

Deccan Education Society's  
**FERGUSON COLLEGE, PUNE**  
**(AUTONOMOUS)**

**SYLLABUS UNDER AUTONOMY**

**FIRST YEAR B.Sc.**  
**SEMESTER – I**

**SYLLABUS FOR F.Y. B.Sc.**

**ENVIRONMENTAL SCIENCE**  
**Academic Year 2016-2017**

Deccan Education Society's  
FERGUSSON COLLEGE, PUNE  
**Scheme of Course Structure with Course Code (Faculty of Science)**  
**Undergraduate**

<b>Particulars</b>	<b>Title of Paper</b>	<b>No. of Credits</b>	<b>Course Code</b>
F.Y. Semester I	Earth and Earth Surface Processes	2	EVS1101
	Physics and Chemistry of Environment	2	EVS1102
	Environmental Science Practical - I	2	EVS1103
F.Y. Semester II	Systematics and Biogeography	2	EVS1201
	Water and Water Resources	2	EVS1202
	Environmental Science Practical - II	2	EVS1203

**PAPER CODE: EVS1101**

**PAPER – I: EARTH AND EARTH SURFACE PROCESSES**

**Objectives:** The paper will introduce students to the basic structure and composition of the Earth and will explore various surface processes and their impact on and role in living systems. It will also deal with the interactive processes in the inner as well as outer Earth's surface.

**[Credit -2: No. of Lectures 36]**

	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit -I</b>	<b>History of Earth</b> <ul style="list-style-type: none"><li>• Solar system formation and planetary differentiation;</li><li>• Orbital Theory</li><li>• Formation of the Earth: Internal Structure of Earth; Formation and composition of core, mantle, crust.</li><li>• Geological time scale</li><li>• Sea floor spreading.</li><li>• Theories of geological evolution: Wagoner's Continental Drift Theory, Plate Tectonic Theory</li></ul>	<b>6</b>
<b>Unit -II</b>	<b>Earth &amp; it's Structural Components</b> <ul style="list-style-type: none"><li>• Holocene and the emergence of humans,</li><li>• Rock cycle.</li><li>• Types of Rocks – Igneous, Sedimentary Metamorphic.</li><li>• Rock forming minerals – quartz, feldspar, micas, clay minerals, calcite, dolomite etc.</li></ul>	<b>6</b>
<b>Unit -III</b>	<b>Soil and weathering processes</b> <ul style="list-style-type: none"><li>• Weathering: Physical weathering, biogeochemical processes.</li><li>• Erosion: physical processes of erosion,</li><li>• factors affecting erosion; agents of erosion</li><li>• Physical &amp; chemical properties of soil</li></ul>	<b>6</b>

	<ul style="list-style-type: none"> <li>• Macro &amp; micro plant nutrients</li> </ul> <p>Soil Profile and Soil classification</p>	
<b>Unit -IV</b>	<p><b>Atmosphere</b></p> <ul style="list-style-type: none"> <li>• Atmosphere: evolution of earth's atmosphere</li> <li>• Composition of atmosphere</li> <li>• Physical, chemical and optical properties</li> <li>• Chemical composition of atmosphere</li> <li>• Vertical structure</li> <li>• Significance</li> </ul>	<b>6</b>
<b>Unit -V</b>	<p><b>Atmospheric temperature</b></p> <ul style="list-style-type: none"> <li>• Atmospheric temperature measurement</li> <li>• Instruments;</li> <li>• Methods (maximum, minimum, mean temperature, temperature range);</li> <li>• Factors regulating atmospheric temperature/ temperature controls</li> <li>• Lapse rate; Types – ELR, DALR &amp; WALR</li> <li>• Temperature inversion -</li> <li>• Types of Inversion – radiation, advection, frontal subsidence, turbulence/ convective inversions.</li> </ul> <p>Temperature inversion &amp; atmospheric stability</p>	<b>6</b>
<b>Unit -VI</b>	<p><b>Atmospheric Pressure and wind</b></p> <ul style="list-style-type: none"> <li>• Atmospheric pressure</li> <li>• Introduction; Measurement; Factors affecting the atmospheric pressure</li> <li>• Spatial &amp; Temporal variations</li> <li>• Atmospheric pressure &amp; Generation of winds</li> <li>• Factors affecting winds</li> </ul> <p>Types of wind</p>	<b>6</b>

