

**Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
(Autonomous)
T.Y.B.Sc. Environmental Science Syllabus**

Class	Semester	Paper Code	Paper Title	Credit
T.Y.B.Sc.	V	EVS 3501	Ecosystem Management	3
		EVS 3502	Wildlife Biology	3
		EVS 3503	Geoscience	3
		EVS 3504	Nature Conservation	3
		EVS 3505	Environmental Governance, Laws and Ethics	3
		EVS 3506	Environmental Biotechnology	3
	VI	EVS 3601	Climate Change	3
		EVS 3602	Analytical Methods	3
		EVS 3603	Sustainable Development	3
		EVS 3604	Environmental Statistics	3
		EVS 3605	Environmental Risk and Assessment Management	3
		EVS 3606	Environmental Economics And Audit	3
	Annual I	EVS 3607	Practical based on Sem-V EVS 3501 to EVS 3503 and Sem-VI EVS 3601 to EVS 3603	04
	Annual II	EVS 3608	Practical based on Sem-V EVS 3504 to EVS 3606 and Sem-VI EVS 3604 to EVS 3606	04
	Annual III	EVS 3609	Project to each student based on Sem-V and Sem-VI theory papers.	04

SYLLABUS (CBCS) FOR T. Y. B. Sc. Environmental Science (w.e. from June, 2020)

Academic Year 2020-2021

Class : T. Y. B. Sc. (Semester - V)
Paper Code : EVS 3501
Paper : I Title of Paper : Ecosystem Management
Credit : 3 No. of lectures : 48

A) Learning Objectives:

- 1) To learn terrestrial ecosystem and its detailed classification.
- 2) To learn aquatic ecosystem and its distribution.
- 3) To make student aware about importance of aquatic and terrestrial ecosystem.

B) Learning Outcome:

- 1) Students understood terrestrial ecosystem and its resources.
- 2) Students understood aquatic ecosystem and their importance.

Credit-I (16L)

Unit-1-Terrestrial Ecosystem

Introduction, The Terrestrial Environment, The terrestrial biota and biogeographic regions, general structure of terrestrial communities. The soil subsystem, the vegetation subsystem, parameters of the terrestrial environment, hotspots in India: Western Ghats and Eastern Himalaya. (8L)

Unit-2- Terrestrial Community

Distribution of major terrestrial communities, patterns, structure and classification, ecotone and edge effect, keystone species and control of community structure, types of interactions: predation, parasitism, antibiosis, commensalism, cooperation, and mutualism. (8L)

Credit –II (16L)

Unit-1- Terrestrial Ecosystem Management

Methods of terrestrial ecosystem management: remote sensing, geographical information system, Joint Forest Management, Eco- development program, community based forest management, traditional methods, Forest fire: reasons, effects, control measures and management Methods of vegetation sampling and data analysis: sampling approaches, quadrat methods, line and belt transect, the point frame method, vegetation classification, species association. (8L)

Unit-2-Aquatic Ecosystem

Introduction, Limnology, Aquatic environment, aquatic biota and water resources. water and plant functioning, structure of aquatic communities. The parameters of the aquatic environment. (8L)

Credit-III (16L)

Unit-1 Types of Aquatic Ecosystem

Distribution of major aquatic ecosystems, patterns, structure and classification (Freshwater, Marine and Estuarine) ecotone and edge effect, types of interactions: predation, parasitism, antibiosis, commensalism, cooperation, and mutualism. (8L)

Unit-2 Management of Aquatic Ecosystem

Methods of aquatic ecosystem management: remote sensing, geographical information system, Eco-development program, traditional methods, Methods of aquatic sampling and data analysis: sampling approaches, species association. (8L)

Reference:-

1. Principles of Environmental science - Cunningham and Cunningham
2. Ecology, Environment and Resource Conservation (2006): Singh JS, Singh SP and Gupta SR; Anamaya Publ, New Delhi.
3. Fundamental of Ecology (1971): EP Odum; WB Saunders Company.
4. Ecology and environment; PD Sharma, Rastogi publications, Meerut. 7th ed –2004.
5. Environmental Science; by-Santra SC; Central Publ. New Delhi
6. Lillisand, T. M. and Keifer, R. W. (1990): Remote Sensing and Image interpretation, John Willey and Sons, New York
7. Joseph G. (2003): Fundamentals of Remote Sensing, Universities Press, Hyderabad.
8. Haywood, Ian (2000): Geographical Information Systems, Longman
9. Chang, Kang-taung (2002): Introduction to Geographic Information Systems, Tata McGraw-Hill. •
10. Burroughs, P. A (1986): Principles of Geographical Information Systems for land Resource Assessment, Oxford University Press.
11. Gupta, R. P. 2003. Remote sensing geology, Springer, New York
12. Barrett, E. C. and Curtis, L. F. 1999. Introduction to environmental remote sensing. Chapman and Hall

