

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Department of Chemistry

Name of Program: M.Sc. (Environmental Science)

SEMESTER I (CBCS) (2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSES101	PG	Instrumentation Techniques in Environmental Analysis	4	0	0	4	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;
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Course Objectives:

1. To impart the basic knowledge of various instrumental techniques in environmental science.
2. To understand the various methods to analyze the physical and chemical characteristics of environmental components.
3. To understand the design and care of instruments used in Environmental studies.
4. To understand the operation and practical use of instruments to analyze the environmental problems.

Course Outcomes:

The students should be able to:

1. Apply the principles of various instrumentation techniques.
2. Analyze instrumental methods theoretically and practically.
3. Environmental potentiality will be achieved.
4. Integrate a fundamental understanding of the underlining principles as they relate to specific instrumentation used for sampling techniques, chromatography, UV-Vis, IR, NMR spectrometry, and XRD.

SYLLABUS:

UNIT I

Sampling Techniques:

Samples preparation, preservation and processing of air, water and soil samples, sampling equipments, separation and sampling techniques, precipitation, Fractional crystallization, fractional distillation, solvent extraction, accuracy and precision, types of errors, trouble

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shooting of instruments.

UNIT II

Chromatographic Analysis:

Introduction, Classification, General idea about adsorption, partition and column chromatography, Paper and thin layer chromatography, Gas Chromatography (GC) and High Performance liquid Chromatography (HPLC) - Instrumentation, methodology and applications.

UNIT III

Spectroscopy: Principles, Instrumentation and Applications of UV- Visible Spectroscopy, IR Spectroscopy, Atomic (absorption and emission) Spectroscopy, NMR (1H and 13C) Spectrometry, Mass Spectrometry.

UNIT IV

Principles, brief Theory and Applications of X-ray fluorescence spectrometry (XRF), X- Ray Diffraction (XRD) and Neutron Diffraction Spectrometry. Thermal Analysis; Principle, Theory and Applications of Differential Thermal Analysis, Thermo gravimetric Analysis, Differential Scanning Calorimetry

UNIT V

Principles, Techniques and Applications of Conductometry, pH and Potentiometry, Flame photometry, Turbidimetry. Morphological Analysis; Principle, brief Theory and Applications of Scanning Electron Microscopy, Transmission Electron Microscopy.

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Text Books:

1. A Textbook on Experiments and Calculations in Engineering Chemistry- Dara S. S., S. Chand & Company Ltd., New Delhi, 2003.
2. Vogel's Textbook of Practical Organic Chemistry – Furniss B. S., Hannaford A. J., Smith P. W. G. and Tatchell A. R., 5th edn., Pearson education Ltd., New Delhi, 2004.

Reference Books:

1. Instrumental Methods of Analysis- Willard Merrit and Settle.
2. Instrumental Methods and Chemical Analysis- G. R. Chattwal and S. Anand
3. Essential of Nuclear Chemistry- H. J. Arnikaar.
4. Advanced Practical Organic Chemistry- Vishnoi N. K., Vikas Publishing House Private Ltd., New Delhi, 2005.
5. Laboratory Manual of Organic Chemistry- Bansal R. K., New Age International 7 Publishers, New Delhi, 2009.
6. Application of Absorption Spectroscopy of Organic Compounds- J. R. Dyer – 17 Prentice Hall
7. Spectroscopic Methods in Organic Chemistry – D .H. Williams ad I Flemming, Mcgraw Hill, 4thEd., (1989)
8. Organic Spectroscopy- P. S. Kalsi
9. Instrumental Methods of Analysis – Chatwal and Anand.

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MSES102	PG	Fundamentals of Environmental Chemistry	4	0	0	4	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

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Course Objectives:

1. To develop an understanding of the fundamental chemical processes that are central to important environmental problems.
2. To enhance the knowledge of carcinogenic compounds, adverse effects of surfactants, pesticides, synthetic polymers and lead compounds.
3. To understand the chemistry of air, water and soil.
4. To analyze the harmful components present in air, water and soil through laboratory experiments.