## References:

1. Bridge, J., & Demicco, R. 2008. *Earth Surface Processes, Landforms and Sediment deposits*. Cambridge University Press.
2. Duff, P. M. D., & Duff, D. (Eds.). 1993. *Holmes' Principles of Physical Geology*. Taylor & Francis.
3. Gupta, A. K., Anderson, D. M., & Overpeck, J. T. 2003. Abrupt changes in the Asian southwest monsoon during the Holocene and their links to the North Atlantic Ocean. *Nature* **421**: 354-357.
4. Gupta, A. K., Anderson, D. M., Pandey, D. N., & Singhvi, A. K. 2006. Adaptation and human migration, and evidence of agriculture coincident with changes in the Indian summer monsoon during the Holocene. *Current Science* **90**: 1082-1090.
5. Keller, E.A. 2011. *Introduction to Environmental Geology* (5th edition). Pearson Prentice Hall.
6. Krishnan, M. S. 1982. *Geology of India and Burma*. CBS Publishers & Distributors.
7. Leeder, M., Arlucea, M.P. 2005. *Physical Processes in Earth and Environmental Sciences*. Blackwell Publishing.
8. Pelletier, J. D. 2008. *Quantitative Modeling of Earth Surface Processes* (Vol. 304). Cambridge:Cambridge University Press. Chicago

**PAPER CODE: EVS1102**

**PAPER – II: PHYSICS AND CHEMISTRY OF ENVIRONMENT**

**Objectives:** This paper aims to build conceptual understanding of students by exposing them to the basic principles behind various environmental processes. The paper has been divided into two sections, with the view to introduce students to the concepts of physics and chemistry associated with particle movement, chemical processes and pollutant chemistry

[Credit -2: No. of Lectures 36]

	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit -I</b>	<b>Fundamentals of environmental physics</b> <b>Part A:</b> Basic concepts of light and matter; Introduction to the concept of absorption and transmission of light, Beer–Lambert law, scattering of light  <b>Part B:</b> 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	<b>6</b>
<b>Unit -II</b>	<b>Fundamentals of Environmental Chemistry</b> <b>Part A:</b> Solution concentration (Normality, Molarity, Molality, ppm, Equivalent weight etc.)  <b>Part B:</b> Types of chemical reactions; acids, bases and salts, solubility products; solutes and solvents; Redox reactions, concepts of pH and pE,	<b>6</b>
<b>Unit -III</b>	<b>Physics and Chemistry of Atmosphere</b> <b>Part A:</b> Photochemical reactions involved in atmosphere.  <b>Part B:</b> Diffusion and dispersion, point and area source pollutants, Pollutant dispersal; Plume behaviour, mixing heights, types of flow	<b>6</b>
<b>Unit -IV</b>	<b>Chemistry of Water</b> <b>Part A:</b> Chemical and physical properties of water, Hydrogen bonding Changes in water properties on addition of solute. Water interaction with gases and earth minerals.  <b>Part B:</b> Alkalinity and acidity of water, hardness of water Solubility of metals, complex formation and chelation	<b>6</b>

<b>Unit –V</b>	<b>Chemistry of some Heavy Metals</b> <b>Part A:</b> Chemistry of Pb, Hg, Cd and Ar, its Physical and chemical properties  <b>Part B:</b> Behaviour of these heavy metals and their compounds, Human exposure-absorption and influence	<b>6</b>
<b>Unit –VI</b>	<b>Chemistry of Surfactants and chemicals in food</b> <b>Part A: Surfactants and Detergents:</b> Need, classification, characteristics and composition. Environmental Impact and toxicity of Soaps and detergents  <b>Part B:</b> Food additives: Preservatives, flavoring agents, coloring agents, adulterants Properties and their effects	<b>6</b>

**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.

**PAPER CODE:EV51103**  
**PAPER – III: ENVIRONMENTAL SCIENCE PRACTICAL - I**  
**[Credit -2: No. of Practicals Any 10]**

	<b>Title of Experiment/ Practical</b>
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 (River/Lake).
7	Determination of pH & Electrical Conductivity from soil sample.
8	Estimation of the Moisture Content & Water Holding Capacity of soil.
9	Determination of Organic Content from soil.
10	Determination of Ca and Mg from given soil sample
11	Estimation of lapse rate
12	Use of social media for e-networking and dissemination of ideas on environmental issues



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**PAPER CODE: EVS1201**

**PAPER - I: SYSTEMATICS AND BIOGEOGRAPHY**

**Objectives:** This course will discuss principles and applications of environmental biology, classical and modern day Systematics to classification of living organisms, develop understanding of historical and contemporary patterns of distributions of organisms, and design effective conservation strategies using bio geographic theories in an era of global change and large scale human induced degradation

**[Credit -2: No. of Lectures 36]**

	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit -I</b>	<b>Origin of Life</b> <ul style="list-style-type: none"><li>• Origin of Life; Evolution of Life through the geological time i.e. – Eras, Periods, Epochs; Events of (Evolutionary) ‘Explosions’ and ‘Mass Extinctions’ &amp; Paleontological Evidences for these.</li><li>• The current 'Mass Extinction' with reference to rate of extinction, factors responsible and possible remedies</li></ul>	<b>6</b>
<b>Unit -II</b>	<b>Environmental Biology</b> <ul style="list-style-type: none"><li>• Principles of Environmental Biology</li><li>• Branches, Scope and Importance in today’s context from environmental point of view.</li><li>• Concepts and components: Biological spectrum (atom to biosphere), Habitat, Carrying Capacity etc. and Earth spheres.</li><li>• Charles Darwin’s Voyage of HMS Beagle – His theory of ‘Survival of the Fittest’. Humans in Environment</li></ul>	<b>6</b>
<b>Unit –III</b>	<b>Biogeography</b> <ul style="list-style-type: none"><li>• A glimpse of the present day distribution of Life on Earth; The factors responsible – Geological - Continental Drift- Barriers and Bridges, Climatic - Barriers and Bridges Evolutionary - Speciation etc.</li><li>• Biogeography – The meaning; Biographical profile of the world and India; The physical, microbial, floral and faunal characteristics of each Biogeographical zone , Wallace line.</li></ul>	<b>6</b>
<b>Unit –IV</b>	<b>Taxonomy</b> <ul style="list-style-type: none"><li>• Taxonomic Principles - aim, objectives, hierarchy, kingdoms.</li></ul>	

	<ul style="list-style-type: none"> <li>• History; Linnaeus system of classification; Bentham &amp; Hooker system of classification.</li> <li>• Components of systematic - characterization, classification, identification &amp; nomenclature</li> <li>• .The concept of species- morphological, biological, phylogenetic, ecological etc</li> </ul>	<b>6</b>
<b>Unit –V</b>	<p><b>Classification</b></p> <ul style="list-style-type: none"> <li>• Classification based on form -</li> <li>• Plants - algae, bryophyte, pteridophyte, gymnosperm angiosperm (monocot &amp; dicot)</li> <li>• Animals - Invertebrates - arthropods - insects Vertebrates – fishes, amphibians, reptiles, birds &amp; mammals.</li> <li>• Microbes - viruses, bacteria &amp; fungi</li> <li>• Life Forms on Earth - <ul style="list-style-type: none"> <li>i)Terrestrial Life forms - floral &amp; faunal</li> <li>ii)Aquatic (fresh water &amp; marine) life forms - floral &amp; faunal</li> <li>iii) Microbial Life (fungi, bacteria &amp; viruses) in air, water &amp; soil</li> </ul> </li> </ul>	<b>6</b>
<b>Unit –VI</b>	<p><b>Ecological Adaptations</b></p> <ul style="list-style-type: none"> <li>• Ecological Adaptations under various environmental conditions –</li> <li>• In plants - hydrophytes, mesophytes, epiphytes, xerophytes &amp; halophytes</li> <li>• In animals - mimicry, vestigiality etc.</li> </ul>	<b>6</b>

**PAPER CODE: EVS1202**  
**PAPER – II: WATER AND WATER RESOURCES**  
**[Credit -2: No. of Lectures 36]**

**Objectives:** The paper introduces students to the hydrological cycle, properties of water, physicochemical and biological water quality assessment and indices, types of water resources, their use and management. It will also highlight the problems associated with water shortages in India and Familiarizes students with case studies on international and national conflicts on water.

