-259-SEC	Practicals on Waste Management	Practical	02
	Ability Enhancement Course (AEC)	MAR-260-AEC/ HIN-260-AEC SAN-260-AEC		Theory (Any One)	02

	Co-curricular Course (CC)	YOG/PES/CUL/NSS/NCC-261-CC	To be continued from the Semester - III		02
				Total Credits Semester - IV	**22**
				Total Credits Semester – III + IV	**44**

CBCS Syllabus as per NEP 2020 for S.Y. B.Sc. (2024 Pattern)

Name of the Programme: B.Sc. Environmental Science
Program Code : USENV
Class : S.Y.B.Sc.
Semester : IV
Course Type : Major Mandatory (Theory)
Course Code : ENV-251-MRM
Course Name : **Solid and Hazardous Waste Management**
No. of Credits : 2
No. of Teaching Hours : 30

Course Objectives:

1. To understand basics of solid wastes.
2. To make the students aware about solid waste processing, recovery and energy generation.
3. Minimize the Production of Waste.
4. Proper management practices help minimize the garbage and scraps that need handling.
5. Reduce Pollution Effects. Secondly, it's vital to lower the impact garbage has on pollution.
6. Protect Groundwater Sources.
7. To characterize the waste and apply the knowledge of laws for municipal solid waste management, for handling of biomedical wastes and for handling of plastic wastes.

Course Outcomes:

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

CO1. Student understanding w.r.t. solid waste generation issue will be enhanced.

CO2. Students will be doing systematic study of solid waste issue and ways to tackle the issue.

CO3. Students will learn important details about collection and transport of solid waste.

CO4. Students will be able to identify different types of solid waste and their characteristics and classify them according to their properties.

CO5. Students will be able to understand economic and environmental benefits of recycling and resource recovery.

CO6. Students will be able to understand hazardous waste classification, types and sources.

CO7. Students will explore various methods of hazardous waste management including treatment storage and disposal.

Topics and Learning Points

Teaching Hours

UNIT 1: Solid Waste **10**

1.1 Solid Waste – types (Domestic, Biomedical, industrial waste etc.) and sources
1.2 Solid waste characteristics, generation rates, solid waste components,
1.3 Proximate and ultimate analyses of solid wastes.
1.4 Solid waste collection and transportation: container systems – hauled and stationary, layout of collection routes, transfer stations and transportation.

UNIT 2: Solid waste processing and recovery **10**

2.1 Solid waste processing and recovery – Recycling, recovery of materials for recycling and direct manufacture of solid waste products.
2.2 Electrical energy generation from solid waste (Fuel pellets, Refuse derived fuels), composting and Vermicomposting, biomethanation of solid waste.
2.3 Disposal of solid wastes – sanitary land filling and its management, incineration of solid waste.

UNIT – 3: Hazardous, Plastic, E waste and its Management **10**

3.1 Hazardous waste – Types, characteristics and
3.2 Health impacts.
3.3 Hazardous waste management: Treatment Methods – neutralization, oxidation reduction, precipitation, solidification, stabilization, incineration and final disposal.
3.4 Plastic waste: sources, consequences and Management methods of plastic waste
3.5 E-waste: Sources, classification & effects of e-waste ,Methods of handling and disposal

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 Development, Govt. of India, New Delhi, 2000.
3) David L.H.F. and Liptak D.G., Hazardous waste and solid waste, Lewis Publisher, 2000.
4) Oberoi N.K, Environmental Management,(2ndEdition) Excel Books, New Delhi,2003.
5) Ashok K. Rathoure , Zero Waste: Management Practices for

Environmental Sustainability, 2019.
6) O.P. Gupta, Elements of Solid Hazardous Waste and Management, 2018.
7) Hand book of Industrial and Hazardous Waste Treatment by Lawrence K. Wang, 2004.
8) Solid and Hazardous Waste Management : Science and Engineering, M. N. Rao, Razia Sultana, Sri Harsha Kota 2016.

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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	PO10	PO11	PO12	PO13
CO1	3	2		1							1	1	
CO2	3	2		1							1	1	
CO3	3	2		1							1	1	
CO4		3			1							1	
CO5		3		2	1						1	1	
CO6		3		2	1						1	1	
CO7		3		2	1						1	1	

Justification for the mapping

PO1: Disciplinary Knowledge:
CO3: Gain important details about the collection and transport of solid waste.
CO4: Identify different types of solid waste, understand their characteristics, and classify them based on their properties.
CO6: Understand hazardous waste classification, types, and sources.

PO2: Critical Thinking and Problem solving:
CO2: Apply critical thinking skills in the systematic study of solid waste issues and devising effective solutions.
CO4: Utilize problem-solving skills to identify and classify different types of solid waste based on their properties.
CO5: Evaluate economic and environmental benefits associated with recycling and resource recovery.

PO3: Social competence:
CO1: Enhance social competence by understanding the impact of solid waste generation issues on the community.

PO4: Research-related skills and Scientific temper:
CO2: Develop research-related skills through a systematic study of solid waste issues.
CO7: Apply scientific temper in exploring various methods of hazardous waste management, including treatment, storage, and disposal.

PO5: Trans-disciplinary knowledge
CO1: Integrate trans-disciplinary knowledge in understanding and addressing solid waste generation issues.

PO6: Personal and professional competence
CO2: Deepen personal and professional competence by actively participating in the systematic study of solid waste issues.

PO7: Effective Citizenship and Ethics:

CO1: Promote effective citizenship by understanding and addressing the social and environmental impacts of solid waste generation issues.
CO7: Consider ethical considerations in exploring various methods of hazardous waste management.

PO8: Environment and Sustainability:
CO3: Promote environmental sustainability by learning important details about the collection and transport of solid waste.
CO5: Advocate for the economic and environmental benefits of recycling and resource recovery.

PO9: Self-directed and Life-long learning:
CO2: Cultivate self-directed learning by actively engaging in a systematic study of solid waste issues.
CO7: Foster life-long learning by exploring various methods of hazardous waste management and staying updated on advancements.

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CBCS SYLLABUS as per NEP 2020 for S. Y. B.Sc. (2024 Pattern)

Name of the Programme: B.Sc. Environmental Science

Program Code : USENV
Class : S.Y. B.Sc.
Semester : IV
Course Type : Major Mandatory (Theory)
Course Code : ENV-252-MRM
Course Name : **Environmental Pollution -II**
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1) To learn about air pollution, noise pollution.
2) To make the students aware of noise pollution.
3) To know basic pollution types, components, phyto-remediation, etc
4) To make the students aware about pollution and control of pollution.
5) To aware students about effects of pollution in day to day life.
6) To know treatments for maintaining quality of water and soil.
7) To provide general understanding of quality of air and impact on local and global effects of air pollution on human, materials, properties and vegetation.