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Academic Year 2020-2021

Class	:	T. Y. B. Sc. (Semester - V)
Paper Code	:	EVS 3502
Paper : II		Title of Paper : Wildlife Biology
Credit : 3		No. of lectures : 48

A) Learning Objectives:

- 1) To learn wildlife resource or wildlife biology.
- 2) To learn major group of plant and animal species and their natural habitat.
- 3) To learn wildlife management techniques and biodiversity hotspot.

B) Learning Outcome:

- 1) Students get information about wildlife and their various species.
- 2) Students understanding diversity of wildlife and their scope.

Credit-I (16L)

Unit-1 Introduction

Introduction, Concept of Wildlife Biology, Definition of Wildlife, examples of protected wildlife species (Refer to Wildlife Protection Act). (8L)

Unit-2 Wildlife Diversity

Diversity of major groups of plants and animals. Plants: Algae, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms (Monocots and Dicots) Animals: Invertebrates- Arthropods (Insects, Arachnids, Crustaceans, Millipedes, Centipedes). Vertebrates- (Mammals, Birds, Fish, Reptiles, Amphibians), habitats of faunal species. (8L)

Credit-II (16L)

Unit-1 Habitats of wildlife diversity

Wildlife Habitats Aquatic (Marine, Freshwater, Brackish) Terrestrial habitats (Vegetation types:- forest, grassland, arid zones, hot and cold deserts, agriculture, landscape patterns Examples of food chain in each type of habitat. (8L)

Unit-2 Threats of wildlife diversity

Threats to Wildlife Habitat destruction, developmental projects, urbanization, agricultural expansions, excessive harvesting and poaching, human-wildlife conflict, examples of excessive exploitation of plants and animals. (8L)

Credit-III (16L)

Unit-1 Wildlife Management Techniques

Wildlife Management Techniques: Population assessment techniques for flying insects, Birds and Mammals: Transects, Point Counts, net swipes, census from pug marks, camera trapping Diversity assessment for plants: Determination of sampling area, quadrates, transects, point centre method, Diversity Indices and its applications. (8L)

Unit-2 Biodiversity

Biodiversity hotspots, reasons for biodiversity formation, contribution to adaptive evolution, land races of crop plants, conservation of genetic resources, highly productive and unique habitats, examples of wetlands and mangrove ecosystem. (8L)

Reference:-

1. Plant Diversity Hotspots in India (1997): PK Hajra and V. Mudgal; Botanical Survey of India
2. Environmental Management (2005): Bala Krishnamoorthy; Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Ecology and environment; PD Sharma, Rastogi publications, Meerut. 7th ed –2004.
4. Environmental Science; by-Santra SC; Central Publ. New Delhi
5. Raymond F Dasmann, Environmental Conservation, John Wiley (1984).
6. Kato, M. The Biology of Biodiversity, (1999), Springer Verlag, Tokyo.
7. Kotwal, P.C. and S. Banerjee. Biodiversity Conservation – In Managed forest and Protected areas, (2002). Agrobios, India.
8. Krishnamurthy, K.V. An Advanced Textbook on Biodiversity – Principles and Practice, (2003). Oxford and IBH Publishing, New Delhi.

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Academic Year 2020-2021

Class	:	T. Y. B. Sc. (Semester - V)
Paper Code	:	EVS 3503
Paper : III		Title of Paper : Geosciences'
Credit : 3		No. of lectures : 48

A) Learning Objectives:

- 1) To learn or study the geological study of earth.
- 2) To make student aware about conservation natural resources.
- 3) To learn origin of earth ,soil weathering.

B) Learning Outcome:

- 1) Students understood origin of earth and soil weathering process.
- 2) Students understood natural hazards and disaster.

Credit-I (16L)

Unit 1- Origin of earth.

