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

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creating an enlightened society...

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Constituent Institute:

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

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Course Curriculum
Master of Science (Environmental Science)

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

Prof. Ratna Trivedi **Chairman,Academic** **& CurriculumCommitteePlace of the meeting** **Science Sarvajanik University OfficeSign**	R.A.Trivedi

The proposed Course Curriculum was approved by **Board of Studies, Science** under the Faculty of Sciencein 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 Sarvajanik University OfficeSign**	Desai

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 ofPlace of the meeting** **Science Sarvajanik University OfficeSign**	Desai

The Course Curriculum approved bythe '**Academic Council of Sarvajanik University'**in the meeting held on 10-12-2021.

Prof. Persi Engineer **Chairman, Academic Council** **&Hon'ble Provost,Place of the meeting** **Sarvajanik University Sarvajanik University OfficeSign**	

- ***The approved curriculum of Masterof 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 Sarvajanik 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 Sarvajanik 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 Sarvajanik 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 Sarvajanik University.

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Faculty of Science

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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M.Sc Environmental Science

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Faculty of Science

M.Sc. Environment Science

Semester - I

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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: Earth Science and Geology	
Semester- I	

Student Learning Outcomes (SLOs):

- The course is designed to provide the basic understanding of various earth science and geological processes.
- The various developments in earth sciences provide an understanding of changing environments, the natural distribution of energy resources, and provide various methodologies for mitigating and predicting the effects of geological disasters.

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

1. Keller E.A (2012): Introduction to Environmental Geology, Pearson Publication, USA.
2. Sagar Rajendra (2014): Geochemistry and Environmental Geology, Anmol Publications Pvt. Ltd., New Delhi.
3. Holden J. (2012): Physical Geography and the Environment, Pearson Publishers.
4. Kailash R. (2014): General Geology, Anmol Publications Pvt. Ltd.
5. Selley R.C (1998): Elements of Petroleum Geology, Academic Press.

UNIT 1: The Earth and Systems **07 Hours**

1.1 Fundamental concept of environmental geosciences; Geological Time Scale, History of Earth
1.2 Earth Interior: Physical, Chemical characteristics and types of crust, mantle and core
1.3 earth systems and its interaction –lithosphere, atmosphere, hydrosphere and biosphere
1.4 Geographical classification and zones of Environment. Energy budget of the earth

UNIT 2: Rocks and Mineral **07 Hours**

2.1 Concepts of major, trace and REE. Classification of trace elements, mobility of trace elements
2.2 Types of rocks, characteristics, types and classification
2.3 Interconversion of rocks, Rock cycle
2.4 Principles of stratigraphy and sedimentary layer formation

UNIT 3: Weathering and Soil formation **07 Hours**

3.1 Physical, Chemical and Biological weathering processes, Soil development, Soil profile
3.2 Soil Complex: Components and properties
3.3 Soil Classification and types
3.4 Factors affecting soil formation

UNIT 4: Ecohydrology and Ground water geology **07 Hours**

4.1 Distribution of water in earth, major basins and groundwater provinces of India

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4.2 Darcy's law and its validity
4.3 Ghyben-Herzberg relation between fresh-saline water
4.4 Origin and composition of seawater, Types of water resources
4.5 Rainwater harvesting techniques and groundwater recharging methods.

UNIT 5: Plate Tectonics **08 Hours**

5.1 Types of plate boundaries and concept of plate tectonics, Rate of plate movement
5.2 Sea-floor spreading and continental drift
5.3 Marine sediments and their classification, Marine resources and coral reefs
5.4 Wilson Cycle, Gaia Hypothesis

UNIT 6: Energy Resources and mineral economics **08 Hours**

6.1 Origin, occurrence, distribution and uses of coal and petroleum
6.2 Renewable, nonrenewable and sustainable energy resources
6.3 Strategic, essential, atomic and critical minerals
6.4 Conservation of mineral resources, mineral resource in India

UNIT 7: Biogeochemical Cycles **08 Hours**

7.1 Hydrological Cycle: Systems concept of hydrological cycle; Precipitation; Evaporation and transpiration
7.2 Mineral Cycles: Carbon Cycle, Nitrogen Cycle, Oxygen cycle, Phosphorus Cycle and Sulfur Cycle
7.3 Uniformity and system concept in mineral cycles
7.4 Energy flow models

UNIT 8: Earth Surface Processes and Ecological Disturbance **08 Hours**

8.1 Earthquake: Magnitude, Intensity and Process
8.2 Oceanic Processes: El Nino, La Nina, ENSO, Walker circulation
8.3 External Influences: Ecological Disturbance, Volcanic Disturbance and Intermediate disturbance hypothesis
8.4 Effect of ecological disturbance on biological diversity

Practicals:

1. Study of Study of contour patterns on topographic map.
2. Study of earthquake and volcanic belts of India.
3. Study of Igeneous (Granite, Basalt), Metamorphic (Slate, Marble) and Sedimentary (Limestone, Sandstone) rocks.
4. Estimation of respiration rate by Light Dark Bottle method.
5. Quantitative analysis of planktons from water sample.
6. Determination trophic status index of given water bod.

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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: Environmental Microbiology and Epidemiology	
Semester- I	

Student Learning Outcomes (SLOs):

- Expanding basic knowledge of environmental microbiology in terms of applied aspects.
- Knowledge of basic concepts and techniques of microbial source tracking and microbial risk assessment.
- Understanding of biodeterioration and biofouling along with techniques of studying them and their management.