Course Outcomes:

The students should be able to:

1. Learn the basic principles of environmental chemistry.
2. Understand various components of the environment and interfaces.
3. Understand the interconnections between different sectors of the environment (soil, water, and atmosphere) and the effect of human activities on the natural chemical processes.
4. Apply the knowledge of experimental work to environmental processes and sample testing.

Syllabus:

UNIT I

Concept and Scope of Environmental Chemistry: Definition and explanation for various terms, segments of environment. Principles and cyclic pathways in the environments.

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MSES102	PG	Fundamentals of Environmental Chemistry	4	0	0	4	60	20	20	0	0

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Chemistry of Biologically Important Molecules: Chemistry of Water: Unusual physical properties, hydrogen bonding in biological systems, unusual solvent properties, changes in water properties by addition of solute.

UNIT II

Chemistry of Various Organic and Inorganic Compounds. Carcinogenic compounds and their effects. Hydrocarbons: Chemistry of hydrocarbon decay, environmental effects, effects on macro and microorganisms.

UNIT III

Surfactants: Cationic, anionic and non ionic detergents, modified detergents and their adverse effects. Pesticides: Classification, degradation, analysis, pollution due to pesticides and DDT. Synthetic Polymers: Microbial decomposition, polymer decay, ecological and consideration, Photosensitize additives.

UNIT IV

Lead and its compounds: Physical and chemical properties, behavior, human exposure, absorption, influence. Destruction of some hazardous substances: Acid halides and anhydrides, alkali metals, cyanides and cyanogens bromides, chromium, aflotoxins, halogenated compounds.

UNIT V

Chemical composition of Air: Classification of elements, chemical speciation. Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter. Thermo chemical and photochemical reactions in the atmosphere. Oxygen and ozone

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MSES102	PG	Fundamentals of Environmental Chemistry	4	0	0	4	60	20	20	0	0

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chemistry. Chemistry of air pollutants, Photochemical smog.

Water Chemistry; Chemistry of water, concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential.

Soil Chemistry; Inorganic and organic contaminants of soil. Soil parameters – Soil destruction, Erosion and Soil conservation.

Text Books/ Reference Books

1. Environmental Chemistry : B.K. Sharma, and H. Kaur.
2. Elements of Environmental Chemistry : H.V. Jadhav.
3. Environmental Chemistry : S. K. Banerjee.
4. Environmental Chemistry : J. W. Moore and E. A. Moore.
5. Destruction of hazards chemicals in the laboratory : G. Lunn and E.B. Sansone.
6. A text book of Environmental Chemistry and Pollution Control : S.S. Dara.
7. Instrumental Methods of Analysis : G. W. Ewing.
8. Instrumental Methods of Analysis : Chatwal and Anand.
9. Environmental Pollution Analysis : Khopkar.
10. Environment Chemistry : A. K. de

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MSES103	PG	Biodiversity Concept and Components	4	0	0	4	60	20	20	0	0

Course Objectives:

1. To understand the concept and components of biodiversity.
2. To Sensitize the role and need of biodiversity conservation in the context of various developmental pathways of mankind
3. To evaluate the level of biodiversity.
4. To estimate the significance of biodiversity to protect environment.

Course Outcomes:

The students should be able to:

1. Understand systematically the natural resources and biodiversity and its vital role.
2. Explain the importance of biodiversity conservation.
3. Articulate the causes and consequences of anthropogenic disturbances on biodiversity.
4. Assess the potential of conservation strategies to help protect biodiversity and environment.

Syllabus:

UNIT I

Biodiversity concept and components:

Biodiversity concept, Biodiversity-components, Biodiversity-Types, Biodiversity-importance, ecological importance, economical importance, key stone umbrella and flagship species, Economic value of biodiversity, ecotone and niche.

