

**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Environmental Science**



**SARVAJANIK**  
**UNIVERSITY**

INCLUSIVE | INTEGRATED | INNOVATIVE

# **Faculty of Science**

## **M.Sc. Environment Science**

# **Semester - III**

**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Environmental Science**

<b>Faculty:</b> Science	<b>Department:</b> Environmental Science
<b>Program:</b> M. Sc. Environmental Science	<b>Type of Subject:</b> Theory + Practical
<b>Subject:</b> Biodiversity and sustainable Development	
<b>Semester-</b> III	

**Student Learning Outcomes (SLOs):**

- This paper will introduce to the students the basic understanding of ecosystem and its structural and functional aspects.
- It will explore the interconnectedness among all the biotic and abiotic components of environment and the dynamic nature of the ecological processes in maintaining equilibrium in nature.

**References and Textbooks: (With Author, Edition, Publishers, ISBN)**

1. P. D. Sharma (Rastogi Publications, New Delhi), Ecology and Environment. ISBN: 8171338143.
2. Junaid Jazib, (Iqra Publications, New Delhi). Basics of Environmental Science. ISBN: 9788193046050.
3. R. Rajagopalan. (Oakbridge Publication). Environment and Ecology: A complete guide. ISBN: 9789350357583
4. Nawneet Vibhav (2017): Environmental Law-An Introduction, LexisNexis.
5. Martha Honey (1999): Ecotourism and Sustainable Development, Island Press Publications.
6. Peter P. Rogers, Kazi F. Jalal, John A. Boyd (2012): An Introduction to Sustainable Development, Earthscan, UK. ISBN: 9781849770477.

**UNIT 1: Biodiversity Science**

**07 Hours**

- 1.1 Biodiversity: Concept, Definition Types, Levels and Constraints
- 1.2 Genetic diversity: Introduction, measurement and determinants of genetic diversity
- 1.3 Species diversity: Species richness, Species abundance and Taxic diversity, Species/Area relationship, Spatial patterns of species diversity
- 1.4 Ecosystem diversity: Classification of ecosystems, measuring ecosystem diversity

**UNIT 2: Agrobiodiversity and values**

**07 Hours**

- 2.1 Origin and evolution of cultivated species diversity
- 2.2 Biodiversity values: Productive, Consumptive and Use values, Precautionary Principle
- 2.3 Methodologies for valuation of biodiversity: Changes in productivity method, Contigent valuation method, Hedonic pricing method, Travel cost method
- 2.4 Use of plants: Food, fodder, forage, Timbers, Rattans, Canes, Medicinal and Ornamental plants

**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Environmental Science**

**UNIT 3: Biodiversity loss and its conservation** **07 Hours**

- 3.1 Loss of diversity: Founder effect, demographic bottleneck, MVP and population viability analysis, Concept of metapopulation
- 3.2 Loss of ecosystem diversity and loss of agrobiodiversity
- 3.3 Conservation Biology: Need, Current practice, Top down and bottom up approaches for conservation
- 3.4 In situ and Ex situ conservation methods

**UNIT 4: Biodiversity Information: Management and Communication** **07 Hours**

- 4.1 Organizations associated with biodiversity management: IUCN, UNEP, UNESCO, WWF, ICSU, CABI, ISBI and WHF
- 4.2 Biodiversity legislations: CITES, UPOV convention, ITTA and ITTO, Plant collection and trade controls
- 4.3 Biodiversity information: Introduction, Libraries, Bibliographies, periodicals, virtual libraries
- 4.4 Biodiversity databases: Taxonomic database, Metadatabase, Species interest network, other database of biodiversity
- 4. Biodiversity Prospecting: Indigenous Knowledge Systems, Biopiracy

**UNIT 5: Biodiversity of India** **08 Hours**

- 5.1 Natural terrestrial Ecosystems: Forest biodiversity, Grassland biodiversity
- 5.2 Wetland biodiversity: Fresh water and Marine biodiversity
- 5.3 Desert biodiversity: Warm desert and cold desert
- 5.4 Floral and faunal diversity for sustainable livelihood

**UNIT 6: Methods for biodiversity studies** **08 Hours**

- 6.1 Global Environmental Facility (GEF) guidelines for data collection on biodiversity
- 6.2 Sampling and measurement of alpha biodiversity
- 6.3 Measurement of beta biodiversity
- 6.6 Transgenic methods for biodiversity measurement
- 6.7 Diversity Indices: Simpson's index, Shannon Index, Brillouin index, Jackknife index

