
# Fergusson College (Autonomous)

# Pune

# Learning Outcomes-Based Curriculum

# for

# F. Y. B. Sc.

# Environmental Science

# With effect from June 2019

| Program Outcomes (POs) for B.Sc. Programme | |
|---|---|
| **PO1** | **Disciplinary Knowledge:**<br>Demonstrate comprehensive knowledge of the disciplines that form a part of an 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:**<br>Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions. |
| **PO3** | **Social competence:**<br>Display the understanding, behavioural skills needed for successful social adaptation , work in groups, exhibits thoughts and ideas effectively in writing and orally. |
| **PO4** | **Research-related skills and Scientific temper:**<br>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:**<br>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:**<br>Performing dependently and also collaboratively as a part of 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:**<br>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:**<br>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:**<br>Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes. |

| Name of the program | Program Specific Outcomes(PSOs)<br>**Upon completion of this programme the student will be able to** |
|---|---|
| **PSO1** | **Academic competence:**<br>(i) Understand fundamental concepts, principles and processes underlying the field of Environmental Science, its interdisciplinary nature (ii) Demonstrate an understanding of a wide range of Environmental techniques (e.g. basic water and soil analysis, microbiological methods, spectrophotometry, GIS based analysis, Ecological data analysis, Bio- assays) |
| **PSO2** | **Personal and Professional Competence:**<br>(i) Carryout laboratory-orientated numerical calculations and be capable in data visualization and interpretation. related to Environmental Science (ii) Analyse environmental data (e.g. in Natural Resource Management, Habitat analysis and biological databases). (iii) Formulate ideas, write scientific reports, demonstrate effective presentation and communication skill. |
| **PSO3** | **Research Competence:**<br>(i) Apply environmental data analysis methodology in order to conduct research and demonstrate appropriate skill to seek innovative solutions to problems that emerge in various fields of Ecology and Environmental Science and interdisciplinary fields (ii) Integrate informatics and statistical skills to explore and authenticate biological data for experimental and research purpose |
| **PSO4** | **Entrepreneurial and Social competence**:<br>(i) Employ skills in specific areas related to Environmental Science such as industrial pollution, Green technology development, Ecological, health, agriculture and ensure multilevel commitment to health and wellbeing of the society at large (ii) Exhibit awareness of environmental and ethical issues: emphasizing on academic and research ethics, scientific misconduct, intellectual property rights and issues of plagiarism |

# Programme Structure

| Year | Course Code | Title of Paper | No. of Credits |
|---|---|---|---|
| | **Semester I** | | |
| **F. Y. B. Sc.** | EVS1101 | Earth and Earth Surface Processes | 2 |
| | EVS1102 | Physics and Chemistry of Environment | 2 |
| | EVS1103 | Environmental Science Practical - I | 2 |
| | **Semester II** | | |
| | EVS1201 | Systematics and Biogeography | 2 |
| | EVS1202 | Water and Water Resources | 2 |
| | EVS1203 | Environmental Science Practical - II | 2 |

| Year | Name of Paper | Paper Code | Title of Paper | No. of Credits |
|---|---|---|---|---|
| | **Semester III** | | | |
| **S.Y. B.Sc.** | Theory Paper - 1 | EVS 2301 | Ecology and Ecosystems | 2 |
| | Theory Paper - 2 | EVS 2302 | Land and Soil Conservation and Management | 2 |
| | Practical Paper - 1 | EVS 2303 | Practical's based on EVS 2301 and EVS 2302 Practical -III | 2 |
| | **Semester IV** | | | |
| | Theory Paper - 3 | EVS 2401 | Urban Ecosystems | 2 |
| | Theory Paper - 4 | EVS 2402 | Natural Resource Management and Sustainability | 2 |
| | Practical Paper - 2 | EVS 2403 | Practical's based on EVS2401 and EVS 2402 Practical -IV | 2 |

| Year | Paper No. | Course Code | Title | Credits | CE maximum Marks | ESE maximum Marks | Total Maximum Marks |
|---|---|---|---|---|---|---|---|
| **T. Y. B.Sc**. | **Semester V** | | | | | | |
| | DSE-1A | EVS3501 | Natural Ecosystems Management | 2 | 50 | 50 | 100 |
| | DSE-1B | EVS3502 | Environmental Monitoring | 2 | 50 | 50 | 100 |
| | DSE-2A | EVS3503 | Remote Sensing and GIS | 2 | 50 | 50 | 100 |
| | DSE-2B | EVS3504 | Environmental Biotechnology | 2 | 50 | 50 | 100 |
| | DSE-3A | EVS3505 | Introduction to Environmental Statistics | 2 | 50 | 50 | 100 |
| | DSE-3B | EVS3506 | Climate Change and Sustainability | 2 | 50 | 50 | 100 |
| | DSE-1 | EVS3507 | Environmental Science Practical -I | 2 | 50 | 50 | 100 |
| | DSE-2 | EVS3508 | Environmental Science Practical - II | 2 | 50 | 50 | 100 |
| | DSE-3 | EVS3509 | Environmental Science Practical -III | 2 | 50 | 50 | 100 |
| | SEC-1* | EVS3511 | Hydroponics: A Green Way of Urban Farming | 2 | 50 | 50 | 100 |
| | SEC-2* | EVS3512 | Software's in Environmental Studies | 2 | 50 | 50 | 100 |

| Year | Paper No. | Course Code | Title | Credits | CE Maximum Marks | ESE Maximum Marks | Total Maximum Marks |
|---|---|---|---|---|---|---|---|
| **T. Y. B.Sc**. | **Semester VI** | | | | | | |
| | DSE-4A | EVS3601 | Waste Treatment Technologies | 2 | 50 | 50 | 100 |
| | DSE-4B | EVS3602 | Wildlife Biology and Conservation | 2 | 50 | 50 | 100 |
| | DSE-4A | EVS3603 | Environmental Impact Assessment and Management System | 2 | 50 | 50 | 100 |
| | DSE-5B | EVS3604 | Environmental Governance and Ethics | 2 | 50 | 50 | 100 |
| | DSE-6A | EVS3605 | Environmental Toxicology, Health and Safety | 2 | 50 | 50 | 100 |
| | DSE-6B | EVS3606 | Ecosystem Restoration and Remediation | 2 | 50 | 50 | 100 |
| | DSE-4 | EVS3607 | Practical Lab-I | 2 | 50 | 50 | 100 |
| | DSE-5 | EVS3608 | Practical Lab-II | 2 | 50 | 50 | 100 |
| | DSE-6 | EVS3609 | Project | 2 | 50 | 50 | 100 |
| | SEC-3* | EVS3611 | Entrepreneurship Development & Services by Environmental Consultancy | 2 | 50 | 50 | 100 |
| | SEC-4* | EVS3612 | Design and Development of Eco- friendly Products | 2 | 50 | 50 | 100 |

| F.Y. B.Sc. Semester I | | |
|---|---|---|
| **Title of the Course and Course Code** | **Earth and Earth Surface Processes (EVS1101)** | **Number of Credits : 02** |
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | |
| CO1 | Recall basic concepts of structure, composition of the earth and describe different surface processes and their impact. | |
| CO2 | Differentiate components of the environment and explain the history of earth and important processes which shaped landforms through different aspects. | |
| CO3 | Demonstrate skills based on rock cycle, field identification of rocks, basics of soil characterization and soil profile. Outline soil quality monitoring techniques in soil quality assessment. | |
| CO4 | Explain different layers in atmospheric structure. Identify the change in lapse rate due to different processes of climate change and other anthropogenic impacts. | |
| CO5 | Compare techniques used in soil quality monitoring and outline physico-chemical parameters and biological aspects of soil. | |
| CO6 | Specify techniques used to analyze soil quality. | |

| Unit. No. | Title of Unit and Contents | No. of Lectures |
|---|---|---|
| I | **Introduction to Environment:**<br>Fundamentals of Environment, Functions of Environment, Concept of Biosphere, Scope and Importance of Environment.<br>Environmental Science, Multidisciplinary and dynamic nature | 6 |
| II | History of Earth, Theories of Geological evolution, Major changes on the Earth's surface; Holocene and the emergence of humans,<br>Geological time scale, Age of reduction and Atmospheric equilibrium, Role of humans in shaping landscapes; Development of cultural landscapes | 6 |
| III | **Earth & it's Structural Components**<br>Solar system formation and planetary differentiation;<br>Orbital Theory, Geological Time Scale, Formation of the Earth: Internal Structure of Earth; Formation and composition of core, mantle, crust, Theories of geological evolution: Wagener's Continental Drift Theory, Plate Tectonic Theory, Sea floor spreading. Types of Rocks – Igneous, Sedimentary Metamorphic.<br>Rock cycle, Rock forming minerals – quartz, feldspar, micas, clay minerals, calcite, dolomite etc. | 6 |

