



*॥ 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**

INCLUSIVE | INTEGRATED | INNOVATIVE

*creating an enlightened society...*

#### UNIVERSITY OFFICE

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

Website: [www.sarvajnikuniversity.ac.in](http://www.sarvajnikuniversity.ac.in)

Email: [admin@sarvajnikuniversity.ac.in](mailto:admin@sarvajnikuniversity.ac.in)

Email: [info@sarvajnikuniversity.ac.in](mailto:info@sarvajnikuniversity.ac.in)

Mo.: +919979102021 / +9197129 30321

Contact No. +912612660266



# CURRICULUM FOR “MASTER OF SCIENCE

ENVIRONMENTAL  
SCIENCE - INDUSTRIAL  
SAFETY AND  
MANAGEMENT  
(M.Sc. ES (ISM))”

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

Constituent Institute:

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



**Course Curriculum**  
**Master of Science (Industrial Safety & Management)**


The Course Curriculum of Master of Science (Industrial Safety & Management) 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.

<b>Prof. Ratna Trivedi</b> <b>Chairman,</b> <b>Academic &amp; Curriculum Committee</b> <b>Science</b>	<b>Place of the meeting</b> <b>Sarvajanik University Office</b>	 <b>Sign</b>
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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.

<b>Prof. Chaulami Desai</b> <b>Chairman,</b> <b>Board of Studies-</b> <b>Science</b>	<b>Place of the meeting</b> <b>Sarvajanik University Office</b>	 <b>Sign</b>
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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.

<b>Prof. Chaulami Desai</b> <b>Chairman &amp;</b> <b>Dean, Faculty of</b> <b>Science</b>	<b>Place of the meeting</b> <b>Sarvajanik University Office</b>	 <b>Sign</b>
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The Course Curriculum approved by the '**Academic Council of Sarvajanik University**' in the meeting held on 10-12-2021.

<b>Prof. Persi Engineer</b> <b>Chairman, Academic Council</b> <b>&amp; Hon'ble Provost,</b> <b>Sarvajanik University</b>	<b>Place of the meeting</b> <b>Sarvajanik University Office</b>	 <b>Sign</b>
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- *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 Industrial Safety and Management



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**Faculty of Science**  
**M.Sc. Environment Science**  
**(Industrial Safety Management)**

**Semester - II**



**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Industrial Safety and Management**

<b>Faculty:</b> Science	<b>Department:</b> Environmental Science
<b>Program:</b> M. Sc. Environmental Science (Industrial Safety and Management)	<b>Type of Subject:</b> Theory + Practical
<b>Subject:</b> Environmental Waste & Its Management	
<b>Semester-</b> II	

**Student Learning Outcomes (SLOs):**

- The paper intends to deal with various techniques needed for sampling, analysis and control of various environmental pollutants.
- The paper will also provide knowledge regarding basic concepts of ecosystems and the ways to manage 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: Environmental Management**

**07 Hours**

- 1.1 Definitions and Scope
- 1.2 Goals and Tools for Environment Management
- 1.3 Implications of Population Growth
- 1.4 Need for Sustainable Development

**UNIT 2: Ecosystem Concepts**

**07 Hours**

- 2.1 Structure of an Ecosystem
- 2.2 Biomass, Energy and Energy Flow
- 2.3 Food Chains, Food Webs and Trophic Levels
- 2.4 Effect of Imbalance on the Ecosystem



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**Faculty of Science**  
**M.Sc Industrial Safety and Management**

<b>UNIT 3: Environmental Audit</b>	<b>07 Hours</b>
3.1 Practice in developed Countries	
3.2 Audit Objectives	
3.3 Audit Methodology	
3.4 Environment Audit Report	
<b>UNIT 4: Environment Impact Assessment</b>	<b>07 Hours</b>
4.1 Purpose and Goal	
4.2 Methodology of EIA	
4.3 EIA of Hazardous Waste	
4.4 Limitations of EIA	
<b>UNIT 5: Life Cycle Assessment</b>	<b>08 Hours</b>
5.1 Origin of LCA	
5.2 LCA Code of Conduct	
5.3 Methodology for LCA	
5.4 Applications of LCA	
<b>UNIT 6: Sampling Site Selection</b>	<b>08 Hours</b>
6.1 Criteria for Site Selection	
6.2 Sampling Types	
6.3 Dissolved Oxygen Sampler	
6.4 Preserving Water Samples	
<b>UNIT 7: Analytical Techniques</b>	<b>08 Hours</b>
7.1 Spectroscopy	
7.2 Flame-Photometer	
7.3 Chromatography	
7.4 Polarography	
<b>UNIT 8: Analytical Methods</b>	<b>08 Hours</b>
8.1 BOD and COD	
8.2 Stack Monitoring	
8.3 Ambient Monitoring	
8.4 Humidity	