Introduction, Primary geochemical differentiation and formation of core, mantle, crust, atmosphere and hydrosphere. Concept of minerals and rocks. Formation of igneous and metamorphic rocks. Climates of India, western disturbances, Indian monsoon, droughts, El Nino, La Nina. Concept of residence time and rates of natural cycles. Geophysical fields. (10L)

Unit 2- Soil Weathering

Definition, Classification, Weathering including weathering reactions, erosion, transportation and deposition of sediments. Soil forming minerals and process of soil formation, Identification and characterization of clay minerals, Soil physical and 5 chemical properties, soil types and climate control on soil formation, Cation exchange capacity and mineralogical controls. Factors affecting on soil erosion. (10L)

Credit-II (16L)

Unit 1-Oceanography

Distribution of water in earth, hydrology and hydrogeology, major basins and groundwater provinces of India, Darcy's law and its validity, groundwater fluctuations, , groundwater tracers, land subsidence, effects of excessive use of groundwater, groundwater quality. Pollution of groundwater resources. Ocean basins and physical structure of the ocean floor. Properties of sea water, waves and tides, ocean Currents, El Niño and Southern Oscillation, Thermohaline circulation and the global conveyor belt, Sea level changes. (10L)

Unit 2 - Conservation of Natural Resources

Introduction, Natural resource exploration and exploitation and related environmental concerns. Historical perspective and conservation of non-renewable resources. Methods of soil Conservation (in-situ and ex-situ) (9L)

Credit-III (16L)

Unit 1 - Natural Hazards and Disasters

Concept, Catastrophic geological hazards - floods, landslides, earthquakes, volcanism, avalanche, tsunami and cloud bursts. Prediction of hazards and mitigation of their impacts. Atmospheric disturbances: Thunderstorms, cyclones, lightening, and drought. Impact of anthropogenic activities such as urbanization, mining, river-valley projects, excess withdrawal of ground water, etc. (9L)

Reference:-

- 1) Ecology and environment; PD Sharma, Rastogi publications, Meerut. 7th ed –2004.
- 2) Environmental Geology: Edward A. Keller Khanke, H.1968.
- 3) Soil Physics. McGraw Hill Publishing Co., NewDelhi.
- 4) Ghildyal, B P, KP Tripathi. 1987. Soil Physics. Wiley Eastern Limited, NewDelhi
- 5) Environmental chemistry by B. K. Sharma, Goel publication house, Meerut, Sixth revised edition – 2001.
- 6) Environmental Science; by-Santra SC; Central Publ. NewDelhi
- 7) Lutgens F. K., Tarbuck, E. J. and Tasa, D. 2008. Essentials of Geology, Prentice Hall Publishers.
- 8) Bell F. G., 1998. Environmental geology: principles and practice. Blackwell Sc.. Oxford.
- 9) Thurman, H.V. and Trujillo, A.P., 2004, Introductory Oceanography, Prentice Hall.
- 10) Randolph, J. 2004 Environmental land use planning and management, Island Press, Washington.
- 11) Strahler, A.H and Strahler A.N (2002): Modern Physical Geography, John Wiley and Sons.
- 12) Kale, V. S. and Gupta, A. 2001. Introduction to Geomorphology, Orient Longman, Calcutta.
- 13) Chamley, H. and Chamley, H. 2003. Geosciences, Environment and Man Elsevier Science & Technology.
- 14) Savindra Singh (2002): Geomorphology, PrayagPustakBhawan, Allahabad.
- 15) Sharma &Vatal (1962): Oceanography for Geographers. Chaitanya Publishing House, Allahabad.
- 16) Basu S.K. (2003) (ed): Handbook of Oceanography, Global Vision, Delhi.
- 17) Kusky, T. M. 2003. Geological Hazards, Greenwood Press, Westport, Conn. London.

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Academic Year 2020-2021

Class : T. Y. B. Sc. (Semester - V)
Paper Code : EVS 3504
Paper : IV Title of Paper : Nature Conservation
Credit : 3 No. of lectures : 48

A) Learning Objectives:

- 1) To learn basic natural resources.
- 2) To learn methods for conservation of a nature.
- 3) To learn information about international efforts for conservation of nature.

B) Learning Outcome:

- 1) Students aware about nature conservation methods and their international efforts.
- 2) Students understood objectives and challenges of nature conservation.