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|---|---|---|
| IV | **Weathering and Soil**<br>Soil, Soil Profile, Soil Formation, Soil classification, Physical & chemical properties of soil, Macro & micro plant nutrients, Importance and Significance of Soil, Soil erosion Types, causes and effects | 6 |
| V | **Temperature and atmospheric phenomenon**<br>Atmosphere: evolution of earth's atmosphere, Composition of atmosphere and its vulnerability to climate change<br>Stratospheric Ozone, Significance, Atmospheric temperature measurement, Instruments;<br>Methods (maximum, minimum, mean temperature, temperature range);<br>Factors regulating atmospheric temperature/ temperature controls, Lapse rate and types, Temperature inversion & atmospheric stability | 6 |
| VI | **Atmospheric Pressure and wind**<br>Atmospheric pressure on Earth, Introduction; Measurement; Factors affecting the atmospheric pressure, Atmospheric pressure winds, Factors affecting winds, Types of wind | 6 |

| Title of the Course and Course Code | Physics and Chemistry of Environment (EVS1102) | Number of Credits : 02 |
|---|---|---|
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | |
| CO1 | Recall concepts, basic principles of environmental processes. | |
| CO2 | Differentiate concepts of physics and chemistry associated with environmental components and processes in different spheres. Explain environmental pollutants, their processing in the environment and impact on living and nonliving things. | |
| CO3 | Apply practical skills for analysis of water quality and outline different water pollutants affecting water quality and aquatic ecosystems. | |
| CO4 | Differentiate between solutes, solvents and identify food additives and preservatives. | |
| CO5 | Compare techniques used for water quality monitoring and physico-chemical properties of different water samples. | |
| CO6 | Specify behavior of heavy metals and its absorption and influence on human anatomy. | |

| Unit. No. | Title and Contents | No. of Lectures |
|---|---|---|
| I | **Fundamentals of environmental physics**<br>Basic concepts of light and matter, Introduction to the concept of absorption and transmission of light, Beer–Lambert law, scattering of light<br>Basic concepts of pressure, force, work and energy, Concept of heat transfer, conduction, convection, concept of temperature, lapse rate (dry and moist adiabatic), Laws of thermodynamics; concept of heat and work | 6 |
| II | **Fundamentals of Environmental Chemistry**<br>Solution concentration (Normality, Molarity, Molality, ppm, Equivalent weight etc.), Types of chemical reactions, acids, bases and salts, solubility products, solutes and solvents, Redox reactions, concepts of pH and pE, | 6 |
| III | **Physics and Chemistry of Atmosphere**<br>Pollutants in Atmosphere, Photochemical Reactions Involved in Atmosphere, Aerosols, Particles, Ions and Radicals in Atmosphere, Smog and Acid Rain, Plume Behavior, Asian Brown Cloud and Great Smog of London, Climate Change and Atmosphere | 6 |

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|---|---|---|
| IV | **Chemistry of Water**<br>Properties of Water, Hydrogen Bonding in Water, Changes in Properties of Water on Addition of Solute, Water Reactive Substances, Solubility of Rules, Analysis of Water Chemistry, Chelating Agents and Environmental Applications | 6 |
| V | **Chemistry of Environmental pollutants: from Industrial and agriculture sector**<br>**Heavy Metals**<br>Chemistry of Pb, Hg, and other heavy metals, Bioaccumulative property and biomagnification, Effect on human health, Prevention and control measures, Case studies.<br>**Chemical pesticides:**<br>Classification: based on chemical properties and target pest, Bioaccumulation and biomagnification of pesticides, Effects on human health, Prevention and control measures, Case studies. | 6 |
| VI | **Chemistry of Environmental pollutants from domestic sector:**<br>**Soaps and Detergents**<br>Need, classification, characteristics and composition, Environmental impact and toxicity of soaps and detergents<br>**Food additives and contaminants:**<br>Preservatives, flavoring agents, coloring agents, adulterants properties and their effects<br>**Plastic**:<br>Types of plastics its impact on environment, Plastic pollution: causes, prevention and control | 6 |