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**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Industrial Safety and Management**

<b>Faculty:</b> Science	<b>Department:</b> Environmental Science
<b>Program:</b> M. Sc. Environmental Scienc (Industrial Safety and Management)	<b>Type of Subject:</b> Theory + Practical
<b>Subject:</b> Accident Prevention Techniques and Disaster Management	
<b>Semester-</b> II	

**Student Learning Outcomes (SLOs):**

After successful completion of this course, students will learn

- Types of accidents, their cause and prevention techniques.
- Knowledge of PPE, its maintenance and importance.
- Understanding of diffrent types of disasters and risks.
- Understanding of role of NIDM and government support system.

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

1. R. K. Jain and Sunil S. Rao, Industrial Safety , Health and Environment Management Systems, Khanna publishers, New Delhi (2006).
2. Industrial Safety - National Safety Council of India.
3. Philip Hagan, "Accident Prevention Manual for Business and Industry", N.S.C.Chicago, 13th edition, 2009.
4. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980. 10.
5. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
6. John Ridley and John Channing. "Safety at Work". Elsevier Publications, 7th Edition.
7. K. U. Mistry. "Fundamentals of Industrial Safety and Health". Siddharth Prakashan, Ahmedabad, 1st edition, 2008.
8. Handbook of Disaster Risk Reduction & Management, Christian N Madu and Chu-Hua Kuei, 1st Edition, 2017, World Scientific.
9. World Famous Disasters, Narendra Malhotra, 1st Edition, 2004, Jain Book Depot.
10. Natural Disasters, R.K. Sharma and Gagandeep Sharma, 1st Edition, 2005, Jain Book Depot.
11. Environmental Hazards: Assessing risk and reducing disaster, Keith Smith, 6th Edition, 2013, Routledge, Taylor and Francis group.

**UNIT-1 Principles of accidents prevention and analysis**

**08 Hours**

- 1.1 Definition: Incident, accident, injury, dangerous occurrences, unsafe acts, unsafe conditions, hazards, error etc.
- 1.2 Accident Prevention : Theories / Models of accident occurrences, Principles of accident prevention
- 1.3 Hazard identification and analysis



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1.4 Fault tree analysis, Event tree analysis, failure modes and effects analysis

**UNIT-2 Theories and principles of accident causation**

**08 Hours**

- 2.1 The effect of accident
- 2.2 Human factors contributing to accidents - causes for unsafe acts
- 2.3 Theories of motivation and their application to safety
- 2.4 Role of safety in industries and significance of Documentation

**UNIT-3 Hazards and their identification**

**08 Hours**

- 3.1 Hazards: Definition and types
- 3.2 Chemical hazards and their effects
- 3.3 Physical hazards and their effects
- 3.4 Biological hazards and their effects
- 3.5 Ergonomic hazards and their effects

**UNIT-4 Casualty and Accident Prevention**

**08 Hours**

- 4.1 Position of causality, The Unconscious casualty, Bledding, Burns and Scalds
- 4.2 Injuries in muscles and joints
- 4.3 Fracture and fracture types
- 4.4 Rescue and Transport of Casualty
- 4.5 First aid, Cardiac massage and artificial breathing

**UNIT 5: Personal Protective Equipment**

**08 Hours**

- 5.1 Personal Protective Equipment's: Need, selection, supply, use, care and Maintenance
- 5.2 Personal protective devices for head, ear, face, eye, foot, knee and body protection
- 5.3 Respiratory personal protective devices
- 5.4 Precaution and care of PPE

