



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

S.Y.B.Sc. (Environmental Science) Semester-III
For Department of Environmental Science
Tuljaram Chaturchand College, Baramati.

Programme Specific Outcomes (PSOs)

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

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

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

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

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

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

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

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

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

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

Class	Semester	Paper Code	Title of Paper	No. of Credits
S.Y.B.Sc	III	EVS 2301	Natural Resources	3
		EVS2302	Environmental Pollution and Control-I	3
		EVS 2303	Practical based on EVS2301 & EVS2302	2
	IV	EVS 2401	Solid and Hazardous Waste Management	3
		EVS 2402	Environmental Pollution and Control- II	3
		EVS 2403	Practical based on EVS2401 & EVS2402	2

SEMESTER - III**PAPER CODE: EVS 2301****PAPER - I: NATURAL RESOURCES****Credit -3: No. of Lectures – 48.****Learning objectives:**

- To learn basic resources natural, forest, Grasslands etc
- To make the students aware about resources.

Course Outcomes:

1. Student understands resources, vermiculture in day to day life, Sponge fishery.
2. Students will understand basics of natural resources and their significance.
3. Students will have the knowledge of forest management and related laws.
4. Students will be able to understand resource management techniques. (insitu and exsitu methods.)
5. Students will be able to understand water and water shed management and water conflicts in India and world.
6. Students will get in depth knowledge of renewable energy resources.
7. Students will have understanding of biological energy and fuels.

Credit 1**UNIT 1- Resources :****10L**

Definition, Classification of Resources: a) Natural Vs Artificial Resources. b) Material Vs Energy Resources. c) Biotic / Biological Vs Abiotic / Non-biological Resources. d) On the basis of its Renewability with-in the Human Time Scale as – Non-renewable, Potentially renewable & Perpetual Resources. Man's interaction with Natural Resources – a) As Resource Base. b) As Waste Sink. c) Cultural Significance of Natural Resources. Importance & Scope of Natural Resources.

UNIT 2 - Forest, Grassland and Wildlife Resources**10L**

- A) Forest Resource: • Classification – Old & Second Growth Forests ...etc. • Ecological Significance. • Forest Mgmt. in India – Laws, JFM, EDP, Protected Areas.
- B) Grassland Resource: • Classification. • Significance - Ecological & Non-ecological. • Grassland Mgmt. – Prevention from Overgrazing ...etc. C) Wildlife Resource: • Meaning & Definition. • Significance - Ecological and Non-ecological. • Protection and Conservation of Wildlife – Laws, Protected Areas - Insitu and Ex-situ methods.

Credit 2:**Unit -3: Land & Water Resources :****14L**

- A) Land Resource: • Significance of the top-most layer. • Soil Erosion – Causes – Water & Wind. Erosion of Soil. Control of Erosion & Soil Conservation Methods.
- B) Water Resource: Sources and Distribution. Water Scarcity – the reasons. Conflicts over water in World and India. Conservation & Mgmt. – a) Traditional Methods. b) Rain-water Harvesting and Ground Water Recharge. c) Water-shed management- concept.

Credit 3:**UNIT 4: Energy Resources:****14L**

- Classification of energy resources: a) Exhaustible Vs Inexhaustible. b) Polluting Vs Non-polluting. c) Conventional Vs Non-conventional. • Energy Crisis. Energy Scenario in World & in India. • Conventional Energy Resource – a) Coal. b) Oil. c) Natural Gas. d) Nuclear Energy. • Solar Energy – Solar Cells, Solar Heating (Active & Passive), Solar Collectors. • Wind Energy – Location of Wind Generator Site, Wind Energy Converters. Hydro-electric Energy – Impulse & Reaction Turbines. Tidal Energy – Wells Turbine. Wave Energy. • Geothermal Energy. Bioenergy – a) Biomass &, Biomass Programme – Energy Plantation, Wastes. b) Biogas. c) Ethanol. d) Biodiesel. • Energy Management – Energy Audit.