Course Outcomes:

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

CO1. Students will be able to understand future sustainability of natural resources.
CO2. Ability to suggest the environmental control /management plan for environmental pollution problems.
CO3. Students understand conflict and management of natural resources.
CO4. To make the surroundings cleaner and greener for the current as well as future generations.
CO5. To aware the surrounding people of the rapidly depleting natural resources and make them contribute to the conservation of the same.
CO6. Ability to identify and quantify the magnitude and intensity of Environmental pollution problems.
CO7. Ability to undertake environmental sampling and analysis with respect to air, water and noise pollution.

Topics and Learning Points

Teaching Hours

UNIT 1: Air Pollution 10

1.1 Sources and types of Pollutants – Natural and anthropogenic sources, primary and secondary pollutants. Impact of air pollutants on human health, plants and materials. Criteria air pollutants.

1.2 Principles and instruments for measurements of (i) ambient air pollutants concentration and (ii) stack emissions. Sampling and monitoring of air pollutants (gaseous and particulates).

1.3 Indian National Ambient Air Quality Standards. Dispersion of air pollutants. Mixing height/depth, Gaussian plume model, line source model and area source model

UNIT 2: Noise Pollution & Vibration 10

2.1 Sources, Impact of noise and vibrations on human health, weighting networks, measurement of noise indices (Leq, L10, L90, L50, LDN, TNI).

2.2 Noise dose and Noise Pollution standards.

2.3 Vibrations and their measurements.

UNIT 3: Control of Air Pollution and Noise Pollution 10

3.1 Control of Air Pollution- At source reduction: a) Raw material changes. b) Process / Operational changes. c) Equipment modification / replacement.

3.2 Air Pollution control technology: - a) Condensation. b) Absorption. c) Adsorption. d) Filtration. e) Electrostatic Precipitation. f) Gravity Settling. g) Wet scrubbing, h) settling chamber.

3.3 Noise Control Techniques-Active and passive - a) Sound Insulation. b) Sound Absorption. c) Vibration Damping. d) Vibration Isolation.

3.4 Control at Source

3.5 Control in Transmission Path

3.6 Control at Receiver

References:

1. Environmental chemistry by B. K. Sharma, Goel publication house, Meerut, Sixth revised edition – 2001.
2. Ecology and environment by P. D. Sharma, Rastogi publications, Meerut. Seventh edition – 2004.
3. Environmental Pollution Control Engineering: C. S. Rao, New Age International (P) Ltd. (1991)
4. Environmental Science and Engineering: Dr.N.Arumugam, Prof.V.Kumaresan (Saras

Publication, Kottar, Dist. Kanyakumari)
5. Perspectives in Environmental Studies: Anubha Kaushik, C.P.Kaushik (New Age International (P) Limited, Publishers)
6. Cheremisin off, N. P., Bio-Technology for Waste and Wastewater Treatment William Andrew Publishing, 1996.
7. Fellen berg, G., Chemistry of Pollution, John Wiley and Sons, 1999.
8. El-Halwagi M.M., Pollution Prevention through Process Integration, AP. 1997

Mapping of Program Outcomes with Course Outcomes

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2		1							1	1	
CO2	3	2		1							1	1	
CO3	3	2		1							1	1	
CO4		3			1							1	
CO5		3		2	1						1	1	
CO6		3		2	1						1	1	
CO7		3		2	1						1	1	

Justification for the mapping

PO1: Disciplinary Knowledge:
CO1: Attain comprehensive knowledge about various forms of environmental pollution, their sources, and causes.

PO2: Critical Thinking and Problem solving:
CO2: Develop critical thinking skills to understand the long-term and short-term effects of pollution on human health and ecosystems.
CO3: Apply problem-solving skills in learning methods for monitoring and measuring pollution levels and interpreting related data.

PO3: Social competence:
CO1: Foster social competence by understanding the societal implications of various forms of environmental pollution.

PO4: Research-related skills and Scientific temper:
CO3: Develop research-related skills in methods for monitoring and measuring pollution levels and interpreting related data.
CO4: Apply scientific temper in exploring strategies and technologies for controlling air pollution.
CO6: Apply scientific temper to understand the sources and effects of noise pollution.

CO7: Explore measures and regulations for controlling and mitigating noise pollution with a scientific mindset.

PO5: Trans-disciplinary knowledge
CO1: Integrate trans-disciplinary knowledge by understanding various forms of environmental pollution and their interconnectedness.

PO6: Personal and professional competence
CO2: Deepen personal and professional competence by understanding the health and ecological effects of pollution.

PO7: Effective Citizenship and Ethics:
CO1: Promote effective citizenship by understanding the environmental impact and societal causes of pollution.
CO7: Explore measures and regulations for controlling and mitigating noise pollution with ethical considerations.

PO8: Environment and Sustainability:
CO4: Advocate for strategies and technologies that contribute to the control of air pollution.
CO5: Understand the role of air quality management in urban and industrial settings, advocating for environmental sustainability.

PO9: Self-directed and Life-long learning:
CO3: Cultivate self-directed learning by actively engaging in methods for monitoring and measuring pollution levels and interpreting related data.
CO4: Foster life-long learning by staying updated on advancements in strategies and technologies for controlling air pollution.

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CBCS Syllabus as per NEP 2020 for S.Y. B.Sc. (2024 Pattern)

Name of the Programme: B.Sc. Environmental Science

Program Code	: USENV
Class	: S.Y. B.Sc.
Semester	: IV
Course Type	: Major Mandatory (Practical)
Course Code	: ENV-253-MRM
Course Name	: Practicals based on ENV-251-MRM and ENV-252-MRM
No. of Credits	: 2
No. of Teaching Hours	: 30

Course Objectives:

1) To understand the basics of sample collection of water and soil.
2) To make the students aware about medicinal and economical plants around them.
3) To make student aware about renewable energy resources around them.
4) To field experience of water treatment plant.
5) To understand sampling and analysis of air pollutants.
6) To understand standards and measurement of noise
7) To understand air pollution impacts on chlorophyll contents.

