

CURRICULUM FOR

“MASTER OF SCIENCE

ENVIRONMENTAL SCIENCE

(M.Sc. ES)”

w.e.f. Academic Year 2021-'22



॥ तमसो मा ज्योतिर्गमय ॥

VISION

To provide equal opportunities for value based global education for creating an Enlightened Society

MISSION

To establish and facilitate educational institutions in the region for providing affordable value based global education to all who aspire to study and to create opportunities to educators, social workers and philanthropists to serve society



**SARVAJANIK
UNIVERSITY**

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creating an enlightened society...

UNIVERSITY OFFICE

Dr. R. K. Desai Marg, Athwalines,
Surat-395001, Gujarat, India.

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Constituent Institute:

**SHREE RAMKRISHNA INSTITUTE OF
COMPUTER EDUCATION AND
APPLIED SCIENCES (SRKI)**



Course Curriculum
Master of Science (Environmental Science)

The Course Curriculum of Master of Science (Environmental Science) was proposed and drafted by **Academic and Curriculum Committee of Environmental Science** under the Faculty of Science in the meeting held on 10-12-2021 and recommended to 'BOARD OF STUDIES' for approval.

Prof. Ratna Trivedi
Chairman, Academic
& Curriculum Committee Place of the meeting
Science Sarvajani University Office Sign 

The proposed Course Curriculum was approved by **Board of Studies, Science** under the Faculty of Science in the meeting held on 10-12-2021 and was recommended to the 'FACULTY' for approval.

Prof. Chaulami Desai
Chairman,
Board of Studies-Place of the meeting
Science Sarvajani University Office Sign 

The Course Curriculum approved by the **Faculty of Science** in the meeting held on 10-12-2021 and was recommended to 'ACADEMIC COUNCIL' for approval.

Prof. Chaulami Desai
Chairman &
Dean, Faculty of Place of the meeting
Science Sarvajani University Office Sign 

The Course Curriculum approved by the 'Academic Council of Sarvajani University' in the meeting held on 10-12-2021.

Prof. Persi Engineer
Chairman, Academic Council
& Hon'ble Provost, Place of the meeting
Sarvajani University Sarvajani University Office Sign 

- The approved curriculum of Master of Science (Environmental Science) is with effect from the Academic year 2021 - '22 and to be reviewed before 2024 - '25

SARVAJANIK UNIVERSITY
Faculty of Science
M.Sc Environmental Science



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Faculty of Science

M.Sc. Environment Science



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Faculty of Science

M.Sc Environmental Science

Introduction:

This program is an exploration into the science that directly affects us all on a daily basis, and that will likely increase in its significance to us in field of Environment. Student will be introduced to the scientific study of our environment, as well as the technological, social, political and economic challenges required for the understanding and critical examination of related issues.

Some important features of the program are as below:

1. M. Sc. Environmental Science Programme will run on Credit Base Choice System.
2. The programme run on semester system and each semester will be of fifteen (16) Weeks.
3. The whole programme will be of two years (Four Semesters).
4. Proposed Teaching and Examination Scheme will be as per Annexure-I.
5. Syllabus of M. Sc. Environmental Science course will be as per Annexure-II.
6. Examination system and passing standards will be as per Sarvajanic University and UGC-CBCS Norms.

Objectives of programme:

1. To aware the student about how science and the scientific method address environment systems and issues.
2. To acquire students about the Earth's major natural systems, how these systems function, and how they are affected by human activity.
3. To provide knowledge the sustainability, and unsustainability, of various interactions between human society and the Earth's natural systems (i.e. energy use and generation, resource consumption and economics, food production).

Eligibility Criteria for M.Sc. Environmental Science:

A candidate must have passed the Bachelor's Degree in biological science or equivalent. The candidate who has passed equivalent exam from other subjects or boards need to avail eligibility certificate for this programme from the Board of Equivalence (BoE) of the Sarvajanic University.

Eligibility Criteria for M.Sc. Environmental Science in Industrial Safety and Management:

A candidate must have passed the Bachelor's Degree in biological science or equivalent / Bachelor's Degree in Chemistry / Fire-safety or equivalent, Bachelor's Degree in Engineering in Chemical / Environmental or equivalent subject. The candidate who has passed equivalent exam from other subjects or boards need to avail eligibility certificate for this programme from the Board of Equivalence (BoE) of the Sarvajanic University.

Eligibility Criteria for M.Sc. Environmental Science in Environmental Management:

A candidate must have passed the Bachelor's Degree examination in any subject with English as one of the subjects in any semester. The candidate who has passed equivalent exam from other subjects or boards need to avail eligibility certificate for this programme from the Board of Equivalence (BoE) of the Sarvajanic University.