Credit-I (16L)

Unit 1- Introduction

Concept of Nature Conservation; Convention on Biological Diversity (CBD), Protected Area Network (PAN) in India, Details of PAN in Maharashtra state. (8L)

Unit 2-Methods of Nature conservation

Methods: In situ-Concept, Principles, Protected areatypes(global and national level, Heritage sites), Examples, challenges, merits and limitations; Ex situ-Concept, Principles, Types (captive breeding and reintroductions, seed banks, gene banks), examples, challenges, merits and limitations; Traditional/community conservation-Concept, examples, challenges, merits and limitations. (8L)

Credit-II (16L)

Unit 1 Awareness about Conservation

Awareness about Conservation: Need, Importance, Methods, Examples National Initiatives for Nature Conservation Ecotourism: Objectives, Principles, Merits, Disadvantages, Limitations, Challenges, Examples. (8L)

Unit-2 International efforts for Conservation

International efforts for Conservation: Role of IUCN, WWF and other large organizations, Role of Governments, International Conventions and Protocols .Role of NGOs, Green Peace, International Whaling Mission, BNHS, Reindeers, Tigers, Crocodile farms, Examples of extreme activism, and practical sustainable efforts. (8L)

Credit-III

Unit 1-Wildlife Law and Administration

Wildlife Law and Administration: Wildlife Protection Act, its merits and limitations .State Symbols (Animals and Plants) ,Administrative Setup: MoEF, Central and State Pollution Control Boards,

Interface between administration and NGO's. Personalities, Institutions, Groups & NGO working for environmental conservation. (8L)

Unit 2- Nature Conservation Challenges

Objectives of Nature Conservation, Challenges (Social, Political, Economical) (8L)

Reference:-

- 1) Ecology and environment; PD Sharma, Rastogi publications, Meerut. 7th ed –2004.
- 2) Environmental Science; by-Santra SC; Central Publ. NewDelhi
- 3) Fundamentals of Ecology: E. P. Odum
- 4) Modern concepts in Ecology: H. D. Kumar
- 5) Gary K Meffe and Ronald Carroll C (1994) Principles of Conservation Biology.
- 6) Sinauer Associates Inc., Massachusetts.
- 7) Groombridge B (Ed.) (1992) Global Biodiversity Status of the Earths Living
- 8) Resources. Chapman & Hall, London. • IUCN (1992) Global Biodiversity and Strategy.
- 9) Sharma PD (2000) Ecology and Environment. Rastogi Publications, Meerut, • India.
- 10) Singh MP, Singh BS and Soma S. Dey (2004) Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.
- 11) Virchow D (1998) Conservation and Genetic Resources, Springer-Verlag, Berlin.
- 12) Singh B, Social Forestry for Rural Development, Anmol Publishers, New Delhi (1992).
- 13) Murthy J.V.S., Watershed Management in India, (1994).
- 14) Raymond F Dasmann, Environmental Conservation, John Wiley (1984).
- 15) Kato, M. The Biology of Biodiversity, (1999), Springer Verlag, Tokyo.
- 16) Kotwal, P.C. and S. Banerjee. Biodiversity Conservation – In Managed forest and Protected areas, (2002). Agrobios, India.
- 17) Krishnamurthy, K.V. An Advanced Textbook on Biodiversity – Principles and Practice,
- 18) (2003). Oxford and IBH Publishing, New Delhi.

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Academic Year 2020-2021

Class :	T. Y. B. Sc. (Semester - V)
Paper Code :	EVS 3505
Paper : V	Title of Paper : Environmental Governance, Laws and Ethics
Credit : 3	No. of lectures : 48

A) Learning Objectives:

- 1) To learn environmental governance, Laws and ethics.
- 2) To learn international conferences and summit for the protection and conservation of environment.
- 3) To learn Environmental ethics.

B) Learning Outcome:

- 1) Students understood the Acts and laws related to Environment protection.
- 2) Students aware about the fundamental duties and rights and also environmental ethics.

Credit-I (16L)

Unit-1 Environmental Governance

Introduction, necessity, What is environmental governance? Elements of environmental governance
Environmental governance in India since 1972 . Environmental protection and Fundamental Rights. (8L)

Unit-2 Environmental International Conference

Stockholm conference, The Earth Summit 1992 – The Rio Declaration on environment and development, the Earth Summit agreements. India's International Obligations, Public interest litigation, Public participation. (8L)

Credit-II (16L)

Unit-1 Environmental Act

The Water (Prevention and Control of Pollution) Act–1974

The Air (Prevention and Control of Pollution) Act – 1981

The public liability Insurance Act, 1991

The National Environmental Tribunal Act,

1995 Environmental Policy Resolution.

Legislation, public Policy Strategies in Pollution Control. Motor Vehicle Act, 1988.