**References:**


1. Beard, J.M. 2013. *Environmental Chemistry in Society* (2nd edition). CRC Press.
2. Boeker, E. & Grondelle, R. 2011. *Environmental Physics: Sustainable Energy and Climate Change*. Wiley.
3. Connell, D.W. 2005. *Basic Concepts of Environmental Chemistry* (2nd edition). CRC Press.
4. Forinash, K. 2010. *Foundation of Environmental Physics*. Island Press.
5. Girard, J. 2013. *Principles of Environmental Chemistry* (3rd edition). Jones & Bartlett.
6. Harnung, S.E. & Johnson, M.S. 2012. *Chemistry and the Environment*. Cambridge University Press.
7. Hites, R.A. 2012. *Elements of Environmental Chemistry* (2nd edition). Wiley & Sons.
8. Manhan, S. E. 2000. *Fundamentals of Environmental Chemistry*. CRC Press.
9. Pani, B. 2007. *Textbook of Environmental Chemistry*. IK international Publishing House.
10. Sodhi G.S. 2009.Fundamental concepts of Environmental Chemistry. Narosa publishing house.

| Title of the Course and Course Code | Environmental Science Practical – I (EVS1103) | Number of Credits : 02 |
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| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | |
| CO1 | Recall laboratory safety rules for handling environmental samples while performing practicals. List different methods used for sample collection and preservation. | |
| CO2 | Estimate moisture content and water holding capacity of soil sample. | |
| CO3 | Illustrate chemicals used for estimation of organic carbon. | |
| CO4 | Identify and illustrate physical properties of rock and mineral samples. | |
| CO5 | Measure pH and conductivity of a given soil sample with the help of suitable methods. | |
| CO6 | Collect soil samples using different methods. Construct textural classification of soil by comparing its physical properties. | |

| Sr. No. | Title of Experiment / Practical |
|---|---|
| 1 | Laboratory safety rules and introduction to laboratory equipments |
| 2 | Identification of different Rock specimens from their physical Properties. |
| 3 | Identification of different Mineral specimens from their physical Properties |
| 4 | Practical based on Weathering |
| 5 | Visit to Weather Station ( Demo working ) |
| 6 | Collection and preservation of water and soil samples (Field Practical). |
| 7 | Study of Physical properties of soil.(Textural classification) |
| 8 | Determination of pH & Electrical Conductivity from soil sample. |
| 9 | Estimation of the Moisture Content & Water Holding Capacity of Soil. |
| 10 | Determination of Organic Content from soil. |
| 11 | Determination of Ca and Mg from given soil sample |
| 12 | Estimation of lapse rate |
| 13 | Identification of food adulteration |
| 14 | Use of social media for e-networking and dissemination of ideas on environmental issues |

| F.Y. B.Sc. Semester II | | |
|---|---|---|
| **Title of the Course and Course Code** | **Systematics and Biogeography (EVS1201)** | **Number of Credits : 02** |
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | |
| CO1 | Describe applications of environmental biology, classical and modern day systematics for classification of living organisms. Outline different levels of classification. | |
| CO2 | Illustrate historical and contemporary patterns of distributions of organisms and design effective conservation strategies. Explain bio-geographic theories in an era of global change and large scale human induced degradation. | |
| CO3 | Apply skills for identifying adaptations in organisms and outline evolution of life through geological time. | |
| CO4 | Differentiate between the concepts of mass and background extinction. Identify different habitats and discuss its importance. | |
| CO5 | Compare biogeographical profiles of the World and India. | |
| CO6 | Develop skills to classify different organisms. | |

| Unit. No. | Title of Unit and Contents | No. of Lectures |
|---|---|---|
| I | **Introduction**<br>Principles of Environmental Biology, Branches, Scope and Importance in today's context from an environmental point of view. Concepts and components: Biological spectrum (atom to biosphere), Habitat, Carrying Capacity etc. and Earth spheres.<br>Charles Darwin's Voyage of HMS Beagle – His theory of 'Survival of the Fittest'. Humans in Environment | 6 |
| II | **Origin of Life**<br>Origin of Life; Evolution of Life through the geological time i.e. – Eras, Periods, Epochs; Events of (Evolutionary) 'Explosions' and 'Mass Extinctions'& Paleontological Evidences for these, The current 'Mass Extinction' with reference to rate of extinction, factors responsible and possible remedies | 6 |
| III | **Biogeography**<br>A glimpse of the present day distribution of Life on Earth; The factors responsible –Geological - Barriers and Bridges, Climatic - Barriers and Bridges Evolutionary - Speciation etc.<br>Biogeography – The meaning; Biographical profile of the world and India; The physical, microbial, floral and faunal characteristics of each Biogeographical zone. | 6 |