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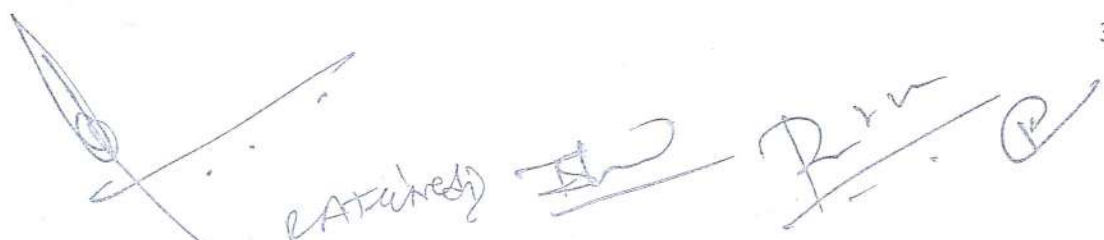
M.Sc Environmental Science


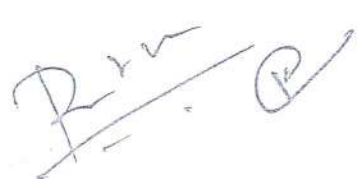
Credit Structure (Annexure-1)

Semester	Subject group	Group credits	Total credits/semester	Total credits
1, 2 and 3	DSC-1	12	24	72
	DSC-2			
	SEC-1	6		
	DSE-1	6		
4	Dissertation	16	24	24
	Seminar	4		
	Review of Publication	4		
Total				96

Evaluation Scheme:

Semester	Subject group	Internal					External	Grand Total
		CCE	Assign.	Attend.	Int. Exam.	Total Int.		
1, 2 and 3	DSC-1	50	10	10		70	30	100
	DSC-2	50	10	10		70	30	100
	SEC-1	50	10	10		70	30	100
	DSE-1	50	10	10		70	30	100
	Practicals		20	20	100	140	60	200
Total						420	180	600
4	Dissertation	140		20	50	210	90	300
	Seminar	60	15		30	105	30	100
	Review of Publication	60	15		30	105	30	100
Total						420	150	600



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Faculty of Science
M.Sc. Environment Science

Semester - III



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Faculty of Science
M.Sc Environmental Science

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



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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**

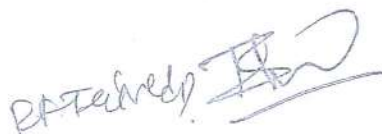
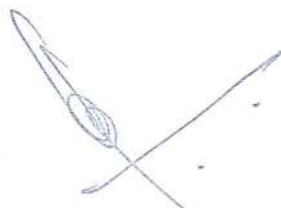
- 6.1 Global Environmental Facility (GEF) guidelines for data collection on biodiversity
- 6.2 Sampling and measurement of alpha biodiversity
- 6.3 Measurement of beta biodiversity
- 6.6 Transgenic methods for biodiversity measurement
- 6.7 Diversity Indices: Simpson's index, Shannon Index, Brillouin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

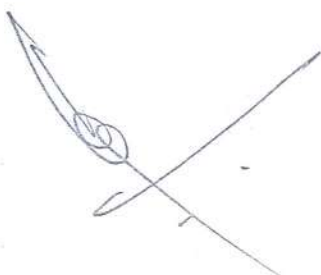


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- 8.2 Sustainable Forest Management (SFM)
- 8.3 Agenda-21 and UNEP programmes towards sustainable development
- 8.4 Sustainable Development Goals (SDGs)

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)



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SARVAJANIK UNIVERSITY
Faculty of Science
M.Sc Environmental Science

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

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- 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
4. EcoDRR <https://www.preventionweb.net/publications/view/26498>



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M.Sc Environmental Science

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

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- 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**

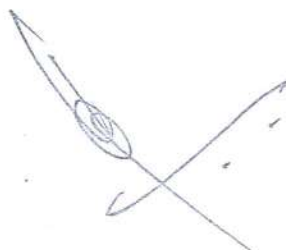
- 6.1 Municipal Solid Wastes (Management and Handling) Rules, 2000
- 6.2 The Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008
- 6.3 The Bio-Medical Waste (Management and Handling) Rules, 1998
- 6.4 E-Waste (Management and Handling) Rules, 2011

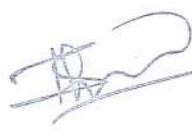
UNIT 7: Indian Laws Forest-I **08 Hours**

- 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



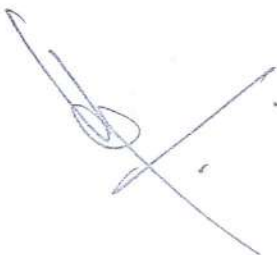
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Practicals:

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



DATE: BY:

