

**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
		EVS 3507	Practical based on EVS3501 and EVS3502	2
		EVS 3508	Practical based on EVS3503 and EVS3504	2
		EVS 3509	Practical based on EVS3505 and EVS3506	2
	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
		EVS 3607	Practical based on EVS 3601 to EVS 3603	2
		EVS 3608	Practical based on EVS 3604 to EVS 3606	2
		EVS 3609	Project	2

\ **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 understand terrestrial ecosystem and its resources.
- 2) Students understand 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. (8L)

Unit-2- Terrestrial Community

Distribution of major terrestrial communities, patterns, 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, ethnobotany, non wood forest (From Wood and non-wood forest) 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, ecotone and edge effect, types of interactions: predation, parasitism, antibiosis, commensalism, cooperation, and mutualism. (6L)

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. (10L)

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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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 Outline of Diversity of major groups

Diversity of major groups of plants and animals. Plants: Algae, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms (Monocots and Dicots) Animals: Mollusca, 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. UAV (Unmanned aerial vehicles), Remotely piloted aircraft. (8L)

Unit-2 Biodiversity

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.
9. (2003). Oxford and IBH Publishing, New Delhi.

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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 and evolution of earth.

Introduction,Primary geochemical differentiation and formation of core, mantle, crust, atmosphere and hydrosphere,Lithosphere. 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, 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.

(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.

(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., New Delhi.
- 4) Ghildyal, B P, KP Tripathi. 1987. Soil Physics. Wiley Eastern Limited, New Delhi
- 5) Environmental chemistry by B. K. Sharma, Goel publication house, Meerut, Sixth revised edition – 2001.
- 6) Environmental Science; by-Santra SC; Central Publ. New Delhi
- 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.
- 18) Physical geography by Mazid Husen.

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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 area types (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, Roll of (NBA) National Biodiversity Authority(Roll and structure),State biodiversity board.

(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 Prominant 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, Climate Change 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. New Delhi
- 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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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, Need and necessity, 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.

(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.

(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

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 & SE Metcalf
- 2) Computerized aided environmental management – SA Abbassi and FI Khan.
- 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

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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 understood composting, 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 environmental biotechnology. (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-1 GMO's in the environment

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

(8L)

Unit-2 Bioremediation

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

Credit-III (16L)

Unit-1 Biomethanation

Biomethanation—Anaerobic treatment for gas generation, microbiology and biochemistry, factors affecting, Problems in Biomethanation, Design of digester, Biomethanation in industries, Potential of Biomethanation from MSW, Merits of Biomethanation from MSW and Biomass gasification, Medical and hospital Waste.

(8L)

Unit-2 Energy Production

Energy production from biomass - biogas, ethanol, hydrogen Biotechnology application of bioleaching.

(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-I (Based on Semester – V Theory Papers)**
Paper Code: **EVS 3507**

Title of Paper: **Practical based on Sem-V EVS 3501 And EVS 3502**

Credit: 2 No. of Practicals : 12

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/herbarium (Field practical)...2P
2. Study of primary productivity from grassland community....1P
3. Study of species interaction from forest area....1P
4. Study of vegetation by Belt/Line method....1P
5. Webseries study of invasive species in agricultural ecosystem...1P

Practical based on EVS 3502-Wildlife biology

6. Study of Fauna of an urban terrestrial ecosystem(Field practical)...1P
7. Quantitative analysis of phytoplanktons and determination of percent composition lockey's drop count method....1P
8. To calculate Shannon, Simpson, Sorenson's coefficient index....2P

Class: **T. Y. B. Sc. Practical-II (Based on Semester – V Theory Papers)**
Paper Code: **EVS 3508**

Title of Paper: **Practical based on Sem-V EVS 3503 to EVS 3504**

Credit: 2 No. of Practicals: 10

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 3503-Geoscience

1. Exercise based on the lapse rate ..1P
2. Draw the simple wind roses with the help of given data....1P
3. Draw the Compound wind roses with the help of given data....P
4. Draw the climatic maps and diagram of climograph /circular graph....2P

Practical based on EVS 3504-Nature Conservation

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

Class: **T. Y. B. Sc. Practical-III (Based on Semester – V Theory Papers)**
Paper Code: **EVS 3509**

Title of Paper: **Practical based on Sem-V EVS 3505 to EVS 3506**

Credit: 2 No. of Practicals: 10

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 3505-Environmental Governance, Laws and Ethics.