Course Outcomes:

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

CO1. Imparts conceptual knowledge of natural resources, and pollution.
CO2. Students will understand the basics knowledge of soil and water quality parameters in day to day life.
CO3. Students will acquire the knowledge about sustainable use of renewable energy resources.
CO4. Students will be able to understand easy way to save water and prevent soil erosion and flood hazard.
CO5. Students will understand handling of air pollutant sampling instrument
CO6. Students will acquire the knowledge about air pollution control technologies.
CO7. Students will understand solid waste management techniques.

Topics and Learning Points

1. Study of principal and function of air volume sample.
2. Determination of SOx from given sample.
3. Estimation of residual chlorine from the given water sample.
4. Determination of total dissolved solids from waste water sample.

5. Determination of the total chlorophyll content from the plant in clean and polluted environment.
6. Study of treatment for decomposable solid waste-vermi-composting.
7. Determination of noise pollution by Db meter.
8. To study noise pollution control devices.
9. Study of Particulate Matter.
10. Documentary on sanitary land filling of solid waste.
11. Visit to any – Vermi-composting plant / Water filtration unit/ Sewage treatment plant/ Biogas unit and submission of GEOTAG photo print at the practical examination.

*Any other practical's 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**	**PO10**	**PO11**	**PO12**	**PO13**
CO1	3					2			1				
CO2		3		2	1			1	2				
CO3		3											
CO4				3				2					
CO5													
CO6				3									
CO7			3	2			1						

Justification for the mapping

PO1: Disciplinary Knowledge:
CO1: Reinforce theoretical concepts and cultivate hands-on skills in environmental studies.

PO2: Critical Thinking and Problem solving:
CO2: Develop critical thinking skills by collecting and analyzing environmental samples to measure pollutant concentrations.

CO3: Apply problem-solving skills in interpreting monitoring results and drawing conclusions about the extent of pollution.

PO3: Social competence:
CO7: Analyze the effects of pollution on plants and their chlorophyll levels, contributing to an understanding of the ecological and social impact of pollution.

PO4: Research-related skills and Scientific temper:
CO2: Enhance research-related skills by collecting and analyzing environmental samples to measure pollutant concentrations.
CO4: Develop scientific temper through conducting air quality measurements using air samplers and analyzers with different analyzing methods.
CO6: Apply scientific methods in identifying and quantifying pollutants in water samples through water analysis tests.
CO7: Conduct scientific analysis of the effect of pollution on plants and their chlorophyll levels.

PO5: Trans-disciplinary knowledge
CO2: Integrate trans-disciplinary knowledge by collecting and analyzing environmental samples, recognizing the interconnectedness of various environmental factors.

PO6: Personal and professional competence
CO1: Deepen personal and professional competence by reinforcing theoretical concepts and developing hands-on skills in environmental monitoring.

PO7: Effective Citizenship and Ethics:
CO7: Analyze the effect of pollution on plants and their chlorophyll levels with ethical considerations for environmental impact and conservation.

PO8: Environment and Sustainability:
CO2: Advocate for environmental sustainability by collecting and analyzing environmental samples to measure pollutant concentrations.
CO4: Apply knowledge of air quality measurements to contribute to strategies for environmental sustainability.

PO9: Self-directed and Life-long learning:
CO1: Cultivate self-directed learning by reinforcing theoretical concepts and developing hands-on skills independently.
CO2: Foster life-long learning by staying updated on advancements in environmental monitoring techniques.

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(2023 Pattern)

Name of the Programme	: B.Sc. Environmental Science
Program Code	: USENV
Class	: S.Y. B.Sc.
Semester	: IV
Course Type	: Vocational Skill Course (Theory)
Course Code	: ENV-221-VSC
Course Name	: **Organic Farming**
No. of Credits	: 02
No. of Teaching Hours	: 30

Course Objectives:

1) To create awareness about Organic farming.
2) It reduces the cost of agricultural production and also improves the soil health.
3) To equip learners with the knowledge and skills necessary to practice sustainable agriculture and the production of healthy, organic food.
4) To introduce the concept of organic ecosystem and learn about biological magnification & its significance in present day scenario.
5) To increase soil fertility by promoting the growth of beneficial soil microorganisms.
6) To inoculate the importance of doing organic farming as the responsibility of every human being to ensure food safety, nutritional security and food security for the present as well as future generation, to achieve sustainable development for every nation.
7) To teach cultivation practices for various crops cultivated using organic farming methods.

Course Outcomes:

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

CO1. Understand various principles, need and prospect of organic farming including the importance of sustainability, biodiversity and ecological balance.

CO2. Gain hands on experience through field work, farm visits or practical exercises to apply their knowledge in a real world setting.

CO3. Explore the significance of soil health in organic farming and various methods to enhance soil fertility through composting and crop rotation.

CO4. Learn about marketing organic products, understanding consumer demand and the economic aspect of Organic farming.

CO5. Culture microbes used as biofertilizers and biopesticides.

CO6. Estimate the application dosage of biofertilizers and biopesticides for a crop.

CO7.Handle the equipment and tools to produce biofertilizers and to apply biopesticides.

Topics and Learning Points

Teaching Hours

UNIT 1: Introduction to organic farming **10**

1.1 History and development, IFOAM Definition and Principle- health, fairness, ecology and care
1.2 Methods, advantages and limitations
1.3 Need of Organic farming in present context and future prospects- barrier
1.4 Types of organic farming-Pure, Integrated ,Mixed

UNIT 2: Organic Farming Process **06**

2.1 Concept of farming system
2.2 Developing organic farms
2.3 Important steps & methods

UNIT 3: Crop Nutrition and Management **14**

3.1 Role of Soil in Organic Farming, Soil factors affecting plant Growth: light, heat, water, humidity, pH and Nutrition
3.2 Plant nutrient- Micro and Macro, Importance & Deficiency Symptoms
3.3 Land preparation - Tools and Technique, Preparation of seed bed , manuring, sowing, watering and raising of seedling
3.4 Pest control: Cultural, Biological and Mechanical method
3.5 Integrated Pest Management(IPM)
3.6 Crop rotation: need and benefits
3.7 Harvesting and Post Harvesting Management

References:

1. Sharma, Arun K. 2002. A Handbook of Organic farming. Agrobios, India.
2. Sathe, T.V. 2004, Vermiculture and Organic Farming. Daya Publishers.
3. Alvares, C. 1996. The Organic Farming Source Book. The Other India Press, Mapusa, Goa.
4. Gupta, M., 2004. Organic Agriculture Development in India. ABD publishers, Jaipur, India.
5. S.P. Palaniappan, K. Annadurai, 1999. Organic Farming- Theory and Practice, Scientific Publishers, Jodhpur, India.
6. Dr. Pratiksha Raghuvanoki. Handbook of Organic Farming.
7. Organic Farming: The Ecological System- Agronomy Monograph 54, ASA, USA.
8. Subha Rao, N.S. 200, Soil Microbiology, Oxford & IBH Publishers, New Delhi

9. Dongarjal R. P. and Zade S.B. 2019. Insect Ecology and Integrated Pest Management, Akinik Publications, New Delhi.
10. Guideline of National Project on Organic Farming, Department of Agriculture and Cooperation, INM Division, Ministry of Agriculture, Govt. of India
11. Dushyent Gehlot. 2005. Organic Farming- standards, accreditation, certification and inspection. Agribios, India.