**UNIT 7: Ecosystem and resource management** **08 Hours**

- 7.1 Threats to ecosystem and ecosystem degradation
- 7.2 UN protected area categories
- 7.3 National parks, sanctuaries, Community and biosphere reserves
- 7.4 Integrated resource management strategies

**UNIT 8: Sustainability and Sustainable Development** **08 Hours**

- 8.1 Sustainability theory, concept of carrying capacity

**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Environmental Science**

8.2 Sustainable Forest Management (SFM)

8.3 Agenda-21 and UNEP programmes towards sustainable development

8.4 Sustainable Development Goals (SDGs)

**Practicals:**

1. Estimation of soil heterotrophic bacteria by TVC technique.
2. Determine minimum quadrat size by species area curve method.
3. Estimation biodiversity indices - Simpson's index, Shannon Index, Brillouin index, Jackknife index
4. Study of various agroclimatic zones of Gujarat
5. Visit and field report to biodiversity park/botanical garden
6. Random sampling, sample size, quadrat, transect and point method for the study of biodiversity
7. Study of various biological diversity databases: BIMS, BRAHMS, ENVIS, DIALOG
8. Database retrieval techniques from major databases by NCBI and EBI (Gene bank and other tools)
9. Molecular phylogeny and sequence analysis using major bio-tools (MEGA-5 )

**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Environmental Science**

<b>Faculty:</b> Science	<b>Department:</b> Environmental Science
<b>Program:</b> M. Sc. Environmental Science	<b>Type of Subject:</b> Theory + Practical
<b>Subject:</b> Climate Change and Risk Reduction	
<b>Semester-</b> III	

**Student Learning Outcomes (SLOs):**

- To provide a systematic knowledge base on disaster typology, risk, vulnerability, their impacts and concerns to growing hydro-met disasters
- To enumerate on possible pathways, tools and options for CCA-DRR and sustainability mainstreaming through developmental planning at sectors, department or local levels, and activities

**References and Textbooks: (With Author, Edition, Publishers, ISBN)**

1. Rajib Shaw and R.R. Krishnamurthy (2009). Disaster Management: Global Challenges and Local Solutions. Universities Press (India) Pvt. Ltd.
2. Ross Prizzia (2015). Climate Change and Disaster Management. Sentia Publishing, USA.
3. Anil K Gupta, S S Nair, S Chatterji and Florian B-Lux (2013). Disaster Management and Risk Reduction. Narosa Publishing New Delhi.
4. Anil K Gupta, S S Nair and V K Sharma (2018). Disaster Risk and Impact Management, Astral Publishing, New Delhi.

**UNIT-1: Climate Change**

**07 Hours**

- 1.1 Introduction
- 1.2 Climate extreme events and disasters: regional and national scenario
- 1.3 Climatic extreme events and disasters–global
- 1.4 predictions and projections on climate change

**UNIT-2: Climate change and vulnerabilities**

**07 Hours**

- 2.1 Environmental & land/geography, social-economic, health, infrastructure
- 2.2 Climate Change for human security
- 2.3 Climate change for national security
- 2.4 Climate change for trans-boundary conflict and disaster

**UNIT-3 Climate system and chemistry**

**07 Hours**

- 4.1 Global Climate system: introduction
- 4.2 GCS: The atmosphere
- 4.3 GCS: The Ocean & the Cryosphere
- 4.4 GCS: The land and Biosphere

**UNIT-4 Climate chemistry and biogeochemical cycle**

**07 Hours**

- 4.1 Climate and chemicals

**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Environmental Science**

- 4.2 Climate chemistry: chemical, dynamical, and radiative processes
- 4.3 Climate and global carbon cycle
- 4.4 Climate and global nitrogen cycle

**UNIT-5 Definition and types of disaster** **08 Hours**

- 4.1 Hazards and Disasters: definition and difference
- 4.2 Natural disasters: earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches
- 4.3 Manmade disaster: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

**UNIT-6 Disaster Risk Mitigation** **08 Hours**

- 6.1 Disaster management journey and paradigm shift
- 6.2 Structural and non-structural measures of mitigation
- 6.3 International and national policy frameworks and guidelines

**UNIT-7 Disaster Risk Management** **08 Hours**

- 7.1 Tools and Methods in Disaster Risk Management
- 7.2 Disaster planning for national and local level
- 7.3 Disaster preparation: crisis management and emergency response
- 7.4 CCA-DRR and sustainability integration into post-disaster/post-conflict development