UNIT II


Uses of Biodiversity

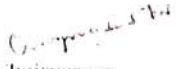
Uses of biodiversity, source of food, medicine, raw material, aesthetic, cultural and ecosystem services, strategies for sustainable exploitation of biodiversity.

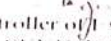
UNIT III


Biodiversity and evaluation:

Biodiversity- values, Biodiversity status: National status and Global status, hotspot; threatened species, IUCN Red list, endangered species, vulnerable species, rare species,


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MSES103	PG	Biodiversity Concept and Components	4	0	0	4	60	20	20	0	0

extinct species and endemic species. Climate change, induced losses. common flora and fauna in India-Aquatic: phytoplankton, Zooplankton and macrophytes. Terrestrial: Forests: Endangered and threatened species.

UNIT IV

Biodiversity Convention and Biodiversity Act:

IPRs, national and international programs for biodiversity conservation. Wildlife values and eco-tourism, wildlife distribution in India, problem in wildlife protection, role of WWF, WCU, CITES, TRAFFIC, Wildlife Protection Act 1972.

UNIT V

Biodiversity Conservation:

Importance of Biodiversity conservation, Different approaches for Biodiversity conservation-In-situ conservation: sanctuaries, biospheres reserves, national parks, nature reserves, preservation plots. Ex-situ conservation: botanical gardens, zoos, aquaria, homestead garden; herbarium; In-vitro Conservation: germplasm and gene Bank; tissue culture: pollen and spore bank, DNA bank.

Text Books:

V.K. Krishnamurthy (2003) Text Book of Biodiversity, Science Publisher, Chennai.

Reference Books:

1. Shahid Nacem, Daniel E. Bunker, Andy Hector and Michel Loreau (2009) Biodiversity, ecosystem functioning and human well being: An ecological and economic perspective.
2. S.K. Agarwal et al (1996) Biodiversity and Environment, APII, Dehra Dun.
3. S.S. Negi (1993) Biodiversity and its Conservation in India, Indus Publications, New Delhi.
4. W.W. Collins and C.O. Qualset (1998) Biodiversity in Agro-ecosystem, CRC, Boston.
5. V.K. Krishnamurthy (2003) Text Book of Biodiversity, Science Publisher, Chennai.

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MSES104	PG	Environmental Pollution	4*	0	0	4	60	20	20	0	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

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Course Objectives:

1. To understand route way of pollutants and their impacts on the environment.
2. To understand classification of pollution, root causes and mitigation strategies.
3. To impart the knowledge on diseases and other adverse effects caused by environmental pollution and their consequences.
4. To impart practical knowledge to test air, water and soil samples.

Course Outcomes:

The students should be able to:

1. Analyze sources of pollution, causes and exposure pathways,
2. Distinguish the effect of various pollutants on human health, economy and environments.
3. Educate others to make environment safe and clean.
4. Ability to develop pollution mitigation/abatement strategies.

SYLLABUS:

UNIT I

Introduction to Environmental pollution, Air and Water Pollution:

Definition and sources of pollution; Different types of pollution and their global, regional and local aspects. Types and sources of air pollutants; Reaction of pollutants in air forming smog, PAN, Acid rain; Atmospheric diffusion and stack performance; Transport of pollutants; Effects of air pollutants on flora and fauna; Sinks of atmospheric gases. Sources of water and their contamination; Types of pollutants, various industrial effluents such as pulp and paper mills, oil exploration and refinery, petrochemicals, iron and steel industries, domestic wastes, organic debris, agricultural wastes, pesticides; Eutrophication - causes and effects and

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control measures.

UNIT II

Soil pollution and solid waste pollution:

Causes of soil pollution; Effects of Fungicides and weedicides on soil components, residual toxicity and pollution. Different kinds of synthetic fertilizer (N, P, K), and their interactions with different components of soil, their toxicity and pollution. Industrial effluents and their interactions with soil components, Contamination by radio nuclides. Solid waste pollution: sources, nature, classification and environmental effects.