Public Liability Insurance Act, 1991 and Rules 1991.

The Indian Wildlife (Protection) Act – 1972 amended 1991. (8L)

Unit-2 Environmental Conservation Act

The Biological Diversity Act, 2002 Forest Conservation Act, 1980.

Indian Forests Act (Revised) 1982. National Forest Policy.

The Environment (Protection) Act, 1986 and Rules 1986.

Scheme of labelling of environmentally friendly products (Ecomark) . (8L)

Credit-III (16L)

Unit-1 Environmental Ethics

Environmental Ethics: Introduction, concept. Development of environmental ethics, ethical theories applied to the environment. Environmental ethics in spirituality, fundamental concerns, relationship between people and environment. (8L)

Unit-2 Ethical Challenges

The ethical dilemma, environmental ethics and population, pollution. Value options, environment and technology. Human life and its environment – The art of ethics and an ethical dilemma, Challenges of world environmental ethics. (8L)

Reference:-

- 1) Computerized environmental modelling – J. Hardstay, DM Taylor & SEMetcalf
- 2) Computerized aided environmental management – SA Abbassi and FIKhan.
- 3) Environmental Governance: The Global Challenge; By Lamont C. Hempel; Island Press (1996)
- 4) Environmental Issues in India – A Reader; By Mahesh Rangrajan; Pearson-Longman Publ.(2007)
- 5) Handbook of Environmental Law, Acts, Guidelines, Compliances, and Standards: Vol. I and II; by R.K. Trivedy; BS publ(2004).
- 6) International Environmental Law, Fairness, Effectiveness and World Order; by Elli Louka, Cambridge, (2006)
- 7) Global Environmental Governance: A Reform Agenda; by Adil Najam, Mihaela Papa, and Nadaa Taiyab (2006), International Institute for Sustainable Development (IISD), Canada
- 8) Environmental Governance and Regulation in India: by *Atiyah Curmally*; (Environment and Rehabilitation) India Infrastructure Report 2002

SYLLABUS (CBCS) FOR T. Y. B. Sc. Environmental Science (w.e. from June, 2020)

Academic Year 2020-2021

Class	:	T. Y. B. Sc. (Semester - V)
Paper Code	:	EVS 3506
Paper : VI		Title of Paper : Environmental Biotechnology
Credit : 3		No. of lectures : 48

A) Learning Objectives:

- 1) To learn composting , vermicomposting and biofuels.
- 2) To learn Genetically modified organisms and their release criteria.
- 3) To learn bioremediation and energy production process.

B) Learning Outcome:

- 1) Students understoodcomposting, vermicomposting and biofuel.
- 2) Students understanding biotechnology and its used to control the environmental pollution.

Credit-I (16L)

Unit-1 Introduction

Environmental Biotechnology: Meaning, necessity and scope, history of environmental biotechnology, objectives of environmentalbiotechnology. (8L)

Unit-2 Vermicomposting and Biofuels

Composting, Vermicomposting and Biofuels—Composting technology, Design aspect, composting process, Temp. Trend I and influencing factors, Vermicomposting—Earthworm life cycle, chemical characteristic of vermicompost, Operating vermicompost, Biofuels—Alternative to non fossil energy resources, Biological energy resources, Combustion of biomass, Biogas, Biodiesel, Ethanol and hydrogen. (8L)

Credit-II (16L)

Unit-1GMO's in the environment

GMO's in the environment—Risk of GMO's, Risk assessment, Directive principles for GMO's. Measures, Deliberate release, and release criteria. Biosafety—Cartagena Protocol, Biosafety regulation. (8L)

Unit-2Bioremediation

Bioremediation—Principles, factors responsible,microbialpopulation for bioremediation, Environmental variation in field, Enzymatic – biodegrative pathway, Genetic Engineering Approach, Bioremediation strategies; Phytoremediation—Metal and Organic Phytoremediation, need for Research and development. (8L)

Credit-III (16L)

Unit-1Biomethanation

Biomethanation—Anaerobic treatment forgasgeneration,microbiology and biochemistry, factors affecting, Problems in Biomethanation, Design of digester, Biomethannation in industries, Potential of

Biomethanation from MSW, Merits of Biomethanation from MSW and Biomass gasification. (8L)

Unit-2 Energy Production

Energy production from biomass - biogas, ethanol, hydrogen Biotechnology application of hazardous waste management Mining with microbes. (8L)

Reference:-

- 1) Environmental Biotechnology ----- Dr. M.Jay
- 2) Environmental Biotechnology -- M.H. Fulekar; Oxford & IBH Publ.,(2005)
- 3) Environmental Biotechnology --- Alan Sagg
- 4) Environmental Biotechnology --- Rajendran Gunasekaran
- 5) Environmental Biotechnology --- Indu Shekar Thakur
- 6) Tade, RL 1995. Soil Microbiology. John Wiley and sons, New York.p.398.
- 7) Agrawal, KC 1996. Environmental Biology. Agro-botanical Publishers – New Delhi.
- 8) Trivedi, PR and R. Gundeep, 1992. Environmental Ecology. Akashdeep Publishing House, New Delhi.
- 9) Jogdand, SN 1995. Environmental Biotechnology. Himalaya Publishing House, Mumbai.
- 10) Crawford, RL and DL Crawford. 1996. Bioremediation - Principles and Applications. Cambridge University Press, London.
- 11) Unsworth, MH and DP Ormrod, 1992. Effects of Gaseous Air Pollution in Agriculture and Horticulture. Butterworth Scientific.p.532.
- 12) Lepp, NW, Effects of Heavy Metal Pollution on Plants.p.257.
- 13) Britton, G. 1994. Waste Water Treatment Technology. John Wiley and Sons, NY
- 14) RS Ramalho. 1983. Introduction to Waste Water Treatment Process. Academic press. New York.
- 15) Qunag, EAR, Principles of Waste Water Treatment Vol.I Biological Process. National Science Development Board, Manila, Phillipines.
- 16) Anonymous, 1991. The Biocycle Guide to the Art and Science of Composting. The JG Press Inc., Pennsylvania.p.270
- 17) Epstein .E, 1997. The Science of Composting. Technomic publishing co inc., Pennsylvania.p.487
- 18) Dirk van Elsas, J., T.Trevors and MH Wellington, 1998. Modern Soil Microbiology.
- 19) Gasser, J.K.R. 1985. Composting of Agricultural and other Wastes. Elsevier Applied Science Publishers, New York
- 20) Gaur, AC; 1992. Organic Recycling. Indian Council of Agricultural Research Publication
- 21) Crawford.,R.L.and D.L.Crawford. 1996. Bioremediation: Principles and Applications. Cambridge University Press,Cambridge.p.399.
- 22) Cook R.J. and K.F.Baker. 1983. The Nature and Practice of Biological Control of Plant Pathogens. American Phytopathological Society.p.539.
- 23) Glick, BR and Jack J Pasternak. 1994. Molecular Biotechnology: Principles and Applications of Recombinant DNA- Chapter-10 Bioremediation and Biomass Utilization.
- 24) Hinchee, R. 1994. Air Sparging for Site Remediation. Baco Ratan, Lewis Publishers.
- 25) National Research Council, Water Science and Technology Board 1993. In situ Bioremediation: When does it work? National Academy Press, Washington

Class: **T. Y. B. Sc. Practical (Based on Semester – V and VI Theory Papers)**
Paper Code: **EVS 3607**
Paper: **Practical-I**

Title of Paper: **Practical based on Sem-V EVS 3501 to EVS 3503 and Sem-VI EVS 3601 to EVS 3603**

Credit: 4 No. of Practicals: 24

A) Learning Objectives:

- 1 To aware the students about ecosystem management.
- 2 To enhance the knowledge of students about the environmental science.
- 3 To aware the students about environmental laws and ethics.

B) Learning Outcome:

- 1 It will help to conserve the wildlife biology.
- 2 Students will get job in GIS mapping and remote sensing.
- 3 Data analyzer will be expert to conclude the significance of biological experiments.

Practical based on EVS 3501-Ecosystem Management

1. Study of Flora of an urban terrestrial ecosystem (Field practical).
2. Study of primary productivity from grassland community.
3. Study of species interaction from forest area.
4. Total chlorophyll estimation from plants of clean and polluted environment.
5. Study of vegetation by Belt/Line method.

Practical based on EVS 3502-Wildlife biology

6. Study of Fauna of an urban terrestrial ecosystem(Field practical)
7. Quantitative analysis of phytoplankton's and determination of percent composition lockey's drop count method.
8. To calculate Shannon, Simpson, Sorenson's coefficient index.