Mapping of Program Outcomes with Course Outcomes

	Programme Outcomes (POs)												
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**
CO1	3						2				1		
CO2		3					2	1			1	2	2
CO3					3		2				1		
CO4			3								1	2	
CO5				3							1		
CO6				3							1		
CO7											1		

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding:
CO1: Introduces students to various principles, needs, and prospects of organic farming, emphasizing sustainability, biodiversity, and ecological balance, thereby providing a comprehensive understanding of organic farming practices and their importance.

PO2: Practical, Professional, and Procedural Knowledge:
CO2: Involves gaining hands-on experience through fieldwork, farm visits, or practical exercises, allowing students to apply their theoretical knowledge in real-world settings, thus developing practical and procedural knowledge essential for professional practice in organic farming.

PO3: Entrepreneurial Mindset and Knowledge:
CO4: focuses on marketing organic products, understanding consumer demand, and the economic aspect of organic farming, which fosters an entrepreneurial mindset by providing insights into business aspects and opportunities in organic agriculture.

PO4: Specialized Skills and Competencies:
CO5: Involves learning about culture microbes used as biofertilizers and biopesticides, developing specialized skills necessary for organic farming practitioners.
CO6: Further enhances skills by estimating application dosages of these bio-agents for crop production.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning:

CO3: explores the significance of soil health in organic farming and various methods to enhance soil fertility, requiring analytical reasoning and problem-solving skills to assess and address soil health issues effectively.

PO7: Research-related Skills:
CO1 to CO3: Collectively contribute to developing research-related skills by introducing students to principles, needs, and methods of organic farming, as well as the significance of soil health, fostering an understanding of research methodologies and practices in organic agriculture.

PO8: Learning How to Learn Skills:
CO2: Involves gaining hands-on experience and practical knowledge through fieldwork and farm visits, promoting experiential learning and the development of learning-how-to-learn skills essential for continuous improvement and adaptation in organic farming practices.

PO11: Value Inculcation and Environmental Awareness:
All COs collectively contribute to promoting environmental awareness and values by emphasizing sustainability, biodiversity, and ecological balance in organic farming practices, instilling a sense of responsibility towards environmental stewardship.

PO12: Autonomy, Responsibility, and Accountability:
CO2: Involves gaining hands-on experience and practical knowledge, promoting autonomy in decision-making and responsibility towards implementing organic farming practices effectively. CO4: further emphasizes understanding the economic aspect of organic farming, fostering accountability in business decisions.

PO13: Community Engagement and Service:
CO2: may involve fieldwork and farm visits, providing opportunities for students to engage with local communities and stakeholders in organic farming initiatives, thereby promoting community engagement and service in sustainable agriculture.

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CBCS Syllabus as per NEP 2020 for S.Y. B.Sc. (2024 Pattern)

Name of the Programme	: B.Sc. Environmental Science
Program Code	: USENV
Class	: S.Y. B.Sc.
Semester	: IV
Course Type	: Community Engagement Project (CEP)
Course Code	: ENV-255-CEP
Course Name	: **Community Engagement Project (CEP)**
No. of Credits	: 02
No. of Teaching Hours	: - /

Course Objectives:

1) Describe selected field-based methodologies and techniques used in collecting, analyzing, presenting and application of environmental information
2) Apply Environmental science concepts in different situations
3) Work in teams to solve cross-disciplinary problems in environmental hazards
4) To create awareness about innovative method.
5) To find out new conclusions through field project.
6) To impart basic knowledge about the environment and its allied problems.
7) Develop an attitude of concern for the environment.

Course Outcomes:

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

CO1. Getting of awareness of innovative methodology.
CO2. Students will experience about innovative methodology to solve environmental problems.
CO3. In a specialization domain of his / her choice, student manager will be able to choose an appropriate topic for study and will be able to clearly formulate& state a research problem.
CO4. For a selected research topic, student manager will be able to compile the relevant literature and frame hypotheses for research as applicable.
CO5. For a selected research topic, student manager will be able to plan a research design including the sampling, observational, statistical and operational designs if any.
CO6. For a selected research topic, student manager will be able to compile relevant data, interpret & analyze it and test the hypotheses wherever applicable.
CO7. Based on the analysis and interpretation of the data collected, student manager will be able to arrive at logical conclusions and propose suitable recommendations on the research problem.

CO8. Student manager will be able to create a logically coherent project report and will be able to defend his / her work in front of a panel of examiners.

Topics and Learning Points

Unit-1 **(30L)**

Topic selection, Study design, Survey preparation, Field work, Analysis.

Unit-2 **(30L)**

Report writing and Oral presentation based on Community Engagement Project work.

Standard Operating Protocols for Community Engagement Project(CEP)UG (Year-II Semester-IV)

In NEP 2020 (2023 Pattern) we are offering to UG (Second Year- Fourth Semester) students **Community Engagement Project (CEP)** for **TWO (2)** credits i.e. **50 Marks**. The total time allocation for the student to carry out Community Engagement Projects **60hours**.The actual field works hold be carried out after college hours or on holidays.