UNIT III

Radiation and Noise pollution:

Radioactive decay; Interaction of radiation with matter; Biological impact and health hazards associated with radiation, Units of radioactivity and radiation dose; Protection against ionizing isotopes and their applications in waste water and air pollution analysis and treatment; Radioactive waste disposal. Basic properties of sound waves - plane and spherical waves, sound pressure, loudness and intensity levels, decibel; Sources of Noise Pollution-Measurement and analysis of sound, Measures to control noise pollution.

UNIT IV

Thermal pollution and Oil Pollution : Definition and sources, Chemical and biological effects of thermal pollution, Effect on marine life, bacteria and water quality and other aquatic biota; Thermal pollution from power plants and their control, spillage movement, spreading, evaporation,

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emulsification, dispersion, remote sensing in water quality monitoring.

UNIT V

E-Waste

Sources of generation, Effects and Control measures, Global Strategy. Project on E-waste handling.

Text Books/References

1. J.N.B. Bell (2002) Air Pollution and Plant Life, 2nd Edition, John Wiley and Sons, NewDelhi.
2. Christon J. Hurst, Ronald L. Crawford, Guy R. Knudsen, Michael J. McInerney, Manual of Environmental Microbiology, 2nd edition, ASM Press. 2001.
3. Bruce Rittman, Perry L. McCarty. Environmental Biotechnology: Principles and Applications, 2nd Edition, McGraw-Hill, 2000.
4. Air Pollution - Stern
5. Environmental Pollution Control Engineering: C. S. Rao
6. Environmental Chemistry : B.K. Sharma, and H. Kaur
7. Air pollution - threat and response: D. A. Lynn
8. Air pollution and Environmental Protection - Legislative policies, Judicial trend and Social perceptions: N. Kumar; Mittal Publication

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MSES105A	PG	Environment and Natural Resources	4	0	0	4	60	20	20	0	0

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Course Objectives

1. To introduce the various components and natural resources of environment.
2. To understand energy concepts for conventional and renewable energy technologies and their application.
3. To enable an understanding of forest, food, water and land resources in the broadest terms.
4. To integrate practical knowledge and skills to solve important natural resource management problems.

Course Outcomes

The students should be able to:

1. Understand the evolution of environment and its composition.
2. Understand types of natural resources and their conservation.
3. Critically examine the gap in the resource availability, use and conservation
4. Apply theories and practical methods with interdisciplinary approach towards natural resource management

Syllabus:

UNIT I

Environment:

Definition of Environment, Earth, Man and Environment, Evolution of environment, Physico-chemical and Biological Characteristics of environment. Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Geographical classification, Distribution and zones.

UNIT II

Mass and energy:

Transfer of mass and energy across various interfaces. First and second laws of thermodynamics, heat transfer processes, Biochemical cycles, gaseous and sedimentary

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MSES105A	PG	Environment and Natural Resources	4	0	0	4	60	20	20	0	0

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turnover rate and turnover item, General relationship between landscape and climate. Climates of India, Indian monsoon, Drought, Tropical cyclones and western disturbances. Atmosphere stability and instability, tem-perature inversion and mixing heights, heat balance of the earth- atmosphere system, global climate change.

UNIT III

Natural resources I:

Types of natural resources.

Forest resources: use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people. Water resources: use and utilization of surfaces and ground water, floods drought, dams-benefits and problems. Mineral resources: environmental effects of extracting and using mineral sources.

UNIT IV

Natural resources II:

Food resources: World food problems overgrazing, effects of modern agriculture, fertilizers-pesticides problems, Water logging, salinity.

Land resources: Land as a resource, Land degradation, man induced landslides, soil erosion and desertification.

UNIT V

Energy resources: Concept and demand of energy, Growing energy needs, Renewable and non renewable sources, use of alternate energy sources, Wind energy, Solar energy, water as source of energy, Biofuels production, use and sustainability, use and over exploitation of energy sources and associated problems. Role of an individual in conservation of natural resources. Equitable use resources for sustainable lifestyles.