Practical based on EVS 3503-Geoscience

9. Exercise based on the lapse rate
10. Draw the simple wind roses with the help of given data.
11. Draw the Compound wind roses with the help of given data.
12. Draw the climatic maps and diagram of climograph /circular graph.

Practical based on EVS 3601-Climate Change

13. Use of RS and GIS technology in mapping climatic changes.
14. Measurements for the impact of environmental stress conditions on plants.
15. Studies on plants facing pollutants from selected areas.
16. Impacts of extreme events in selected areas: A case study

Practical based on EVS 3602-Analytical Methods

17. Determination of biological oxygen demand (BOD) in given water sample.
18. Estimation of Dissolved Oxygen (DO).
19. Determination of Free CO₂ in given water sample.
20. Analyzing the pH and EC of different waste water/soil sample.

Practical based on EVS 3603-Sustainable Development

21. Introduction to strategies of sustainable development.
22. Studies on measurements of sustainable farming practices.
23. RS and GIS based land use pattern change.
24. Study of life cycle analysis (LCA).

- Visit to Biodiversity rich area / Sewage treatment plant and submit the report.

Class: **T. Y. B. Sc. Practical (Based on Semester – V and VI Theory Papers)**

Paper Code: **EVS 3608**

Paper: **Practical-I**

Title of Paper: **Practical based on Sem-V EVS 3504 to EVS 3606 and Sem-VI EVS 3604 to EVS 3606**

Credit: 4

No. of Practicals: 24

A) Learning Objectives:

1. To aware the students about ecosystem management.
2. To enhance the knowledge of students about the environmental science.
3. To aware the students about environmental laws and ethics.

B) Learning Outcome:

1. It will help to conserve the wildlife biology.
2. Students will get job in GIS mapping and remote sensing.
3. Data analyzer will be expert to conclude the significance of biological experiments.

Practical based on EVS 3504-Nature Conservation

1. To study methods of preparation of compost by using Indore and Bangalore method.
2. To study vermicomposting of farm/other solid waste.
3. To Study factors influencing on composting.
4. Continuation of use of social media for e-networking and dissemination of ideas of nature conservation.

Practical based on EVS 3505-Environmental Governance, Laws and Ethics.

5. Introduction of Environmental Governance, Laws and Ethics.
6. Understanding process of public interest litigation through court
7. Legal survey based on questionnaire to understand environmental governance
8. Introduction about Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB).

Practical based on EVS 3506-Environmental Biotechnology

9. To isolate microorganisms from decaying matter/soil.
10. Identification and classification of bacteria.
11. Determination of H₂S from sewage sample.
12. Identification and classification of bacteria by gram staining technique.

Practical based on EVS 3604-Environmental Statistics

13. Grouping of data and preparation of frequency distribution, Histogram and Frequency polygon.
14. Calculating Mean, Median and Mode for grouped and ungrouped data.

15. Calculating variance, standard deviation, and coefficient of variation for grouped and ungrouped data.
16. Fitting simple linear regression. Plotting scatter diagram and regression line.

Practical based on EVS 3605-Environmental Risk and Assessment Management

17. Screening of environmental risk.
18. Risk assessment guidance and tools (Planning application).
19. Risk management in waste management.
20. Case studies on risk assessment.

Practical based on EVS 3605-Environmental Economics and Audit

21. Baseline data collection for one season of any project.
 22. Case study of any one project.
 23. Preparation of report of audit with a specific institute or industry.
 24. Origin of basic economics, definitions, scope and importance.
- Visit to composting and vermicomposting unit / effluent treatment plant/ and submit the report.

Class: **T. Y. B. Sc. Practical-III**
(**Project - Based on Semester –V and VI Theory Papers**)
Paper Code: **3609**
Paper: **Practical-III** Title of Paper: **Project**
Credit: 4 No. of Practicals: --

A) Learning Objectives:

1. To give information of research work
2. To create awareness about innovative methods.
3. To find out new conclusions through research

B) Learning Outcome:

1. Information acquired about research work
2. Getting of awareness of innovative methodology.
3. Significant conclusions and outputs

Research Project

60L

Projects will be allotted for fifth and sixth semester and students will submit project work at sixth semester practical examination.

Practicals Research Project

- 1 Introduction and review of literature
- 2 Material and methods and results and discussion
- 3 Conclusions and references
- 4 Compilation of data, typing, binding and submission of dissertation
- 5 Writing of research paper
- 6 Power point presentation based on project work