1. **Community-Based Learning:** Students should participate in community-based field projects under the supervision of faculty.
2. **Learning Hours Requirement:** A minimum of 30 hours of learning per credit in a semester is required.
3. **Assignment of Project Topics:** Project topics should be assigned to individual students or groups of students (2 or 3 students in one group. One faculty member from the department will act as a GUIDE for the student or group of students.
4. **Preparation of Questionnaire:** Students should prepare a questionnaire (20-30 questions or more)related to their project topic in Marathi or English .If the project is related to work that does not involve SURVEY work, then the questionnaire part can be replaced accordingly.
5. **Finalization of Questionnaire:** The departmental coordinator/guide should review and finalize the questionnaire. Questions that may create unnecessary complications should be avoided. The questions should be both qualitative and quantitative.
6. **Field Data Collection:** Students should visit their chosen field with the questionnaire and collect information regarding the questions from the concerned people. Collect as much information as possible by gathering 25 or more questionnaires or related data. The more data collected, the better it will be for analysis.
7. **Data Compilation and Analysis:** Students should compile all relevant data and carry out its analysis.
8. **Project Report Writing:** Write a project report in the standard format (2 Copies): Index, Chapter-1, Chapter-2, Conclusion, References, etc. The report should clearly mention the output derived from the study. The typed project report should have a minimum of 25 pages, with a font size of 12 and line spacing of 1.5.
9. **Submission of Project Report:** Submit the project report with the Guide's signature to the department (to the Departmental CEP Coordinator).
10. **Oral Presentation:**Thedepartmentshouldarrangeanoralpresentationforallprojects.To evaluate the project, TWO examiners should be appointed by the HoD (details about the appointment of examiners, weightage to internal and external marks, etc., will be provided by the examination section).

11. **Project Evaluation:** The total project work, including preparation of the questionnaire to the oral presentation, should be evaluated for 2 credits (50 Marks). The details about the allocation of time, marks, and the scheme of examination for the Community Engagement Project are given in the Table. The departmental CEP coordinator/HoD should submit the marks as per the regular procedure to the examination section.
12. **Compulsory Subject:** Since this is a compulsory subject in our syllabus, passing the Community Engagement Project is a MUST to complete the degree.

Typical Time and marks allocation for the different stages of the Community Engagement Project

Step of Project	Individual students work in hours	Marks
Topic Selection/Study Design	05	05
Survey preparation /Fieldwork	25	20
Analysis	10	05
Report writing	20	10
Oral Presentation		10
Total	**60**	**50**

Mapping of Program Outcomes with Course Outcomes

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3		2					1			1		
CO2	3		2					1			1		
CO3		3		2	2	2	2	1				1	
CO4		3		2	2	2	2	1				1	
CO5		3		2	2	2	2	1				1	
CO6		3		2	2	2	2	1				1	
CO7		3		2	2	2	2	1				1	

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding:
CO1 and CO2: Introduce students to innovative methodologies for solving environmental problems, broadening their understanding of different approaches to addressing environmental challenges.

PO2: Practical, Professional, and Procedural Knowledge:
CO3 to CO7: Collectively contribute to developing practical, professional, and procedural knowledge. They guide students through the process of conducting research in environmental management, from formulating research problems (CO3) to proposing recommendations based on data analysis (CO7).

PO3: Entrepreneurial Mindset and Knowledge:
CO1 and CO2: Exposure to innovative methodologies (CO1 and CO2) can foster an entrepreneurial

mindset by encouraging students to think creatively and adaptively in addressing environmental challenges.

PO4: Specialized Skills and Competencies:
CO3 to CO7: Focus on developing specialized skills and competencies related to research in environmental management. This includes formulating research problems, compiling relevant literature, planning research designs, analyzing data, and proposing recommendations.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning:
CO3 to CO7: Enhance students' capacity for application, problem-solving, and analytical reasoning by guiding them through the process of conducting research. This involves identifying research problems, designing studies, collecting and analyzing data, and drawing conclusions.

PO6: Communication Skills and Collaboration:
CO3 to CO7: require students to communicate their research findings effectively and collaborate with peers, instructors, and potentially external stakeholders. This includes articulating research problems, presenting findings, and proposing recommendations.

PO7: Research-related Skills:
CO3 to CO7: Directly contribute to developing research-related skills such as formulating research problems, compiling literature reviews, designing research studies, collecting and analyzing data, and drawing conclusions based on empirical evidence.

PO8: Learning How to Learn Skills:
CO1 and CO2: Introduce students to innovative methodologies, which require them to learn new concepts and techniques.
CO3 to CO7: guide students through the research process, helping them develop the skills necessary for continuous learning and improvement.

PO11: Value Inculcation and Environmental Awareness:
CO1 and CO2: emphasize the importance of innovative methodologies for addressing environmental problems, which helps instill values of creativity, adaptability, and innovation in environmental management practices.

PO12: Autonomy, Responsibility, and Accountability:
CO3 to CO7: require students to take ownership of their research projects, demonstrating autonomy in formulating research problems, conducting studies, and proposing recommendations. This fosters a sense of responsibility and accountability in their research endeavors.

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CBCS Syllabus as per NEP 2020 for S.Y. B.Sc. (2024 Pattern)

Name of the Programme: B.Sc. Environmental Science

Program Code	: USENV
Class	: S.Y. B.Sc.
Semester	: IV
Course Type	: Minor (Theory)
Course Code	: ENV-256-MN
Course Name	: **Basics of Environmental Geoscience and Biology**
No. of Credits	: 2
No. of Teaching Hours	: 30

Course Objectives:

1) To ensure 'well variedness' with the basic, scientific concepts of many of the current environmental issues, environmental Biology & happenings
2) To encourage incitation of a thought process related to Evolution of Life and the adaptations to changing environment during the course of evolution
3) To enumerate the significance of Bioresources, threats and exploitation
4) To get knowledge about Earths structural components and significance of Soil from agriculture point of view.
5) Gain a foundational understanding of how geoscience and biology interact within environmental systems.
6) Understand soil formation, types, and their importance in supporting plant life and ecosystems.
7) Learn basic research methods for studying environmental systems, including data collection and analysis.

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: Earth's structural components and Soil **10**

1.1 Internal Structure of Earth
1.2 Theories of geological evolution – Wagener's Continental Drift Theory, Plate Tectonic Theory
1.3 Types of Rocks – Igneous, Sedimentary, Metamorphic, Rock cycle
1.4 Soil: Introduction, Formation – weathering processes (types), Physical, Chemical & biological properties.
1.5 Ocean basins and physical structure of the ocean floor. Properties of sea water, waves and tides, ocean Currents. **8**

UNIT 2: Origin of Life

2.1 The origin of Life; Evolution of Life through the geological time scale i.e. – Eras, Periods, Epochs
2.2 Events of (Evolutionary) 'Explosions' and 'Mass Extinctions'& Paleontological Evidences for these.
2.3 The current 'Mass Extinction' with reference to rate of extinction, factors responsible and possible remedies **12**

UNIT – 3: Ecology and Bio-resources

3.1 Ecological Adaptations under various environmental conditions –In plants - Hydrophytes, Mesophytes, Epiphytes, Xerophytes & Halophytes, in animals - mimicry, vestigially etc.
3.2 Bio-resources in India (Forests, Agricultural crops, Livestock, Fisheries etc.)
3.3 Significances / use of the Bio resources; Threat to bio resources.