Text Books/References

1. Renewable Energy - Environment and Development: M. Dayal; Konark Pub. Pvt. Ltd. Alternative

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Energy: S. Vandana; APH Publishing Corporation.

2. Nuclear Energy - Principles, practice and prospects: S. K. Agarwal; APH Publishing Corporation.

3. S. Glasstone, D. Van Nastrand, Source book on atomic energy, 3rd Edition, Germany, 1967.

4. M. Eisendbud, Environmental radioactivity, Academic Press.

5. E.D.Enger, B.E. Smith, Environmental Sciences- A study of Inter relationships, WCB Publication.

6. Bio-Energy Resources: Chaturvedi; Concept Pub.

National Energy - policy, crisis and growth: V S. Mahajan; Ashis Publishing House.

8. Geography and Energy - Commercial energy systems and national policies: J. D. Chapman

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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Science
Department of Chemistry

Name of Program: M.Sc. (Environmental Science)
SEMESTER I (CBCS) (2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSES105B	PG	Atmospheric Chemistry	4	0	0	4	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To give the brief knowledge of different regions and gaseous cycles of the atmosphere
2. To understand the photochemical reactions, processes and mechanisms of change in the atmosphere.
3. To impart knowledge on air modeling and carbon trend.
4. To give practical knowledge about atmospheric chemistry.

Course Outcomes:

The student should be able to:

1. Understand the atmosphere profile and gaseous cycles.
2. Understand the atmospheric processes and chemistry behind them.
3. Understand the process of air modeling and carbon dating
4. Analyze the process of physicochemical changes in the atmosphere.

Syllabus:

Unit-I:

Chemical composition and Meteorological aspects of air pollutants Earth atmosphere, particles, aerosols and clouds, ozone, cyclic processes including carbon cycle, oxygen cycle, nitrogen cycle, sulphur cycle, Temperature lapse rate and stability, adiabatic lapse rate, atmospheric stability, Inversion, Plume behavior and Gaussian plume, Wind velocity and turbulence.

Unit-II:

Photochemistry Photochemical change, photo-dissociation and photo-ionization, reaction of electronically excited species, adiabatic process and the correlation rules. Application of kinetics to atmosphere (bimolecular reactions, unimolecular and trimolecular reactions, liquid phase reactions, multi-step reaction scheme).

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Unit-III:

Ozone in Earth's Stratosphere Chemistry of oxygen, Chapman layers, influence of trace constituents, natural sources and sinks of catalytic species, heterogeneous chemistry. Ionization mechanisms, chemistry of the specific region (F-region processes, E-region processes, D-region positive ion chemistry, D-region negative ion chemistry), a brief idea of ion in stratosphere and troposphere. Solar proton events, solar ultra violet irradiance, El Nino, volcanoes, halocarbon, polar ozone holes consequence of ozone perturbation.

Unit-IV:

Earth Troposphere Brief Introduction to Troposphere, sources ,sinks and transport, Oxidation and transformation:- Photochemical chain Initiation , oxidation steps ,importance of NOX ,The reaction of OH CO.

Unit-V:

Air Modelling and current carbon trends Air modelling, air monitoring , Chemistry of carbon dioxide in atmosphere , CO2 sequestration, Carbon trading , Carbon footprint.

Books Recommended

1. Richard P. Wayne, Chemistry of Atmosphere 3rd ed., Oxford University Press (2000).
2. Seinfeld, J.H. and Pandis, S.N., Atmospheric Chemistry and Physics, John Wiley, Chichester (1998).
3. Hobbs P.V., Introduction to Atmospheric Chemistry, Cambridge University Press (1999).
4. C.S.Rao, Environmental Pollution Control Engineering, 3rd ed., Wiley Eastern Ltd.New Age International Pvt.Ltd. (1995).

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