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| IV | **Taxonomy**<br>Taxonomic Principles - aim, objectives, hierarchy, kingdoms. History; Linnaeus system of classification; Bentham & Hooker system of classification, Components of systematic - characterization, classification, identification & nomenclature<br>The concept of species- morphological, biological, phylogenetic, ecological etc | 6 |
| V | **Classification**<br>Classification based on form -<br>Plants - algae, bryophyte, Pteridophytes, gymnosperm angiosperm (monocot & dicot)<br>Animals – Invertebrates - arthropods - insects<br>Vertebrates – fishes, amphibians, reptiles, birds & mammals.<br>Microbes – viruses, bacteria & fungi<br>Life Forms on Earth -Terrestrial Life forms - floral & faunal<br>Aquatic (fresh water & marine) life forms - floral & faunal | 6 |
| VI | **Ecological Adaptations**<br>Ecological Adaptations under various environmental conditions –In plants - hydrophytes, mesophytes, epiphytes, xerophytes & halophytes, In animals - mimicry, vestigiality etc. | 6 |

**References:**


1. Lomolino, M.V., Riddle, B.R., Whittaker, R.J. & Brown, J.H. 2010. *Biogeography* (4th edition). Sinauer Associates, Sunderland.
2. Mani, M.S. 1974. *Ecology and Biogeography in India*. Dr. W Junk Publishers., The Hague.
3. Singh, G. 2012. *Plant Systematics: Theory and Practice* (3rd edition). Oxford & IBH Pvt. Ltd.,New Delhi.
4. Wheeler, Q.D. & Meier R. 2000. *Species Concepts and Phylogenetic Theory: A Debate.* Columbia University Press, New York.
5. Williams, D. M., Ebach, M.C. 2008. *Foundations of Systematics and Biogeography*. Springer.
6. Wilkins, J. S. 2009. *Species: A History of the Idea* (Vol. 1). University of California Press.

| Title of the Course and Course Code | Water and Water Resources – (EVS1202) | Number of Credits : 02 |
|---|---|---|
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | |
| CO1 | Recall the key terms in the hydrological cycle. List the forms of precipitation, condensation, types of aquifers. | |
| CO2 | Outline water resources, its utilization and management along with problems associated with it. Discuss traditional and advanced water management practices. | |
| CO3 | Illustrate the hydrological cycle with its components. Classify types of aquifers. Outline different pollutants affecting components of water quality. | |
| CO4 | Identify and relate the problems associated with water shortages in India and other countries. Explain national and international conflicts on water. | |
| CO5 | Evaluate threats associated with marine ecosystems and associated resources, list the marine research institutes and identify their importance in oceanography. Compare techniques used for water quality monitoring with reference to physical and chemical properties of different water samples. | |
| CO6 | Design a water quality monitoring plan based on water sampling methods and water quality parameters. | |

| Unit. No. | Title of Unit and Contents | No. of Lectures |
|---|---|---|
| I | **Evolution of Hydrosphere**<br>Classification of water resources (oceans, rivers, lakes and wetlands), Hydrological cycle –Introduction & significance<br>Evaporation; Factors affecting the rate of evaporation, potential evapotranspiration(PE), Condensation; Factors affecting the rate of condensation; Forms of condensation – dew, frost, fog & cloud, Precipitation; Factors affecting precipitation; Forms of precipitation – rain, drizzle, snow, hail, sleet etc. | 6 |
| II | **Water Quality Monitoring**<br>Objectives of water quality monitoring, Collection and preservation of water samples<br>Water sampling: sampling frequency, water samplers,<br>Types of Samples-Grab, composite, integrated, Water quality parameters: Methods of analysis and significance and water quality standards.<br>Physical: temperature, colour, odour, total dissolved solids and total suspended solids<br>Chemical: major inorganic and organic constituents, dissolved gases, DO, COD, BOD, acidity and alkalinity, electrical conductivity | 6 |