References:

1) 'A Textbook of Plant Ecology' Ambashta R.S. &Ambashta N.K (1999) CBS Publ.& Distributers, New Delhi
2) Environmental Science: A Global Concern' Cunningham W.P. & Saigo S.W. (1997) WCB, McGraw Hill
3) 'Elements of Ecology' Sharma P.D. Rastogi Publication
4) 'Environmental Science' Tyler M.G. Jr. (1997) Wadsworth Publ. Co.
5) 'Environmental Studies' Benny Joseph (2005) Tata McGraw Hill Publ. Co. Ltd.
6) 'Patterns in the Living World' – Biology-an Environmental approach, John Murray, London
7) Diversity Among Living Things' Biology-an Environmental approach, John Murray, London

8) Environmental Geology; Valdiya K.S.; Indian Context. Tata McGraw Hill
9) Essentials of Climatology; D. S. Lal; Chaitanya Publishing House, Allahabad, 1989.
10) Holmes' – Principles of Physical Geology; Edt. by P. McL. D. Duff; ELBS Chapman & Hall Low Priced Edtn; 4thEdtn.
11) A Textbook of soil Science; T.D. Biswas& S.K. Mukharjee; Tata McGraw-Hill Education
12) Introductory Soil Science; Dilip Kumar Das; Kalyani Publishers; 2ndEdtn.
13) Environmental Geology; Kellar E.A. (2011); Prentice Hall, 624 p; 9thEdtn.
14) 'Ecology: Principles and Applications' Chapman J.L. & Reiss M.J. (1995) Cambridge University Press

Mapping of Program Outcomes with Course Outcomes

	Programme Outcomes (POs)												
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**
CO1	3							2					
CO2	3							2	1				
CO3	3			2				1					
CO4		3		2	1		1	1	1				
CO5	3			2				1					
CO6	3	2		1				1	1				
CO7		3					2						

Justification for the mapping

PO1: Disciplinary Knowledge:
CO1. Focuses on bioresources,
CO2. Involves the study of biodiversity.
CO3. Imparts conceptual knowledge of the environment.
CO5. Involves proficiency in ecological field methods.
CO6.Applies the scientific method to understand environmental systems. All of these contribute to disciplinary knowledge in environmental science.

PO2: Critical Thinking and Problem solving:
CO4. Involves using interdisciplinary approaches for problem-solving.
CO6. Applies the scientific method and quantitative techniques,
CO7. Evaluates current environmental issues and problems, collectively contributing to critical thinking and problem-solving skills.

PO4: Research-related skills and Scientific temper:
CO3. Involves imparting conceptual knowledge,
CO4. Involves interdisciplinary approaches,
CO5. Involves ecological field methods,
CO6.Applies the scientific method. These collectively contribute to research-related skills and a scientific temper.

PO5: Trans-disciplinary knowledge:
CO4. Involves using interdisciplinary approaches such as ecology, economics, ethics, and policy. This directly contributes to trans-disciplinary knowledge by integrating different disciplines in addressing environmental problems.

PO7: Effective Citizenship and Ethics:
CO4. Involves using interdisciplinary approaches, including ethics, to devise solutions to environmental problems.
CO7 involves evaluating current environmental issues and problems, considering solutions and management practices, contributing to effective citizenship and ethical considerations.

PO8: Environment and Sustainability:
CO1. Focuses on bioresources,
CO2. Involves the study of biodiversity,
CO3. Imparts conceptual knowledge of the environment,
CO4. Uses interdisciplinary approaches for problem-solving,
CO5. Involves ecological field methods, and
CO6. Applies the scientific method. Together, they address the broader Program Outcome related to Environment and Sustainability.

PO9: Self-directed and Life-long learning:
CO2. Involves applying knowledge of biodiversity in day-to-day life.
CO4. Involves using interdisciplinary approaches.
CO6. Involves applying the scientific method and quantitative techniques. These outcomes collectively contribute to students' ability to engage in self-directed and life-long learning by applying knowledge and skills beyond the classroom.

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CBCS Syllabus as per NEP 2020 for S.Y. B.Sc. (2024 Pattern)

Name of the Programme: B.Sc. Environmental Science

Program Code	: USES
Class	: S.Y. B.Sc.
Semester	: IV
Course Type	: Minor (Practical)
Course Code	: ENV-257-MN
Course Name	: **Practical course on Environmental Geoscience and Biology**
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

1) To learn the properties of rock and mineral samples.
2) To estimate the various parameters of soil samples.
3) To illustrate the different ways for the safe disposal of solid waste.
4) To identify native plants for plantation with respect to Geography and Climate and their significance in providing ecological services.
5) To study the Plant / Animal Fossil Forms from different geological periods.
6) Develop practical skills in using techniques and tools common in environmental biology and geoscience.
7) Learn and practice various methods for collecting environmental samples (e.g., soil, water, biological specimens).

Course Outcomes:

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

CO1. Understand the types of plant and animal adaptations under various environmental conditions.
CO2. Estimate the parameters like Soil temperature, Texture, Moisture content and water holding capacity of soil.
CO3. Identify the food adulterants from food samples.
CO4. Find out the % Carbon and Organic Content from soil.
CO5. Analyze collected data using appropriate statistical methods and software, and interpret results to draw meaningful conclusions about environmental conditions.
CO6. Address real-world environmental problems by integrating knowledge from both disciplines to propose practical solutions.
CO7. Communicate complex environmental concepts and findings in a way that is accessible to the general public, promoting environmental awareness and understanding.

Topics and learning points

1) To study of plant / animal fossil forms from different geological periods (bones, shells, stone, coal etc.)
2) Study of plant adaptations under various environmental conditions (Hydrophytes, Mesophytes, Epiphytes, Halophytes & Xerophytes).
3) Study of animal adaptations under various ecological conditions.
4) Identifying native plants for plantation with respect to geography and climate.
5) Identification of different rock specimens for their physical properties.
6) Identification of different mineral specimens for their physical properties.
7) Study of soil properties – temperature, texture and particle size
8) Study of vegetation by quadrate method.
9) Estimation of the water holding capacity of given soil sample.
10) Visit of forest / water reserve and submission of excursion report is compulsory at the time of practical examination.
11) Visit to study different fishery resources OR Visit to study and inventories the various agricultural/ horticultural resources in the area.