1. Introduction of Environmental Governance, Laws and Ethics...1P
2. Understanding process of public interest litigation through court...1P
3. Legal survey based on questionnaire to understand environmental governance...2P
4. Introduction about Central Pollution Control Board (CPCB) ..1P

Practical based on EVS 3506-Environmental Biotechnology

5. To isolate microorganisms from decaying matter/soil...2P
 6. Identification and classification of bacteria...1P
 7. Determination of H₂S from sewage sample...1P
 8. Identification and classification of bacteria by gram staining technique...1P
- Visit to Biodiversity rich area / Sewage treatment plant and submit the report.

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**SYLLABUS (CBCS) FOR T.Y.B.Sc. Environmental Science Syllabus (w.e.from June,
2021)**

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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
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		EVS 3604	Environmental Statistics	3
		EVS 3605	Environmental Safety and Risk Management	3
		EVS 3606	Environmental Economics And Audit	3
		EVS 3607	Practical based on EVS 3601 to EVS 3603	2
		EVS 3608	Practical based on EVS 3604 to EVS 3606	2
		EVS 3609	Project	2

Class : **T. Y. B. Sc. (Semester - VI)**
Paper Code : **EVS 3601**
Paper : **I** Title of Paper : **Climate Change**
Credit : **3** No. of lectures : 48

A) Learning Objectives:

- 1) Understand the anthropogenic and natural drivers of climate change and future developments aspects for the sustainability
- 2) Identify and evaluate the environmental, social, and economic impacts of anthropogenic activities and required sustainability framework for mitigation of the same.
- 3) Realize scope, importance, and opportunities for climate change studies.

B) Learning Outcome:

- 1) Sensitize about Impacts of climate change and future goals and of sustainability
- 2) Aware of various policies and agreements regarding these two aspects
- 3) Understand Methodologies for impact assessments and current practices of the societies

Credit-I (16L)

Unit-1- Climatic Systems and Variations

- Global Climate System, Causes for Modern Climate Change.
- Internal Variability: Ocean-Atmosphere Variability, Ocean Currents
- External Climate Forces: Greenhouse Gases, Orbital Variations, Solar Fluctuations, Volcanism, Plate Tectonics
- Evidence and Measurement of Climate change
- History and Evolution of Green Gases
(8L)

Unit-2- Consequences and Challenges

- Impacts on Life, Flora and Fauna
- Glaciers and Ice Sheets Melting- Sea Level Changes, Economics of Climate Change, Climate Change and Water Scarcity, Coastal Ecosystem and Vulnerability, Threats to Forest and Biodiversity, Energy Generation and Climate Change Mitigation.
- Agriculture and Food Security, Carbon Sequestration, Climate Change in agriculture and health.
(8L)

Credit –II (16L)

Unit-1 International Organization for Climate Change

- Extreme Events and Disasters,
International Efforts,
UNFCCC and Conference of the Parties,
Special Reports by IPCC,
Kyoto Protocol and Agreements (G-7, G-17)
Copenhagen Conference,
Glasgow Conference,
Role of NGO's.

(8L)

Unit-2 Confronting Climate Change:

- Policies and Efforts-
India: National Action Plan on Climate Change (NAPCC),
State Action Plan on Climate Change (SAPCC),
National Adaptation Fund on Climate Change (NAFCC),
Climate Change Action Programme (CCAP),
Long Term Ecological Observatories (LTEO) Programme.

(8L)

Credit-III (16L)

Unit-1 Mitigation Approaches in Climate Change

Climate and Weather Statistics,
Climate Change Modeling,
Carbon Emissions Reduction Technologies,
Climate Change Research,
Climatology Journals and Top Institutions.

(8L)

Unit-2 Governance of Climate Change

Governance for Climate Change,
Clean Development Mechanism,
Technology Options Fuel Switching and Carbon Sequestration,
Regional, National and International Experiences.