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|---|---|---|
| | Biological: MPN, SPC, plankton etc.<br>Preparation of monitoring report, Water Quality Indicators | |
| III | **Surface and subsurface water**<br>Introduction to surface and ground water, Surface and ground water pollution, Water table; vertical distribution of water Formation and properties of aquifers techniques for ground water recharge, Wetlands and their importance. | 6 |
| IV | **Oceanography and related resources**<br>Oceanography: principles and scope, Physical and chemical properties of seawater<br>Marine Ecosystems: vertical stratification<br>Marine resources: commercial use of marine resources<br>Threats to marine ecosystems and resources: overexploitation, pollution due to ballast water, oil spills, microplastics etc. Case studies, Marine research institutes in India | 6 |
| V | **Humans and Water**<br>Demand for Water in India, Water Footprint, Water Quality Standards in India, Hot Spots of Surface Water, Role of State in Water Resource Management, Traditional Water Harvesting Systems in India, Environmental Status Report of Rivers | 6 |
| VI | **Water Resources and Related Issues**<br>Water Resources of India, Interlinking of Rivers, National Water Policy of India, Water Scarcity: Social Impacts and Ecological Losses, Conflicts over Water Sharing: Local, National and International, Surface and Groundwater Pollution: Case Studies | 6 |

**References:**


1. Bansil, P.C. 2004. *Water Management in India*. Concept Publishing Company, India.
2. Brebbia, C.A. 2013. *Water Resources Management VII*. WIT Press.
3. CEA. 2011. *Water Resources and Power Maps of India*. Central Board of Irrigation & Power.
4. Grumbine, R.E. & Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science* 339:
5. Loucks, D.P., Stedinger, J.R. & Haith, D. A. 1981. *Water Resource Systems Planning and*
6. *Analysis*. Englewood Cliffs, NJ, Prentice Hall.
7. Mays, L.W. 2006. *Water Resources Sustainability*. The McGraw-Hill Publications. Schward& Zhang, 2003. *Fundamentals of Groundwater*. John Willey and Sons.
8. Souvorov, A.V. 1999. *Marine Ecologonomics: The Ecology and Economics of Marine Natural Resource Management*. Elsevier Publications.
9. Vickers, A. 2001. *Handbook of Water Use and Conservation*. Water Plow Press.

| Title of the Course and Course Code | Environmental Science Practical – II (EVS1203) | Number of Credits : 02 |
|---|---|---|
| **Course Outcomes (COs)**<br>**On completion of the course, the students will be able to:** | | |
| CO1 | Recall laboratory safety rules for handling environmental samples while performing practicals. List different methods used for sample collection and preservation. | |
| CO2 | Estimate pH and Conductivity of water sample. | |
| CO3 | Illustrate chemicals used for estimation of Alkalinity. | |
| CO4 | Identify adaptations in organisms and illustrate different plant and animal forms. | |
| CO5 | Measure total hardness, chlorides, conductivity and turbidity of a given water sample with the help of suitable methods. | |
| CO6 | Write a report on collection of water samples using different methods. Construct experiments to understand physical properties of water by comparing its level of pollution. | |

| Sr. No. | Title of Experiment/ Practical |
|---|---|
| 1 | Determination of pH & Electrical Conductivity from water. |
| 2 | Determination of Alkalinity from water. |
| 3 | Determination of Total Hardness (Ca & Mg) from water. |
| 4 | Determination of Chlorides from water. |
| 5 | Determination of TDS, TSS & TS from water |
| 6 | Determination of Turbidity in water by Secchi disc (Field practical). |
| 7 | Determination of Calcium Carbonate from given soil sample |
| 8 | Determination of Boron from given soil sample. |
| 9 | Study of Plant Fossil Forms from different geological periods/visit to Paleo-botanical museum |
| 10 | Collection and characterisation of planktons/plant bio-indicators rom Eutrophic lake (Field Practical). |
| 11 | Study of Plant Adaptations under various environmental conditions (Hydrophytes, mesophytes, epiphytes, halophytes & xerophytes). |
| 12 | Study of Animal Adaptations under various ecological conditions (Mimicry & vestigiality). |
| 13 | Study of Plant & Animal Diseases (one each of viral, bacterial & Fungal). |
| 14 | Identifying native plants for plantation with respect to geography and climate. |