*Any other relevant practical related to syllabus.

References:

1. S.K. Maiti Handbook of methods in Environmental Studies Vol—I & II, ABD Publishers, Jaipur, India
2. Manivaskam, N, Physico-Chemical Examination of water, sewage and industrial effluents, Pragti Prakashan, Meerut, 1984.
3. Trivedi, R.K. and Goel,P.K Chemical and biological method for water pollution studies, Environment Publications, Karad, 1986.
4. Willard Instrumental methods of analysis cbspd; 7thEdtn

Mapping of Program Outcomes with Course Outcomes

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2											
CO2					3						2		
CO3			3										
CO4				3	2		1						
CO5							3		2				
CO6						3				2	1		2
CO7								3				2	

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding:
CO1: involves understanding and applying foundational laboratory techniques and knowledge essential for studying microorganisms, aligning with comprehensive knowledge in microbiology.

PO2: Practical, Professional, and Procedural Knowledge:
CO1: requires practical and procedural skills in laboratory techniques, reflecting professional competencies in environmental microbiology.

PO3: Entrepreneurial Mindset and Knowledge:
CO3: involves applying practical knowledge of bioremediation techniques, demonstrating procedural skills and professional application.

PO4: Specialized Skills and Competencies:
CO4: emphasizes specialized skills in molecular techniques, which are crucial for advanced studies and applications in microbiology.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning:
CO2: involves applying analytical reasoning to interpret microbial data, showcasing problem-solving abilities in environmental contexts.
CO5: focuses on the application of analytical reasoning and problem-solving skills to interpret experimental data accurately.

PO6: Communication Skills and Collaboration:
CO6: involves communicating findings on environmental impacts effectively, reflecting the importance of clear communication and collaborative understanding.

PO7: Research-related Skills:
CO4: involves research-related skills in molecular biology techniques, essential for studying and understanding microbial functions and diversity.
CO5: emphasizes the research-related skills necessary for data analysis and interpretation, critical for scientific inquiry.

PO8: Learning How to Learn Skills:
CO7: reflects the ability to integrate knowledge from various sources and apply it to real-world problems, demonstrating self-directed learning and adaptability.

PO9: Digital and Technological Skills:
CO5: involves the use of digital tools and software for data analysis, showcasing the application of technological skills in research.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:
CO6: requires an understanding of how environmental microbiology impacts various ecosystems, which can foster a broader perspective and empathy towards environmental issues.

PO11: Value Inculcation and Environmental Awareness:
CO3: emphasizes the importance of environmental awareness and value inculcation through practical applications of bioremediation.
CO6: focuses on understanding and evaluating environmental impacts, reflecting the value of environmental awareness.

PO12: Autonomy, Responsibility, and Accountability:
CO7: involves taking responsibility for applying integrated knowledge to real-world issues, demonstrating autonomy and accountability in scientific contributions.

PO13: Community Engagement and Service:
CO6: involves understanding environmental impacts that are relevant to community health and well-being, aligning with community engagement and service.

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CBCS Syllabus as per NEP 2020 for S.Y. B.Sc. (2024 Pattern)

Name of the Programme	: B.Sc. Environmental Science
Program Code	: USENV
Class	: S.Y.B.Sc.
Semester	: IV
Course Type	: Open Elective (Practical)
Course Code	: ENV-258-OE
Course Name	: **Eco Friendly Practices**
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

1) Identify key areas where eco-friendly practices can reduce negative effects on the environment.
2) Learn about sustainable practices and technologies, such as renewable energy sources, waste reduction, and resource conservation.
3) Understand the principles of reduce, reuse, and recycle, and how they contribute to environmental sustainability.
4) Develop skills to implement eco-friendly practices in various settings, such as home, work, and community.
5) Analyze the effectiveness of different eco-friendly practices and solutions.
6) Raise awareness about environmental issues and the importance of eco-friendly practices.
7) Learn to measure and assess the impact of eco-friendly practices.
8) Understand how eco-friendly practices align with broader goals, such as corporate social responsibility, public health, and economic development.

Course Outcomes:

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

CO1. Make informed decisions regarding environmental sustainability, considering factors such as energy efficiency, resource management, and waste reduction.

CO2. Apply eco-friendly practices in various contexts, including their personal lives, workplaces, and communities.

CO3. Changes in behavior that reflect a commitment to sustainability, such as adopting habits that minimize their carbon footprint or promoting green practices among peers.

CO4. Analyze and address environmental challenges using eco-friendly solutions. This includes identifying problems, assessing potential solutions, and implementing effective strategies.

CO5. The ability to articulate the importance of eco-friendly practices and advocate for environmental sustainability within their spheres of influence, such as in their communities, workplaces, or educational settings.

CO6. To measure and evaluate the effectiveness of eco-friendly practices and initiatives, including setting goals, tracking progress, and making necessary adjustments to improve environmental impact.

CO7. Understand relevant environmental policies, regulations, and standards, and how they impact eco-friendly practices and compliance requirements.

Topics and Learning Points

1) Basic eco-friendly practices for safe environment.
2) To start sustainable shopping.
3) To understand sustainable eating habitat.
4) Identification and reduction of single use plastic in day today life.
5) To prepare eco-friendly floor cleaning product.
6) To practice responsible tourism.
7) Practice organic gardening techniques.
8) To start and maintain a home composting system.
9) To conduct energy audit of a building.
10) To understand renewable energy technologies.
11) Demonstration of affordable rainwater collection system.
12) To design products with minimal environmental impact.
13) To promote alternative transportation methods.
14) Do's & dont's for solid waste collection (paper waste & waste generated by students)
15) Calculation of carbon footprint

*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
5. Laboratory Exercise in Microbiology by Prescott and Harley. MGH Publication.
6. Media Used for Environmental Microbiology by Ronald and Atlas. Taylor and Francis Publication.

Mapping of Program Outcomes with Course Outcomes

	Programme Outcomes (POs)												
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1		3									2		
CO2		3								2			
CO3								3			2		
CO4			3		2								
CO5						3							2
CO6				3					2			1	
CO7	3						2						

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding:
CO7: involves understanding environmental policies and regulations, which requires comprehensive knowledge of how these frameworks influence eco-friendly practices.

PO2: Practical, Professional, and Procedural Knowledge:
CO1: involves applying practical knowledge to make informed decisions on sustainability, which aligns with practical and procedural knowledge in environmental management.
CO2: focuses on the application of eco-friendly practices across different settings, demonstrating practical and professional knowledge in sustainability.