	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit -I</b>	<b>Evolution of hydrosphere.</b> <ul style="list-style-type: none"> <li>• Classification of water resources (oceans, rivers, lakes and wetlands).</li> <li>• Hydrological cycle –</li> <li>• Introduction &amp; significance</li> <li>• Evaporation; Factors affecting the rate of evaporation</li> <li>• Condensation; Factors affecting the rate of condensation;</li> <li>• Forms of condensation – dew, frost, fog &amp; cloud.</li> <li>• Precipitation; Factors affecting precipitation; Forms of precipitation – rain, drizzle, snow, hail, sleet etc</li> </ul>	<b>6</b>
<b>Unit -II</b>	<b>Water Quality Parameters</b> <ul style="list-style-type: none"> <li>• Physical: temperature, colour, odour, total dissolved solids and total suspended solids;</li> <li>• Chemical: major inorganic and organic constituents, dissolved gases, DO, COD, BOD, acidity and alkalinity, electrical conductivity,</li> <li>• Biological: Indicators of water quality MPN, SPC , plankton, macro-invertebrates</li> </ul>	<b>6</b>
<b>Unit –III</b>	<b>Surface and subsurface water</b> <ul style="list-style-type: none"> <li>• Introduction to surface and ground water</li> <li>• Surface and ground water pollution</li> <li>• Water table; vertical distribution of water</li> <li>• Formation and properties of aquifers techniques for ground water recharge.</li> <li>• Wetlands and their importance.</li> </ul>	<b>6</b>
<b>Unit –IV</b>	<b>Oceanography and related resources</b> <ul style="list-style-type: none"> <li>• Vertical stratification in Marine Ecosystems</li> <li>• Marine resources: commercial use of marine resources;</li> <li>• Threats to marine ecosystems and resources</li> </ul>	<b>6</b>

<b>Unit –V</b>	<b>Man and Water</b> <ul style="list-style-type: none"> <li>• Water footprint</li> <li>• Demand for water (agriculture, industrial, domestic)</li> <li>• Overuse and depletion of surface and ground water resources;</li> <li>• Water quality standards in India; hot spots of surface water.</li> <li>• Role of state in water resources management.</li> <li>• Traditional water harvesting systems in India.</li> </ul>	<b>6</b>
<b>Unit –VI</b>	<b>Water resources and related issues</b> <ul style="list-style-type: none"> <li>• Water resources and sharing problems</li> <li>• Social and ecological losses versus economic benefits</li> <li>• International conflicts on water sharing</li> </ul>	<b>6</b>

**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**: 36-37.
5. Loucks, D.P., Stedinger, J.R. & Haith, D. A. 1981. *Water Resource Systems Planning and Analysis*. Englewood Cliffs, NJ, Prentice Hall.
6. Mays, L.W. 2006. *Water Resources Sustainability*. The McGraw-Hill Publications.
7. Schward & Zhang, 2003. *Fundamentals of Groundwater*. John Willey and Sons.
8. Souvorov, A.V. 1999. *Marine Ecogonomics: The Ecology and Economics of Marine Natural Resource Management*. Elsevier Publications.
9. Vickers, A. 2001. *Handbook of Water Use and Conservation*. Water Plow Press.

**PAPER CODE: EVS1203**  
**PAPER – III: ENVIRONMENTAL SCIENCE PRACTICAL - II**  
**[Credit -2: No. of Practicals 10]**

**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	Collection and characterisation of planktons/plant bio-indicators from eutrophic lake(Field Practical).
8	Study of Plant Fossil Forms from different geological periods/visit to Paleo-botanical museum
9	Study of various Plant Forms (Specimens).
10	Study of Plant Adaptations under various environmental conditions (Hydrophytes, mesophytes, epiphytes, halophytes & xerophytes).
11	Study of various Animal Forms (Specimens).Techniques of Animal studies
12	Study of Plant & Animal Diseases (one each of viral, bacterial & Fungal).