(8L)

Reference:-

Reference Books

- The Climate Fix: What Scientists and Politicians Won't Tell You About Global Warming by Roger Pielke, Basic Books (2010)
- The Climate Solution: India's Climate Change Crisis and What We Can Do About It by Mridula Ramesh, Hachette India (2018).
- This Changes Everything: Capitalism vs. the Climate by Naomi Klein, Penguin (2015).
- What Is Climate Change? (What Was?) by Gail Herman (Author), Illustrated by John Hinderliter, Penguin Workshop (2018).
- Climate Change Biodiversity and Green Economy by H.S. Sharma S. Padmaja and Ganesh Sharma, Concept Publishing Company Pvt. Ltd. (2013).
- Climate Change by Joseph Romm, OUP US (2018).

Class : **T. Y. B. Sc. (Semester - VI)**
Paper Code : **EVS 3602**
Paper: **II** Title of Paper: **Analytical Methods**
Credit: **3** No. of lectures: 48

A) Learning Objectives:

- 1) To learn analytical and physico-chemical methods.
- 2) To learn estimation of elements techniques.
- 3) To learn chemistry of biologically important molecules.

B) Learning Outcome:

- 1) Students understood the analytical methods
- 2) Students understood the instrument handling technique.

Credit-I (16L)

Unit-1 Analytical Instrumentation

•Estimation of various elements at major, minor trace, ultra trace level concentrations:

Choice of a technique and its principles, merits and demerits of the techniques –

- 1) Neutron Activation Analysis,
- 2) Spectrophotometry,
- 3) Colorimetry,
- 3) Atomic absorption spectroscopy,
- 4) ICPAES, gas chromatography, HPLC,
- 5) Ion exchange chromatography, X-ray fluorescence, X-ray diffraction,
- 6) Flame photometry and polarography.

(16L)

Credit-II (16L)

Unit-1 Introduction to Soil Chemistry.

Definition of soil, life on soil, composition of soil,

Mineral matter in soil, organic matter in soil, soil respiration,

Process of soil formation, factors affecting soil, soil profile,

Soil microorganisms,

Types of soils, micro and macro plant nutrients, nutrient functions.

(8L)

Unit-2 Chemistry of Water:

Unusual physical properties, hydrogen bonding in biological systems,

Unusual solvent properties, changes in water properties by addition of solute.

(8L)

Credit-III (16L)

Unit-1 Chemistry of Biologically Important Molecules

Protein structure and biological functions, enzymes, enzyme metabolism, biosynthesis of DNA and RNA.

Chemistry of hydrocarbon decay, environmental effects, effects on macro and micro organisms Surfactants.

Cationic, anionic and nonionic detergents, modified detergents.

Lead and its compounds: Physical and chemical properties, behavior, human exposure,

absorption, influence.
(8L)

Unit-2 Residual Effect of Hazardous Substances and Their Properties:

Definition, characterization, UN classification, Identification,
Chemistry of Various Organic and Inorganic Compounds.
Carcinogenic compounds and their effects,
Acid halides and anhydrides, alkali metals,
Cyanides, Isocyanides and cyanogens bromides, chromium, halogenated compounds.
(8L)

Reference:-

- Environmental Chemistry- A.K.Dey New Age International publishers
 - Destruction of hazardous chemicald- G.Lunn, E.B.Sandome
 - Hazardous substances in chemical lab-G.D.MuMivir
 - Essentials of Nuclear Chemistry, H. J Arnikar, Wiley Eastern Limited, 4th Edition.(1995)
- Course no. Title Credits Semester I
- Instrumental methods of analysis-Chatwal and Anand

Class : **T. Y. B. Sc. (Semester - VI)**
Paper Code : **EVS 3603**
Paper : **III** Title of Paper : **Sustainable development**
Credit : **3** No. of lectures : 48

A) Learning Objectives:

- 1) To learn or study the Concept of Sustainable Development
- 2) To make student aware about conservation natural resources.
- 3) To learn Goals of Sustainable Development.