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

1. Pepper IL, Gerba CP, Gentry TJ, Maier RM, editors. Environmental microbiology. Academic press; 2011 Oct 13. 978-0123705198.
2. Yates MV. Manual of environmental microbiology. John Wiley & Sons; 2020 Aug 11. 978-1555816025.
3. Allsopp D, Seal KJ, Gaylarde CC. Introduction to biodeterioration. Cambridge University Press; 2004 Jun 28. 978-0521528870.

UNIT-1 Methods in Water Microbiology **07 Hours**

1.1 Current and developing methods of detecting indicator organisms
1.2 Assessing efficiency of wastewater treatment
1.3 Epidemiology of waterborne infections
1.4 Drinking water microbiology

UNIT-2 Methods in Air Microbiology **07 Hours**

2.1 Introduction to aeromicrobiology
2.2 Analysis of bioaerosol samples
2.3 Transport of microorganisms in air
2.4 Aerobiology of agricultural pathogens

UNIT-3 Sampling for environmental microbiology studies **07 Hours**

3.1 Water sampling and processing
3.2 Surface sampling
3.3 Soil sampling for microbial analyses
3.4 Sampling of wastewater and biosolids

UNIT-4 Physiological methods for the detection of microorganisms **07 Hours**

4.1 Measuring microbial activity in pure cultures

4.2 Measuring carbon respiration
4.3 Use of radiolabelled tracers
4.4 Enzyme assays

UNIT-5 Microbial Source Tracking and Risk Assessment **08 Hours**

5.1 Evolution of microbial source tracking
5.2 Human fecal pollution tracking
5.3 Risk assessment framework
5.4 Exposure assessment

UNIT-6 QA/QC in Environmental Microbiology **08 Hours**

6.1 Introduction to principles of QA
6.2 General quality control
6.3 Quality control for bacteriological analyses
6.4 Quality control for virological analyses

UNIT-7 Microbiology of extreme environments **08 Hours**

7.1 Low temperature environments
7.2 High temperature environments
7.3 Desiccation and UV stress
7.4 Deep-sea hydrothermal vents
7.5 Acidic environments

UNIT-8 Biodeterioration and Biofouling **08 Hours**

8.1 Introduction to biodeterioration
8.2 Fungal, algal and cyanobacterial growth affecting structures
8.3 Investigative biodeterioration
8.4 Control of biodeterioration

Practicals:

1. Detection of fecal streptococci by membrane filtration method
2. Study of microorganisms from bioaerosols
3. Use of dehydrogenase enzyme activity to study microbial activity
4. Detection of microbial respiration in soil

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: Emerging Environmental Problems and Technology for Pollution Control	
Semester- I	

Student Learning Outcomes (SLOs):

- The paper intends to deal with various pollution sources, its effects, control, measures and treatment options for various pollutants using technological upgradation.
- The paper will help students understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways to take action to keep our environment healthy and sustainable for the future.

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

1. Rao M.N (2012): Air Pollution, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. Birdie G.S and Birdie L.S (2015): Water Supply and Sanitary Engineering, Dhanpat Rai Publishing Company, New-Delhi.
3. Sharma B.K (2016): Environmental Chemistry, Krishna Prakashan, U.P.
4. Khan I.H and Ahsan Naved (2017): Textbook of Solid Waste Management, CBS Publishers, New Delhi.
5. Metcalf and Eddy (2015): Wastewater Engineering Treatment and Reuse, McGraw Hill Education (India) Pvt. Ltd.
6. DattA A.K. and Rao M.N (2014): Wastewater Treatment, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Phifer Russell and Mctigue William (1988): Handbook of Hazardous Waste Management, Lewis Publishers, USA.

UNIT 1: Environment and Pollution **07 Hours**

1.1 Biogeochemical Cycles
1.2 Greenhouse Effect
1.3 Global Warming
1.4 Acid Rain

UNIT 2: Industrial Pollution **07 Hours**

2.1 Introduction
2.2 Causes of Industrial Pollution
2.3 Environmental Problems of Industries
2.4 Clean Technology

UNIT 3: Air Pollution **07 Hours**

3.1 Classification of Air Pollutants
3.2 Primary and Secondary Pollutants
3.3 Stationary and Mobile Source
3.4 Control of Air Pollution by modern Equipments.

UNIT 4: Vehicular Pollution **07 Hours**

4.1 Automobile Emissions
4.2 Alternative Fuels
4.3 Biofuels
4.4 Ecofriendly Vehicles

UNIT 5: Industrial Effluent Treatment **08 Hours**

5.1 Characteristics of Industrial Effluent
5.2 Physical Methods- Screening, Skimming, Equalization, Sedimentation, Floatation
5.3 ChemicalcMethods-Neutralization,Precipitation,Electrolysis,Ion Exchange
5.4 Biological Methods- Activated Sludge Process, UASB, Trickling Filter, SBR

UNIT 6: Common Effluent Treatment Plant **08 Hours**

6.1 Introduction
6.2 Principles of CETP
6.3 Common Quality Parameters
6.4 Treatment Units at CETP

UNIT 7: Hazardous Waste **08 Hours**

7.1 Characteristics of Hazardous Waste
7.2 Secured Landfilling
7.3 Detection and Classification of Radioactive Waste
7.4 Disposal of Radioactive Waste

UNIT 8: Environment Friendly Technologies **08 Hours**

8.1 Eco-Technology
8.2 Ecological Farming System
8.3 Organic Farming
8.4 Watershed Management

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Practicals:

1. Principle and Working of Stack Monitoring Kit.
2. Determination of Total Dissolved Solids in industrial sample.
3. Determination of Chromium in industrial sample.
4. Determination of Aluminum in industrial sample.