PO3: Entrepreneurial Mindset and Knowledge:
CO4: involves problem-solving and implementing strategies for environmental challenges, which aligns with an entrepreneurial mindset by addressing issues with innovative and effective solutions.

PO4: Specialized Skills and Competencies:
CO6: involves specialized skills in evaluating and measuring the impact of eco-friendly initiatives, which aligns with developing competencies in environmental sustainability.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning:
CO4: requires analytical reasoning and problem-solving skills to tackle environmental challenges, aligning with the capacity for application and analytical thinking.

PO6: Communication Skills and Collaboration:
CO5: emphasizes the need to communicate and advocate for eco-friendly practices effectively, highlighting the importance of communication skills and collaboration.

PO7: Research-related Skills:
CO7: involves researching and understanding environmental policies and regulations, which requires research-related skills to grasp compliance and standards.

PO8: Learning How to Learn Skills:
CO3: reflects an ongoing learning process about sustainability and personal behavior changes, demonstrating the ability to adapt and learn continuously.

PO9: Digital and Technological Skills:
CO6: involves using digital tools and technologies for tracking and evaluating eco-friendly practices, aligning with digital and technological skills.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:
CO2: requires applying eco-friendly practices in diverse settings, reflecting an inclusive spirit and consideration of different cultural and community contexts.

PO11: Value Inculcation and Environmental Awareness:
CO1: involves making decisions that reflect environmental values and awareness, demonstrating the inculcation of sustainability principles.
CO3: reflects personal behavior changes that embody environmental values and awareness, aligning with value inculcation.

PO12: Autonomy, Responsibility, and Accountability:
CO6: requires taking responsibility for evaluating and improving eco-friendly practices, demonstrating autonomy and accountability in environmental management.

PO13: Community Engagement and Service:
CO5: involves engaging with communities and advocating for environmental sustainability, reflecting community engagement and service.

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CBCS Syllabus as per NEP 2020 for S.Y. B.Sc. (2024 Pattern)

Name of the Programme	: B.Sc. Environmental Science
Program Code	: USENV
Class	: S.Y. B.Sc.
Semester	: IV
Course Type	: Skill Enhancement Course (Practical)
Course Code	: ENV-259-SEC
Course Name	: **Practicals on Waste Management**
No. of Credits	: 02
No. of Teaching Hours	: 60

Course Objectives:

1) To learn about the sources and quantities of waste generated in different sectors.
2) Understand different methods and systems for waste collection and their suitability for various settings (urban, rural, and industrial).
3) Explore strategies for reducing waste generation at the source, including product design and process improvements.
4) Understand the recycling process for different materials (paper, glass, plastics, and metals) and the technologies involved.
5) Learn about composting methods for organic waste, including aerobic and anaerobic composting.
6) Study physical and chemical methods for waste treatment, such as sorting, shredding, and chemical stabilization.
7) Identify and apply best practices in solid waste management.

Course Outcomes:

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

CO1. Demonstrate a comprehensive understanding of solid waste management principles, including waste generation, collection, treatment, and disposal methods.

CO2. Design and evaluate waste collection systems suitable for different settings, considering factors such as efficiency, cost, and environmental impact.

CO3. Implement and recommend effective strategies for reducing waste generation at the source, such as product redesign or process improvements.

CO4. Understand and describe the processes for recycling various materials, including sorting, processing, and material recovery.

CO5. Assess the quality of compost produced and its potential applications in agriculture and landscaping.

CO6. Apply appropriate treatment methods to specific types of waste, considering effectiveness and environmental impact.

CO7. Apply best practices to develop and improve waste management strategies and programs.

Topics and Learning Points

1) Prepare list of components of municipal, agricultural and biomedical solid waste.
2) To understand the processes involved in recycling domestic waste.
3) Designing the organization chart for the institution for solid waste management.
4) To study management of disposal of hazardous waste safely.
5) To study technologies that convert waste into energy.
6) Prepare report on 'solid waste management in your municipal/ grampanchayat/ rural/ primary health center.
7) To understand the design and management of landfills.
8) Solid waste audit of college campus.
9) Preparation of composting by indore method.
10) Preparation of composting by bangalore method.
11) Food waste management system in college (study/ audit).
12) To study biogas plant.
13) Visit to hospital to understand hospital waste management.

*Any other relevant practical related to syllabus

References:

12. Environmental Science: A Practical Manual Book by G Lakshmi Swarajya and P Prabhu Prasadini (2018)
13. Environmental Chemical Analysis Laboratory Manual, Prepared by Dr. Erik Krogh, Dr. Chris Gill, Shelley Gellein, and Peter Diamente Department of Chemistry, 2018
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CO1	3												
CO2		3											
CO3										2			
CO4					3								
CO5				3									
CO6						3					2		
CO7					3				2				
							3	2				1	1

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding:
CO1.Demonstrating comprehensive knowledge of waste generation, collection, treatment, and disposal

PO2: Practical, Professional, and Procedural Knowledge:
CO2. Designing and evaluating waste collection systems involves applying practical skills and procedural knowledge in real-world settings.

PO4: Specialized Skills and Competencies:
CO4. Understanding and describing recycling processes involves specialized knowledge and skills in handling different materials.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning:
CO3. Implementing and recommending waste reduction strategies involves applying analytical reasoning and problem-solving skills.
CO6. Applying treatment methods involves problem-solving and analytical reasoning to choose the most effective and environmentally friendly options.

PO6: Communication Skills and Collaboration:
CO5. While assessing compost quality is more technical, it often involves collaboration with others to apply the compost effectively in agriculture and landscaping.

PO7: Research-related Skills:
CO7. Developing and improving waste management strategies based on best practices involves researching and evaluating existing methods and approaches

PO8: Learning How to Learn Skills:

CO7. The ability to continuously improve waste management strategies requires an ongoing learning approach.

PO9: Digital and Technological Skills:
CO6. Application of treatment methods may benefit from digital tools and technologies, making this PO indirectly relevant.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:
CO2. Understanding diverse waste management practices and engaging with various communities

PO11: Value Inculcation and Environmental Awareness:
CO5. The focus on waste reduction, recycling, and composting directly aligns with environmental awareness and values, emphasizing the importance of sustainable practices.

PO12: Autonomy, Responsibility, and Accountability:
CO7. The ability to implement waste management strategies and recommend improvements involves taking responsibility and being accountable for the effectiveness of these strategies.

PO13: Community Engagement and Service:
CO7. Waste management strategies often involve community engagement to address local needs and ensure effective service delivery.

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