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 Introduction

Origins of Sustainable Development: Definition, Evolution and Principles, Strategies for Sustainable Development, Sustainability and Human Development.
(8L)

Unit -2 Goals and Issues

UN Sustainable Development Knowledge Platform, Tools for Sustainable Development, Sustainable Development Goals, Communicating the Sustainable Development Goals, Criticisms in Sustainability, Women and Gender Equality, Roll of women and youth in environmental protection.
(8L)

Credit-II (16L)

Unit -1 Environmental Conservation and Sustainability

Technical Skills in Environment and Sustainability, Preservation of Biological Diversity, Sustainable Forest Management, Challenges in Energy, Food and Agriculture.
(8L)

Unit- 2 Recent Trends in Sustainability

Appropriate Technology and Sustainability Science, Consumption and Production Patterns, Sustainable Transport, Corporate Sustainability, Ecological and Carbon Footprint for Sustainability Measurement, Sustainability Measurement and Reporting Tools,

Sustainability in Policy Design.

(8L)

Credit-III (16L)

Unit -1 Management and Strategies

Cultural Elements in Sustainable Development Frameworks,

Human Centered Designs in Sustainability,

The 2030 Agenda.

Environmental management and innovation strategies.

(8L)

Unit -2 Green Building

Introduction, Features, Goals, design, material and energy efficiency, Examples, Impacts,

Role of Green building in environmental protection,

The Indian Green Building Council (IGBC).

(8L)

Reference:-

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

Class : **T. Y. B. Sc. (Semester - VI)**
Paper Code : **EVS 3604**
Paper: **IV** Title of Paper: **Environmental Statistics**
Credit: **3** No. of lectures: 48

A) Learning Objectives:

Student should be able to

- 1) Compute various measures of central tendency, dispersion, skewness and kurtosis
- 2) Understand basic concepts of probability

B) Learning Outcome:

At the end of this course students are expected to be able:

- 1) To find the probabilities of various events.
- 2) Compute various measures of central tendency, dispersion, moments, skewness and kurtosis.
- 3) Compute correlation coefficient, regression coefficients and to interpret the results.
- 4) Compute the correlation coefficient for bivariate data and interpret it.
- 5) To fit linear, parabolic and exponential curves to the bivariate data to investigate relation between two variables.

Credit-I (16L)

Unit-1 Population and Sample (6L)

- 2.1 Types of data: Primary data, secondary data
- 2.2 Notion of a sample and a random sample.
- 2.3 Methods of sample (Description only) :Simple random sampling with and without replacement (SRSWR and SRSWOR), stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.

UNIT 2: Univariate data analysis

(10L)

Classification: Raw data and its classification, ungrouped frequency distribution, Sturges'rule ,method of classification inclusive and exclusive, open end classes, grouped frequency distribution ,cumulative frequency distribution, relative frequency distribution

Measures of Central Tendency: Concept of central tendency.

Arithmetic Mean (AM), Median, Mode.

Graph and Diagram; Histogram, Frequency polygon, Ogive curve, Box plot

Measures of Dispersion: Concept of dispersion

Range, Variance and standard deviation, Coefficient of variation (CV)

Credit-II (14L)

UNIT 4: Moments, Skewness and Kurtosis (6L)

Raw moments (μ_r), Central moments(μ_r)
Relations between central moments and raw moments, up to 4th order
Concept of skewness and Kurtosis of frequency distribution

UNIT 5: Correlation and Regression (8L)

Bivariate data, Scatter diagram.
Concept of correlation between two variables, positive correlation, negative correlation, no correlation. Interpretation of correlation using scatter diagram.
Regression : Linear and nonlinear regression models. Fitting of regression line ($Y = a + bX$), and Fitting of second degree curve ($Y = a + bX + cX^2$), Fitting of exponential curves of the type $Y = abX$ and $Y = aXb$.

Credit-I (16L)

UNIT 6: Sample Space, Events and Probability (10)

Concepts of experiments, deterministic and nondeterministic experiments.
Definitions: Sample space, Types of sample space, Event, Types of Events: Elementary event, Complementary event, sure event, impossible event.
Concept of occurrence of an event, Equally-likely events, Algebra of events (Union, Intersection, Complementation), Definitions of Mutually exclusive events, Exhaustive events.
Classical definition of probability, examples.

UNIT 7: Statistical Models in environmental Science (8)

Population Growth Model, Catch Model. Cohort Projections, Pope's Approximation

References:

1. Gupta and Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
2. Sarma K.V.S.(2001)Statistics made it simple: Do it your self on PC. Prentce Hall of India, New Delhi.
3. B.L.Agarwal: Programmed Statistics, New Age International Publishers ,New Delhi.

Class : **T. Y. B. Sc. (Semester - VI)**
Paper Code : **EVS 3605**
Paper: **V** Title of Paper: **Environmental Safety and Risk Management**
Credit: **3** No. of lectures: 48

A) Learning Objectives:

- 1) To learn basics of Environmental risk and their management.
- 2) To learn methods of chemical risk assessment.
- 3) To learn information about hazard identification and risk management.

B) Learning Outcome:

- 1) Student understood fire and chemical safety.
- 2) Student understood hazard identification and their management.

Credit-I (16L)

Unit-1 Introduction to Environmental Risk

Environmental safety: Definition, Goals, Introduction, objectives.

Categorization of Industries (Red, Orange, Green, White) (MPCB)

Concept of Risk and risk identification,

Risk assessment and risk communication,

Allocation and mitigation strategies,

Potential of health risks in industrial and development processes.

(8L)

Unit-2 Risk Management

Local and national policies, public awareness and participation in prevention procedures,

Industrial environmental conditions,

Emissions and noise abatement,

Ecological risk assessment.

(8L)

Credit-II (16L)

Unit-1 Fire Risk

Introduction –Definition, History of fire services, Chemistry and physics of fire.

Classification of fire. Causes, Detection and management.

The regulatory Reform (Fire safety) order 2005, Fire hazard and Risk.

Fire control technologies.

(8L)

Fire Audit.

Unit-2 Fire Risk Assessment

Fire Risk Assessment structure and Layout, means of escape principals: Basic requirements

and what to look for, Fire signage: National requirements, Fire alarms and fire detection:

Basic components, Testing, Emergency lighting: when it's required, basic components and

testing. (8L)

Credit-III (16L)

Unit-1 Chemical Risk Assessment

Importance of Chemical Safety, Basic laboratory rules and Safety.

Personal Protective Equipment (PPE),

Toxic Substances: Definition, Classes of toxicity, Entry points of Toxic agents, Effects of Toxic substances.

Chemical process safety –Decomposition and Runway Reactions, Reactive chemical hazard.

Chemical safety technologies. Case study in India.
(8L)

Unit-2 Hazard Identification and Risk Management

The Process of Risk Management , Hazard Identification , Evaluation (Risk Assessment , Risk Matrix), Risk Control implementation, action and recommendation.

(8L)

Reference:-

- 1) Computerized environmental modelling – J. Hardstay, DM Taylor & SE Metcalf
- 2) Computerized aided environmental management – SA Abbassi and FI Khan.
- 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

Class : **T. Y. B. Sc. (Semester - VI)**
Paper Code : **EVS 3606**
Paper: **VI** Title of Paper: **Environmental Economics and Audit**
Credit: **3** No. of lectures: 48

A) Learning Objectives:

- 1) To learn Environmental Economic and Development.
- 2) To learn Rural Planning and Development.
- 3) To learn Environmental valuation.

B) Learning Outcome:

- 1) Students understood Dimensions of natural Resources
- 2) Students understanding the term Environmental Audit.

Credit-I (16L)

Unit-1 Meaning and need of Economic Environment

Economic and Development; Economic efficiency and Concept of Cost , Cost benefit analysis; concept of Consumerism; Poverty and globalization; Monitoring economic and environmental progress.

Factors influences economic environment

Challenges in Indian Economy
(8L)

Unit-2 Application of economics to improve environmental quality

Rural planning and development; Importance of rural economy in Development.

Environmental valuation (Hedonic pricing, Contingent valuation and Travel cost Method) and decision making; Agricultural environment, Factors Affecting agricultural Environment.

(8L)

Credit-II (16L)

Unit-1 Dimensions of Natural Resources

Basic services of natural resources;

Natural resources as a national capital;

Natural resources and sustainable development;

Resource economics;

Issues and challenges of SEZ and EEZ in India.

(8L)

Unit-2 Environmental Audit

Basics of Environmental Audit and its need.

Types of Environmental Audits

Environmental Appraisal and Environmental Accounting

Environmental Audit Procedure; Case studies.

Green audit and energy Audit

(8L)

Credit-III (16L)

Unit-1 Environmental Management System (EMS)

EMS definition, Environment Policy and components of EMS,
Identification of environmental aspects and impacts,
Legal and other requirements,
Training and awareness requirements,
Application of Environmental Standards -ISO standards and history of their development.
(16L)

Reference:-

Barthwal R.R. (2002): Environmental Impact Assessment, New Age International (P)Ltd .
Pub New Delhi.

