# University of Pune

# S.Y.B.Sc.
# Environmental Science
# Revised Syllabus 2020-21
# Course Design

| Semester | Paper | Course code | Course Title | Credits | Marks Distribution | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Internal | University | Subtotal | Total |
| I | I | EVS – 231 | Ecology & Ecosystem | 02 | 15 | 35 | 50 | 150 |
| | II | EVS – 232 | Natural Resource Conservation and Management | 02 | 15 | 35 | 50 | |
| | III | EVS – 233 | Practical Course Based on EVS - 231 & EVS – 232 | 02 | 15 | 35 | 50 | |
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| II | I | EVS-241 | Biological Diversity & its Conservation | 02 | 15 | 35 | 50 | 150 |
| | II | EVS-242 | Environmental Pollution Control Technology | 02 | 15 | 35 | 50 | |
| | III | EVS-243 | Practical Course Based on EVS - 241 & EVS - 242 | 02 | 15 | 35 | 50 | |
| | | | | Total = 12 | | | | 300 |

**Semester – I, Paper – I, EVS – 231**

## Ecology & Ecosystem

**(Total Lectures- 40)**

| Unit No. | Name of the Unit | Content | Lectures |
|---|---|---|---|
| **1.** | **Ecology** | • **Introduction & Interdisciplinary nature of Ecology.**<br>• **Levels of Organisation –**<br>a) Biological / Ecological Spectrum.<br>b) Ecological Hierarchy by Barett et al.<br>• **Ecological Classification based on –**<br>a) Taxonomic Affinity (From Kingdom to Species Level Ecology).<br>b) Habitat Types (Terrestrial & Aquatic Ecology).<br>c) Levels of Organisation (Autecology & Synecology – Population, Community, Biome & Ecosystem Ecology) | **08** |
| **2.** | **Ecosystem Structure & Function – Energy Flow** | • **Concept** of the Ecosystem.<br>• **Macro & Micro-ecosystems …etc.**<br>• **Ecosystem Structure** – Abiotic & Biotic Components.<br>• **Ecosystem Function : Functional attributes-**<br>a) Food Chain – Grazing & Detritus.<br>b) Food Web & Ecosystem Stability<br>c) Ecological Energetics –<br>i) Energy Input.<br>ii) Energy Flow – Single Channel & Y shaped models.<br>d) Productivity of Ecosystem –<br>i) Primary Production – GPP & NPP.<br>ii) Secondary Production.<br>iii) Standing Crop (Biomass).<br>e) Ecological Pyramids – of Number, Biomass & Energy with examples | **08** |
| **3.** | **Ecosystem Function : Nutrient Cycling** | • **Concept of –**<br>a) Macro & Micro-nutrients, deficiency syndrome, Functions<br>b) Nutrient Cycling-- Biogeochemical Cycles –<br>• **Gaseous Cycles** – Hydrological, Carbon & Nitrogen Cycles.<br>• **Sedimentary Cycles** – Phosphorus & Sulphur Cycles.<br>• **Human Impact** on Biogeochemical Cycles.<br>• **Ecosystem Nutrient Cycling Model – Intra-system Cycling & Extra-system Transfers.**<br>a) Nutrient Inputs.<br>b) Biotic Accumulation of Nutrient.<br>c) Nutrient Outputs. | **08** |

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| **4.** | **Population Ecology** | • **Introduction & Basic Concepts.**<br>• **Population Characteristics** –<br>a) Size & Density.<br>b) Dispersion – Random, Aggregate & Uniform.<br>c) Natality (Potential & Realised).<br>d) Fecundity<br>e) Mortality (Potential & Realised).<br>f) Survivorship Curves.<br>g) Age & Sex Structure.<br>h) Life Table and Viability analysis<br>• **The Concept of Carrying Capacity.**<br>• **Population Growth –**<br>a) Growth Curves – Exponential & Logistic.<br>b) Population Fluctuation.<br>c) Biotic Potential & Environmental Resistance. | **08** |
| **5.** | **Community Ecology and Succession** | • **Characteristics of Community** - Species Diversity, Growth form & Structure, Dominance, Succession, Trophic Structure, Ecological Niche, Ecotone & Edge Effect.<br>• **Characters used in Community Structure-**<br>a) Analytical Characters –<br>i) Quantitative.<br>ii) Qualitative.<br>b) Synthetic Characters.<br>• **Inter-specific & Intra-specific Relationships.**<br>• **Causes** of Succession.<br>• **Basic Types** – Primary, Secondary, Autogenic, Allogenic …etc.<br>• **Mechanism** of Succession –<br>a) Nudation.<br>b) Invasion.<br>c) Competition, Co-action & Reaction.<br>d) Stabilisation (Climax).<br>• **Models** of succession –<br>a) Hydrosere.<br>b) Lithosere. | **08** |

## Semester – I , Paper – II, EVS – 232

# Natural Resources & their Management (Total Lectures- 40)

| Unit No. | Name of the Unit | Content | Lectures |
|---|---|---|---|
| 1. | **Resources** | • **Meaning and Definition**<br>• **Classification of Resources**<br>1. On the basis of Origin: Biotic & Abiotic<br>2. On the basis of recovery rate: Renewable and Non Renewable<br>3. Natural and Artificial Resources<br>4. Material and Energy Resources<br>• **Importance and Scope** of Resources<br>• **Nature** of Resources : Regenerative and Assimilative Capacity of Earth<br>• **Man's Interaction with Natural Resources**:<br>1. An important resource<br>2. A waste sink<br>3. Cultural Significance<br>• **Problems** associated with Natural Resources | **08** |
| 2. | **Forest and Mineral Resources** | A. **Forest Resources** :<br>• Function of Forest : Protective, Productive, Regulative and Accessory<br>• Importance of Forest : Ecological and Economical<br>• Human Interaction with Forest : Overexploitation, Deforestation (Causes and Effects)<br>• Forest Management in India—JFM, EDP, Protected Areas<br>• Case studies on Timber extraction, Dam construction and its effect on tribal people<br>B. **Mineral Resources**<br>• Origin of Mineral Resources with examples<br>• Need of Mineral Resources<br>• Overexploitation of Mineral Resources<br>• Effects of Mining on Ecosystem with case studies.<br>• Conservation of Mineral resources and its importance | **08** |
| 3. | **Food Resources** | • **World Food Problems**:<br>a) Increasing World Food Demand.<br>b) Nutritional deficiency in food.<br>c) Food Distribution.<br>• **The Green Revolution in India**- Concept, Its Impacts in India.<br>• Introduction of Hybrid Varieties-HYV and Genetically Modified Crops.<br>• Effects of Modern Agriculture technologies<br>• Genetically Modified Crops & Regulations in India<br>• **Fertilizer-Pesticide Problems** –NPK Fertilizers | **08** |

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| **4.** | **Water Resources** | • **Use and over-utilization** of surface and ground water,<br>• Under-ground water pollution<br>• Water Crisis--- the reasons<br>• Conflicts over water ---World and India<br>• **Conservation & Management**<br>a) Traditional Methods.<br>b) Rain-water Harvesting & Ground Water Recharge.<br>c) Watershed Management– the concept.<br>d) Flood and flood plain management | **08** |
| **5.** | **Land Resource** | • **Traditional & Modern Agricultural Systems**<br>• **Major causes of soil degradation**:<br>Soil erosion, Pollution , Use of fertilisers, pesticides, heavy metals, Plastic pollution<br>• **Consequences of soil erosion**<br>a) Decline of soil fertility<br>b) Water logging<br>c) Salinity<br>d) Shifting / jhum cultivation<br>• **Soil conservation methods**<br>• **Sustainable Agriculture Methods** | **08** |

**Semester – II, Paper – I, EVS -241,**

## Biological Diversity & its Conservation (Total Lectures- 40)

| Unit No. | Name of the Unit | Content | Lectures |
|---|---|---|---|
| 1. | **Biological Diversity – Ecosystem Diversity** | **Biological Diversity---**<br>• The Concept, Definition<br>• Levels – Ecosystem, Species & Genetic.<br>• Methods of assessment of Biological diversity<br>**Ecosystem Diversity**<br>• Classification of Ecosystem –<br>a) Udvardy's Classification.<br>b) Bailey's Classification.<br>c) Olsen's Classification.<br>d) Holdridge's Classification.<br>• **Major Ecosystem types of India** with their physical & biological characteristics.<br>• **Major Ecosystem types of the World** with their physical & biological characteristics.<br>• **Importance of Ecosystem in maintaining Ecological balance** | **08** |
| 2. | **Species Diversity** | a) **Species Diversity** at Local , National and International Level<br>b) Special features and Latest estimates for major groups of Plants, Animals & Microbes.<br>• **Measuring Species Diversity** – Species Richness, Species Abundance and Species Evenness.<br>• **Factors** affecting global distribution of Species Richness – Latitudinal, Altitudinal, Rainfall gradients, temperature …etc.<br>• **Endemism** –<br>a) The Concept.<br>b) Types with Examples.<br>c) Endemism in India.<br>• **Centers of Diversity** –<br>a) The Concept.<br>b) Centers of Diversity : Analyses at Global Level –<br>• **Concept of hotspot**<br>i) Myer's Hot-spots.<br>ii) Mega-diversity Centers / Countries.<br>**c) Western Ghat as a Hot-spot.**<br>d) **India as a Mega-diversity Country**. | **08** |
| 3. | **Genetic Diversity** | • **Meaning & Introduction** to Genetic Variations in Species.<br>• **Nature & Origin** of Genetic Variations.<br>• **Factors** affecting Genetic Diversity.<br>• **Darwin's theory of Evolution and Lamarck's theory of Natural Selection**<br>• **Measurement of Genetic Diversity** –<br>a) Based on DNA & Chromosomes.<br>b) Molecular Marker Techniques.<br>• **Transgenic Organisms**.<br>• **Diversity in Domesticated Species** – | **08** |

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| | | a) Variations since the first domestication to the present.<br>• Land Races, Advanced Cultivars, Wild Relatives of Cultivated Plants & Feral Plants. | |
| **4.** | **Significance & Threat to Biodiversity** | **(Significances)**<br>• Ecological Significances – Contribution of Biodiversity to various Eco- Services.<br>• Non Ecological Significances – Nutritional, Medicinal, Aesthetic, Cultural, Commercial Values …etc.<br>• Optional Values, Use of microorganism in remediation of pollution<br>**(Threats)**<br>• Threats with suitable Examples –<br>a) Large Scale Dev. Projects – Habitat Destruction & Fragmentation.<br>b) Changing Agri. & Forestry Practices.<br>c) Invasion by Introduced Species.<br>d) Over-exploitation.<br>e) Environment Pollution.<br>f) Global Climate Change.<br>g) Loss of Traditional Knowledge.<br>h) Nature of Legal & Mgmt. System – Human Wildlife Conflict.<br>i) Genetically Modified Organisms ...etc. | **08** |
| **5.** | **Biodiversity Conservation** | • **Conservation Methods** – In-situ & Ex-situ methods with Example.<br>• **National Conservation Efforts –**<br>a) The laws – Environment Protection Act, Forest Act, Wildlife Act, Biodiversity Act 2002<br>b) Involving People's Participation – NBSAP, PBR<br>c) Involving Community Participation – JFM, EDP<br>d) People's Movement – Silent Valley Movement, Beej Bachao Andolan<br>• **International Conservation Efforts –**<br>a) IUCN – The World Conservation Union.<br>b) CBD.<br>c) CITES.<br>• **Traditional Methods of Conservation** – Sacred Groves / Ponds / Species, Periodic restrictions on resource harvesting …etc.<br>• **Need & Awareness**. | **08** |