**UNIT-6 Natural Disasters**

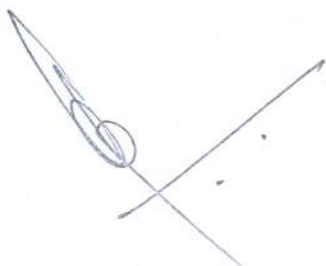
**08 Hours**

- 6.1 Hazards, risk and disasters
- 6.2 Current views: the complexity paradigm
- 6.3 Phases of disaster
- 6.4 Explaining, measuring and managing disaster

**UNIT-7 Risk Assessment and Management**

**08 Hours**

- 7.1 Nature of risk and assessment



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- 7.2 Risk perception and its' communication and practice.
- 7.3 Risk management
- 7.4 Role of information technology in risk assessment and management

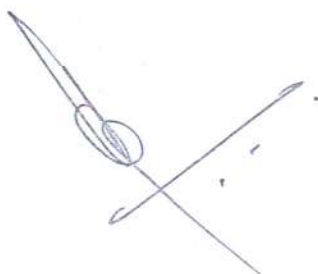
**UNIT-8 Disaster Management in India**

**08 Hours**

- 8.1 Lessons from the past considering the examples of Bhuj earthquake, tsunami disaster, and Bhopal tragedy
- 8.2 National Disaster Management Framework, national response mechanism, role of government bodies such as NDMC and IMD
- 8.3 Role of armed forces and media in disaster management; role of space technology in disaster management
- 8.4 Case study of efficient disaster management during cyclone 'Phailin' in 2013.

**Practicals:**

1. Study of PPE and its importance
2. Calculation of map distance using a ratio scale.
3. Calculation of earthquake travel times.
4. Study of first aid for safety - First aid for Drowning, First aid for Fire Injuries, First Aid for Severe Burns, First Aid for Mild Burn, First Aid for Injuries, First Aid for laboratory chemicals.
5. Study of muscle injuries and fractures (Chart).



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**SARVAJANIK UNIVERSITY**  
**Faculty of Science**  
**M.Sc Industrial Safety and Management**

<b>Faculty:</b> Science	<b>Department:</b> Environmental Science
<b>Program:</b> M. Sc. Environmental Science (Industrial Safety and Management)	<b>Type of Subject:</b> Theory
<b>Subject:</b> Instrumentation and Analytical Techniques	
<b>Semester- II</b>	

**Student Learning Outcomes (SLOs):**

- This Course Paper proposes to teach about Principle, Instrumentation and Applications of various spectroscopy and chromatographic techniques, advanced instrumentation techniques, chemical sensors and biosensors.
- This papers deals with the history, origin, laws, principles, theories, instrumental set up, its working mechanism, various components and it working pattern, procedure of analysis and applications in the various field of analysis.

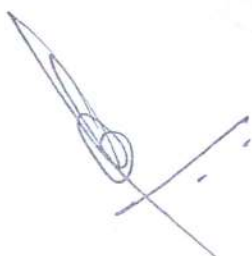
**References and Textbooks: (With Author, Edition, Publishers, ISBN)**

1. Engineering Chemistry, P.C. Jain & Monica Jain, 17th Edition, Reprint 2011, Dhanpatrai Publishing Company (P) Ltd.
2. Handbook of Analytical Instrument, R.S. Khandpur, 2nd Edition, Reprint 2009, Tata McGraw Hill Publishers.
3. Instrumental Methods of Chemical Analysis (Analytical Chemistry), H. Kaur, 8th Edition, 2012, Pragati Prakashan.
4. Basic Concepts of Analytical Chemistry, S.M. Khopkar, 3rd Edition, Reprint 2009, New Age International (P) Limited, Publishers.
5. Analytical Instrumentation Handbook, Ewing's, Edited by Jack Cazes, 3rd Edition, 2005, Marcel Dekker Publisher.
6. Instrumental Methods of Analysis, H.H. Willard, L.L. Meritt, J.A. Dean and F.A. Settle, 7th Edition, 1986, CBS Publishers.
7. Instrumental methods of analysis, B.K. Sharma, 24th Edition, 2005, Goel Publishing House.
8. Instrumental Analysis, D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, 11th Edition, Reprint 2012, Cengage Learning.
9. BIOS-Instant Notes-Analytical Chemistry, D. Kealey, P.J. Haines, 2002, Viva Books (P) Ltd.
10. Analytical Instrumentation, Bela G. Liptak, 1st Edition, 1994, 1st Indian Reprint, 2012, Chilton Book Company.