References:

- 1) P.D. Sharma (2006): Ecology and Environment – Rastogi Publications, Meerut
- 2) S.T. Ingle et al. (2005) Environment Studies – Prashant Publication House, Pune
- 3) P.S. Verma and V.K. Agrawal (1998) Environmental Biology (Principles of ecology), S. Chand and company Ltd, New Delhi
- 4) H.V. Jadhav (1994): Principles of Environmental Sciences, Himalaya Publishing House
- 5) Dr. A. M. Deshmukh (1996): Outlines of Microbiology, Krishnai Publication, Karad
- 6) P.C. Dubey, D.K. Maheshwari (1993): A Textbook of biotechnology, S. Chand and Co. Ltd, New Delhi
- 7) Ltd, New Delhi
- 8) S.C. Santra (2001): Environmental Sciences, New Central Book Agency (P) Ltd, Kolkata
- 9) Environmental Geography : Savindra Singh (Pravalika Publications, Prayagraj)
- 10) Physical Geography: Savindra Singh (Pravalika Publications, Prayagraj)

- 11) Disaster Management: Savindra Singh (Pravalika Publications, Prayagraj)
- 12) Ecology and Environment: P. D. Sharma (Rastogi Publications, Meerut)
- 13) Principles of Environmental Biology: P. K. G. Nair (Himalaya Publishing House, New Delhi)
- 14) Environmental Biology: M. P. Arora (Himalaya Publishing House, New Delhi)
- 15) Environmental Science: Enger Smith, Smith, W. M. C. Brown (Company Publishing)
- 16) Principles of Soil Science: Watt K. E. F. (1973), (McGraw Hill Book Company, New Delhi)

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		2		2	2			
CO 2	2	3			3			3	2
CO 3	2			3				3	
CO 4	2	3				2			
CO 5		3	2				3		
CO 6					3	2		3	3
CO 7				3			3		

Justification for the mapping

PO1: Disciplinary Knowledge

CO1: Students will demonstrate comprehension of resources, vermiculture in day-to-day life, and Sponge fishery.

CO2: Attain a solid understanding of the basics of natural resources and their significance.

CO3: Acquire knowledge of forest management and related laws.

CO4: Develop the ability to understand resource management techniques, encompassing both insitu and exsitu methods.

PO2: Critical Thinking and Problem Solving

CO2: Cultivate critical thinking skills through understanding the basics of natural resources and their significance.

CO4: Enhance problem-solving abilities by understanding resource management techniques.

CO5: Foster critical analysis in comprehending water and watershed management, and water conflicts.

PO3: Social competence:

CO1: Develop social competence through comprehension of resources, vermiculture, and Sponge fishery.

CO5: Understand the social dimensions of water and watershed management, and water conflicts.

PO4: Research-related skills and Scientific temper:

CO3: Acquire knowledge of forest management and related laws, fostering research-related skills.

CO7: Develop scientific temper through understanding biological energy and fuels.

PO5: Trans-disciplinary Knowledge

CO1: Integrate trans-disciplinary knowledge through comprehension of resources, vermiculture, and Sponge fishery.

CO2: Cultivate a trans-disciplinary perspective by understanding the basics of natural resources and their significance.

CO6: Gain a holistic view through in-depth knowledge of renewable energy resources.

PO6: Personal and Professional Competence

CO1: Develop personal and professional competence through comprehension of resources, vermiculture, and Sponge fishery.

CO4: Enhance competence in resource management techniques.

CO6: Deepen personal and professional competence through in-depth knowledge of renewable energy resources.

PO7: Effective Citizenship and Ethics:

CO5: Understand water and watershed management, and water conflicts, fostering effective citizenship.

CO7: Attain understanding of biological energy and fuels, considering ethical implications.

PO8: Environment and Sustainability:

CO2: Understand the basics of natural resources and their significance for environmental sustainability.

CO3: Gain knowledge of forest management and related laws, contributing to environmental awareness.

CO6: Deepen understanding of renewable energy resources, fostering sustainability awareness.

PO9: Self-directed and Life-long Learning

CO2: Cultivate self-directed learning through understanding the basics of natural resources and their significance.

CO6: Encourage life-long learning through in-depth knowledge of renewable energy resources.

SEMESTER - III**PAPER CODE: EVS 2302****PAPER - II: ENVIRONMENTAL POLLUTION AND CONTROL- I****Credit -3: No. of Lectures - 48.****Learning objectives:**

- To know basic pollution types, components, phytoremediation , etc
- To make the students aware about resources.

Course Outcomes:

1. Student understanding w.r.t. biofertilizers, biopesticides, cropping and pest management, innovative Ex-situ and In-situ methods of pollution remediation
2. Students will able to determine soil quality and effect of fertilizers and pesticides on the soil.
3. Students will learn about various important parameters for water analysis.
4. Students will learn the stepwise detailed process of water analysis.
5. Students will understand various aerobic and anaerobic water treatment techniques and various types of water treatment plants.
6. Students will know the IS standard procedures for analysis and standard pollution levels for industries.
7. Students will expertise in waste management techniques for different type of wastes and pollution.

Credit -1:**UNIT 1 - Soil Pollution****06 L**

Analysis of soil quality. Soil Pollution control. Industrial effluents and their interactions with soil components. Soil microorganisms and their functions – degradation of pesticides and synthetic fertilizers.

UNIT 2 - Soil Pollution Control**10L**

Biological Methods: a) To reduce dependency on chemicals – Use of Biofertilizers & Biopesticides, Conservational Tillage, Mixed Cropping, Crop rotation, Biological Pest Mgmt., Organic Farming ...etc. b) Bio / Phyto-remediation of contaminated sites. • Chemical Methods: a) Ex-situ - Acid Leaching. b) In-situ - pH correction using Lime or Gypsum. • Physical / Mechanical Methods: a) Ex-situ - Heavy metal immobilization through Vitrification. b) In-situ – Soil Vapour Extraction.

Credit -2:**UNIT 3 – Water Pollution****16L**

Types and sources of water pollution. Impact on humans, plants and animals. Measurement of water quality parameters: sampling and analysis for pH, EC, turbidity, TDS, hardness, chlorides, salinity, DO, BOD, COD, nitrates, phosphates, sulphates, heavy metals and organic contaminants. Microbiological analysis – MPN. Indian standards for drinking water (IS: 10500, 2012). Drinking water treatment: Coagulation and flocculation, Sedimentation and Filtration, Disinfection and Softening.

Credit -3:**UNIT 4- Control of Water Pollution****16L**

• Segregation & Re-utilization of Domestic Waste Water – Gray & Black Water. • Waste Water Treatment: a) Primary Treatment – Screening, Grit removal, Sedimentation etc. b) Secondary Treatment - • Aerobic Method- i) Activated Sludge Process. ii) Trickling Filter. • Anaerobic Method. c) Tertiary Treatment – Disinfection (Chlorination). d) Advanced Treatments – Carbon Adsorption, Reverse Osmosis, Ion exchange. Bioremediation.

References:

1. Environmental chemistry by B. K. Sharma, Goel publication house, Meerut, Sixth revised edition – 2001.
2. Environmental geography by Savindra Singh, Prayag Pustak Bhavan, Allahabad. Revised edition – 2002.
3. Ecology and environment by P. D. Sharma, Rastogi publications, Meerut. Seventh edition – 2004.
4. Environmental studies by S. T. Ingle and S. R. Thorat, Prashant publications, Pune, First edition – 2005.
5. Waste Water Engineering: Metcalf & Eddy, Tata Mc-Graw Hill Publishers, III Edition (1995).
6. Water Supply and Sanitary Engineering: S. C. Rangwala, Charotar publishing house, Anand (1992).
7. Water and Wastewater Technology: Mark J Hammer & Mark J Hammer Jr., Prentice Hall of India, IV Edition (2002)
8. Environmental Pollution Control Engineering: C.S.Rao, New Age International (P) Ltd. (1991)
9. Environmental Science and Engineering: Dr.N.Arumugam, Prof.V.Kumaresan(Saras Publication, Kottar, Dist. Kanyakumari)
10. Perspectives in Environmental Studies: Anubha Kaushik, C.P.Kaushik (New Age International(P) Limited, Publishers)

11. Principles of Soil Science: Watt K. E. F. (1973),(McGraw Hill Book Company, New Delhi)

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CO2					2		3	3	2
CO3			3			3			
CO4	2			3					2
CO5	2	2							
CO6	3	2		2					
CO7						2			

Justification for the mapping

PO1: Disciplinary Knowledge:

CO4: Develop the ability to determine the content of important elements like organic carbon and nitrogen in the soil.

CO5: Gain practical knowledge of determining important properties of soil, including EC, bulk density, and salinity.

CO6: Acquire practical knowledge of determining important properties of water, such as carbonates, bicarbonates, hardness, turbidity, salinity, and dissolved oxygen.

PO2: Critical Thinking and Problem solving:

CO5: Apply problem-solving skills in determining important properties of soil like EC, bulk density, and salinity.

CO6: Apply critical thinking in determining important properties of water, such as carbonates, bicarbonates, hardness, turbidity, salinity, and dissolved oxygen.

PO3: Social competence:

CO3: Understand and appreciate the social significance of marketed forest resources, medicinal, and economical plants.

PO4: Research-related skills and Scientific temper:

CO4: Develop research-related skills by determining the content of important elements like organic carbon and nitrogen in the soil.

CO6: Apply scientific temper in determining important properties of water, such as carbonates, bicarbonates, hardness, turbidity, salinity, and dissolved oxygen.

PO5: Trans-disciplinary knowledge

CO1: Gain awareness about local groundwater resources.

CO2: Acquire practical knowledge of water conservation practices like rainwater harvesting.

PO6: Personal and professional competence

CO3: Develop personal and professional competence through knowledge of marketed forest resources, medicinal, and economical plants.

CO7: Enhance competence by identifying rock and mineral samples with their classification.

PO7: Effective Citizenship and Ethics:

CO2: Contribute to effective citizenship by applying practical knowledge of water conservation practices like rainwater harvesting.

PO8: Environment and Sustainability:

CO1: Promote environmental awareness by gaining awareness about local groundwater resources.

CO2: Apply practical knowledge of water conservation practices like rainwater harvesting for sustainable water management.

PO9: Self-directed and Life-long learning:

CO2: Cultivate self-directed learning by gaining practical knowledge of water conservation practices like rainwater harvesting.

CO4: Foster life-long learning by continuously improving research-related skills in soil and water analysis.

SEMESTER - III, PAPER – III**PAPER CODE: EVS 2303****Practicals based on EVS - 2301 and EVS- 2302.****No. of Practicals - 13****Course Outcomes:**

1. Students will be aware about local ground water resources.
 2. Students will have practical knowledge of water conservation practices like rain water harvesting.
 3. Students will know marketed forest resources, medicinal and economical plants their significance.
 4. Students will be able to determine content of important elements like organic carbon, nitrogen in soil.
 5. Students will have practical knowledge of determining important properties of soil like EC, bulk density, salinity.
 6. Students will have practical knowledge of determining important properties of water like Carbonates, bicarbonates, hardness, turbidity, salinity, DO, etc.
 7. Students will be able to identify rock and mineral samples with their classification.
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1. Determination of organic carbon from soil.
 2. Determination of available nitrogen from soil.
 3. Determination of available carbonate and Bicarbonate from water - by titrimetric method.
 4. Determination of the SAR value by given data.
 5. Study of economical and medical values of minimum five plants available in local areas.
 6. Identification and classification of the given mineral samples.
 7. Identification and classification of given rock samples.
 8. Determine the Electrical conductivity (EC) and salinity of given soil samples.
 9. Study of hardness of given water samples by EDTA-Titrimetric method.
 10. Determination of the bulk density of given water samples.
 11. Study of physico-chemical properties as dissolved oxygen, turbidity and salinity of water samples
 12. Case study of rain water harvesting and ground water in local area.
 13. Study of any five forest resources available in local market (Gum, Bamboo, Spices, Timber, Resins, etc) and submission of report at practical examination.

Reference:

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

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CO5	2	2							
CO6	3	2		2					
CO7						2			

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

CO4: Develop the ability to determine the content of important elements like organic carbon and nitrogen in the soil.

CO5: Gain practical knowledge of determining important properties of soil, including EC, bulk density, and salinity.

CO6: Acquire practical knowledge of determining important properties of water, such as carbonates, bicarbonates, hardness, turbidity, salinity, and dissolved oxygen.

PO2: Critical Thinking and Problem solving:

CO5: Apply problem-solving skills in determining important properties of soil like EC, bulk density, and salinity.

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PO3: Social competence:

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PO4: Research-related skills and Scientific temper:

CO4: Develop research-related skills by determining the content of important elements like organic carbon and nitrogen in the soil.

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