Agrawal S.K.(2002) Pollution Management-(Vol-3),A.P.H publishing

Gabriele Crognale P.C(1999).

Environmental management strategies (The 21st century perspective) Printice Hall PTR

Prabhakar V.K. (2001) Environmental Management. Anmol Publication pvt ltd.

Kuhre W.L. (2000) ISO14031 Environmental performance evaluation EPE,Prentice Hall,
PTR.Upper Saddle Rive

Class : **T. Y. B. Sc. (Semester - VI)**
Paper Code : **EVS 3607**
Paper : **Practical-I** Title of Paper : **Practical based on EVS 3601 to EVS 3603**
Credit : **2** No. of Practicals : **12**

A) Learning Objectives:

- 1) To learn controlling pollution in environment.
- 2) To learn different analytical methods.
- 3) To learn and controlling global warming.

B) Learning Outcome:

- 1) Students understood handling of instruments.
- 2) Students understanding the basics for industrial purpose.
- 3) Student understanding the sustainable farming practices.

Practical based on EVS 3601: Climate Change (04 Practicals)

- 1) Measurements for the impact of environmental stress conditions on plants.
- 2) Estimation of carbon sequestration.
- 3) Studies on plants facing pollutants from selected areas.
- 4) Impacts of extreme events in selected areas: A case study.

Practical based on EVS 3602: Analytical Methods (04 Practicals)

- 5) Estimation of COD.
- 6) Estimation of alkali metals in various samples by Flame-photometry
- 7) Estimation of heavy metals in soil samples by using AAS.
- 8) Estimation of oil and grease from given sample.

Visit: Visit to any Agricultural Research Institute and submission of report.

Practical based on EVS 3603: Sustainable development (04 Practicals)

- 9) Studies on measurements of sustainable farming practices
- 10) Measurement of sustainability by using innovative approaches and designs.
- 11) Designing of Green Building.
- 12) Measurement of carbon footprint of electricity.

Class : **T. Y. B. Sc. (Semester - VI)**
Paper Code : **EVS 3608**
Paper: **Practical-II** Title of Paper: **Practical based on EVS 3604 to EVS 3606**
Credit: **2** No. of Practicals: **12**

A) Learning Objectives:

- 1) To learn Environmental Economic and Development.
- 2) To learn the application of statistics in environment.
- 3) Student learns the safety rules.

B) Learning Outcome:

- 1) Students understood the term Environmental Audit.
- 2) Student understood proper safety practices in chemical lab.
- 3) Student understood environment friendly concepts.

Practical based on EVS 3604: Environmental Statistics (04 Practicals)

- 1) Grouping of data and preparation of frequency distribution, histogram and frequency polygon.
- 2) Calculating mean, median and mode for grouped and ungrouped data
- 3) Calculating variance, standard deviation and coefficient of variation, correlation coefficient for grouped and ungrouped data
- 4) Fitting simple linear regression. Plotting scatter diagram and regression line

Practical based on EVS 3605: Environmental Risk and Assessment management (04 Practicals)

- 5) To study the lab safety rules.
- 6) First aid treatment of fire and chemical hazards.
- 7) To study the types of fire alarm systems.
- 8) Designing and operating system of fire estimation.

Visit: Visit to any chemical industry/ fire and safety institute and submission of report.

Practical based on EVS 3606: Environmental Economics and Audit (04 Practicals)

- 9) Study of economical values of minimum five ecofriendly products.
- 10) To study the green audit/Energy Audit.
- 11) Preparation of questionnaires for waste management site.
- 12) Use of social media for e-networking dissemination of collection of ecofriendly Products/concepts.

Class : **T. Y. B. Sc. (Semester - VI)**
Paper Code : **EVS 3609**
Paper: **Practical-III** Title of Paper: **Project Work**
Credit: **2** No. of lectures: -----

A) Learning Objectives:

- 1) To give information of research work.
- 2) To create awareness about innovative method.
- 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.

Project Work

- 1) Compilation of data, typing, binding and submission of dissertation
- 2) Writing of research paper.
- 3) Power point presentation based on project work.