**UNIT 1: Visible Spectroscopy**

**07 Hours**

- 1.1 Characteristics of electromagnetic spectrum
- 1.2 Origin of spectra and electronics transitions
- 1.3 Laws of absorption of radiation - Lambert & Beer's law and its deviation



RAJESH K. JAIN



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- 1.4 The architecture of a spectrophotometer
- 1.5 Calibration curve and standard addition method - multi component analysis
- 1.6 Applications of UV-visible spectroscopy

**UNIT 2: Atomic Absorption Spectrometry**

**08 Hours**

- 2.1 The history & principle of atomic absorption spectroscopy
- 2.2 AAS – Instrumentation
  - 2.2.1 Radiation sources: line & continuum
  - 2.2.2 Atomization techniques: FAAS & GFAAS
  - 2.2.3 Wavelength selector: monochromator
  - 2.2.4 Detectors: PMT
  - 2.2.5 Single & double beam AAS
- 2.3 Applications of atomic absorption spectrometry

**UNIT 3: Optical Emission Spectrometry**

**08 Hours**

- 3.1 Introduction and principle
- 3.2 Atomic spectroscopic sources
- 3.3 Inductively coupled plasma - the discharge
- 3.4 ICP-OES Instrumentation
  - 3.4.1 Nebulizers
  - 3.4.2 Spray Chambers
  - 3.4.3 Sample introduction systems
  - 3.4.4 Optics and the spectrometer
  - 3.4.5 Emission detectors
- 3.5 Applications of ICP-OES

**UNIT 4: Advanced Instrumentation Techniques**

**07 Hours**

- 4.1 Principle, Instrumental set up & Applications of Non dispersive IR (gas analyzer)
- 4.2 Modern elemental analyzer
- 4.3 Total organic carbon analyzer
- 4.4 Mossbauer Spectroscopy
- 4.5 Turbidimetry
- 4.6 Naphelometry

**UNIT 5: Gas Chromatography**

**07 Hours**

- 5.1 Introduction of chromatography and principle of separation
- 5.2 Classification -GSC and GLC & its applications



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- 5.3 Components of instruments: carrier gas, sample injection system, stationary and mobile phase
- 5.4 Columns - packed column and capillary column - WCOT, SCOT, PLOT
- 5.5 Detectors - FID, TCD, ECD, ASD
- 5.6 Principle and applications of GC-HS, GC-MS

**UNIT 6: High Performance Liquid Chromatography** **08 Hours**

- 6.1 Introduction, principle and types of HPLC
- 6.2 Components of instruments: pumps high pressure, pneumatic, syringe, reciprocating, hydraulic
- 6.3 Sample injection system
- 6.4 Column
- 6.5 Detector: ultra violet light absorption, refractive index, evaporative light scattering
- 6.6 Selective applications in separation and estimations
- 6.7 Principle and applications of LC-MS

**UNIT 7: Ion Exchange and Ion Exclusion Chromatography** **07 Hours**

- 7.1 Ion exchangers – types, characteristics and properties
- 7.2 Ion exchange equilibrium and factors affecting it
- 7.3 Instrumental set up of IEC- columns and detector
- 7.4 Principle, procedure and applications of IEC
- 7.5 Principle, working procedure and applications of Ion Exclusion Chromatography:
  - 7.5.1 Gel Permeation Chromatography
  - 7.5.2 Ion Exclusion Technique
  - 7.5.3 Inorganic Molecular Sieves

**UNIT 8: Chemical Sensors and Biosensors** **08 Hours**

- 8.1 Definition and classification of sensors, Signal and noise
- 8.2 Efficiency of sensors, sensitivity and limit of detection
- 8.3 Principle and applications of
  - 8.3.1 Electrochemical sensors
    - 8.3.1.1 Coulometry & Potentiometry
    - 8.3.1.2 Conductimetry & Amperometry
    - 8.3.1.3 Polarography & Voltammetry
  - 8.3.2 Solid state electrode & Mass sensitive sensors
  - 8.3.3 Optical sensors & Thermal sensors
  - 8.3.4 Biosensors & Biocatalytic biosensors



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