**UNIT-8 Mainstreaming CCA-DRR** **08 Hours**

- 8.1 Role and need of CCA-DRR integration
- 8.2 Pathways and mechanism
- 8.3 NRM-DRM integration, ecosystem-based adaptation and eco DRR
- 8.4 Role of Green growth, REDD++ and sustainable NRM – IWRM

**Practicals:**

1. Uttarakhand Disaster 2013, Cyclone Phailin 2014, Kashmir Flood 2015, Drought 2015, Forest Fire 2015
2. Heat wave 2015-16, Cyclone Hudhud, Bundelkhand drought, etc.
3. IPCC-SREX Case Studies [https://www.ipcc.ch/pdf/special-reports/srex/SREX-Chap9\\_FINAL.pdf](https://www.ipcc.ch/pdf/special-reports/srex/SREX-Chap9_FINAL.pdf)
4. EcoDRR <https://www.preventionweb.net/publications/view/26498>

**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Environmental Science**

<b>Faculty:</b> Science	<b>Department:</b> Environmental Science
<b>Program:</b> M. Sc. Environmental Science	<b>Type of Subject:</b> Theory + Practical
<b>Subject:</b> Environmental Law and Policies	
<b>Semester-</b> III	

**Student Learning Outcomes (SLOs):**

- The paper will enable students to acquire knowledge on various laws, policies, control and management of pollution in various abiotic environment.
- The paper describes a network of regulations and customary laws that address the effects of human activity on the natural environment.

**References and Textbooks: (With Author, Edition, Publishers, ISBN)**

1. Sharma B.K (2016): Environmental Chemistry, Krishna Prakashan, U.P
2. PUROHIT and AGRAWAL (2012): Environmental Pollution-Causes, Effects and control, Agrobios, Jodhpur.
3. Rao M.N (2012): Air Pollution, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. Bhargava S.K (2015): Practical Methods for Water and Air Pollution Monitoring, New Age International Publishers, New-Delhi.
5. Maiti S.K (2003): Hand Book of Methods in Environmental Studies-I, ABD Publishers, Jaipur.
6. Maiti S.K (2003): Hand Book of Methods in Environmental Studies-II, ABD Publishers, Jaipur.
7. Kulkarni Vijay and Ramchandra T.V (2015): Environmental Management, TERI press, New Delhi.
8. Ramchandra T.V (2018): Management of Municipal Solid Waste, TERI press, New Delhi.

**UNIT 1: Life Cycle Assessment**

**07 Hours**

- 1.1 Origin of LCA
- 1.2 LCA Code of Conduct
- 1.3 Methodology for LCA
- 1.4 Applications of LCA

**UNIT 2: Environmental Audit**

**07 Hours**

- 2.1 Practice in developed Countries
- 2.2 Audit Objectives
- 2.3 Audit Methodology
- 2.4 Environment Audit Report

**UNIT 3: Environment Impact Assessment**

**07 Hours**

- 3.1 Purpose and Goal

**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Environmental Science**

- 3.2 Methodology of EIA
- 3.3 EIA of Hazardous Waste
- 3.4 Limitations of EIA

**UNIT 4: Environmental Management** **07 Hours**

- 4.1 Environment Management Systems
- 4.2 Preparation of EMS
- 4.3 ISO – 14010 Audit Standards
- 4.4 ISO – 14020 Labelling Standards

**UNIT 5: Indian Policies- I** **08 Hours**

- 5.1 The Water (Prevention and Control of Pollution) Act, 1974
- 5.2 The Air (Prevention and Control of Pollution) Act, 1981
- 5.3 The Environment (Protection) Act, 1986
- 5.4 The Noise Pollution (Regulation and Control) Rules, 2000

**UNIT 6: Indian Policies- II** **08 Hours**

- 6.1 Municipal Solid Wastes (Management and Handling) Rules, 2000
- 6.2 The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008
- 6.3 The Bio-Medical Waste (Management and Handling) Rules, 1998
- 6.4 E-Waste (Management and Handling) Rules, 2011

**UNIT 7: Indian Laws Forest-I** **08 Hours**

- 7.1 The Indian Forest Act, 1927
- 7.2 Wildlife Protection Act, 1972
- 7.3 The Forest Conservation Act, 1980
- 7.4 The Biological Diversity Act, 2002

**UNIT 8: Indian Laws Forest-II** **08 Hours**

- 8.1 National Green Tribunal Act, 2010
- 8.2 The Wetland (Conservation and Management) Rules, 2009
- 8.3 Coastal Regulation Zone, 2011
- 8.4 The National Forest Policy, 1988

**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Environmental Science**

**Practicals:**

1. Seminar on various Case Studies (Minimum four).