



Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Science (Environmental Science)

SEMESTER III

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*
MSCENV301	PG	Analytical Methods in Environmental Science	3	1	0	4	60	20	20	00	00

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:

To give basic knowledge of concept of Physical Method of analysis.

To develop the understanding of Separation techniques in Environmental Science.

Course Outcomes:-

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes. The student will demonstrate capability of CO1. Theoretical understanding of concept of analytical methods of environmental science.

CO2. Became aware of the Separation techniques.

Syllabus:

UNIT-I:

Statistical Analysis I

Introduction to analytical chemistry: Types of analysis-qualitative and quantitative. classification of analytical methods-classical and instrumental, basis of their classification with examples. Statistical analysis and validation: Errors in chemical analysis. Classification of errors-systematic and random, additive and proportional, absolute and relative. Accuracy and precision. Mean, median, average deviation and standard deviation.

UNIT-II:

Statistical Analysis II

Correlation coefficient and regression analysis. Comparison of methods: F-test, T-test and Chi



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square test. Least square method and curve fitting. Applications of Computer in Environmental Science. Introduction of recent softwares used in statistical analysis for environmental studies.

UNIT-III:

Electrochemical Analysis

Electrochemistry: Electrochemical cells, Nernst equation and applications of Debye-Huckel-theory, Electrolytic conductivity and the Debye-Hückel-Onsanger treatment.

Electro Chemical Techniques: Introduction, Types of Electro Chemical Technique, Principle, Instrumentation and Application of Polarography in Environmental Chemical Analysis, Anodic Stripping, Voltametry with its Application in Environmental Measurements.

UNIT-IV:

Classical Methods of Analysis

Volumetric analysis: General principle. Criteria for reactions used in titrations. Primary standards and secondary standards. Theory of indicators. Types of titrations with examples-Acid-base, precipitation, redox and complexometric. Indicators used in various types of titrations. Masking and demasking agents.

Gravimetric analysis: General principles and conditions of precipitation. Concepts of solubility, solubility product and precipitation equilibria. Steps involved in gravimetric analysis. Purity of precipitate: Co-precipitation and post-precipitation. Fractional precipitation. Precipitation from homogeneous solution. Particle size, crystal growth, colloidal state, aging and peptization phenomena. Ignition of precipitates.

UNIT-V:

Optical Methods of Analysis

Spectrophotometry and Colorimetry: Principle of colorimetry. Lambert Beer's law, its verification and derivation. Instrumentation in colorimetry and spectrophotometry (single and double beam). Sensitivity and analytical significance of molar extinction coefficient and λ_{\max} . Comparison method, calibration curve method and standard addition method for quantitative estimation. Role of organic ligands in spectrophotometric analysis of metal ions.



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REFERENCES:

1. Quantitative analysis: Day and Underwood (Prentice-Hall of India)
2. Vogel's Text Book of Quantitative norganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry: Gary D. Christian (Wiley, India).
4. Instrumental Methods of Analysis: Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
6. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
7. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
8. Analytical Chemistry: Problems and Solution-S. M. Khopkar (New Age International Publication)
9. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
10. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)



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MSCENV302	PG	Fundamentals of Environmental Chemistry	4	1	2	6	60	20	20	30	20

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 provide student with an understanding of the fundamental chemical processes that are central to important environmental problems.
2. To encourage student to utilize this knowledge in making critical evaluations of these problems.

Course Outcomes:

1. Students learn the basic principles of environmental chemistry.
2. They will be able to apply previous knowledge on analytical chemistry to environmental processes and samples.
3. They will understand the interconnections between different sectors of the environment (soil, water, atmosphere) and the effect of human activities on the natural chemical processes.

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.

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. Protein structure and biological functions, enzymes, enzyme metabolism.

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.



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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. Thermochemical and photochemical reactions in the atmosphere. Oxygen and ozone 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 components of soil.

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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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCENV303	PG	Environmental Geosciences	4	1	2	6	60	20	20	30	20

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

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Course Objectives:

1. To understand geological hazards and environmental land use planning and management.
2. To study the prevention, analysis and correction of interactions between human activities and natural systems, in terms of natural and cultural resources, environmental impacts (including impacts on geological heritage), geological hazards and environmental land use planning and management.

Course Outcomes:

1. The students will acquire broad knowledge about man-made perturbations to physical-chemical processes at the Earth surface related to the utilisation of geo-resources.
2. Students learn the methodology to assess some of the impacts of human changes to environmental processes.

Syllabus:

UNIT I

Atmosphere: Earth's Atmosphere: Evolution, structure and chemical composition of atmosphere.

Solar radiation and terrestrial radiation electromagnetic spectrum latitudinal and seasonal variations, effect of atmosphere, green house effect heat budget.

UNIT II

Temperature measurements and controls, Environmental lapse rate, dry and wet adiabatic lapse rate, inversion of temperature and atmospheric stability.



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Atmospheric pressure and winds: Pressure measurements and distribution; Wind observation, measurement, factors affecting wind; geostrophic wind and gradient wind, local winds, model of general circulation of the atmosphere, Jet stream.

UNIT III

Atmospheric moisture: Forms of condensation; Precipitation, Hydrological cycle.

Atmospheric disturbances: Thunderstorms, Cyclones, lightening, flood, and drought.

UNIT IV

Earth science: Internal structure of Earth, Geological evolution, Rocks and their classification, minerals and their classification. Weathering and soil formation, soil profile, soil classification, soils of India.

Water Resources and Environment: Global Water Balance. Ice sheets and fluctuations of sea levels. Origin and composition of seawater. Hydrological cycle. Factors influencing the surface water. Types of water. Resources. Human use of surface ground waters.

UNIT V

Environmental Geochemistry: Concepts of major, trace and REE. Classification of trace elements, mobility of trace elements, Geochemical cycles. Biochemical factors in environmental health. Human use, trace elements and health. Possible effects of imbalance of some trace elements. Diseases induced by human use of land.

Geological Hazards and its mitigation measures: Earthquake and Tsunamis, Volcanoes, Landslides

References:

1. Valdiya, K.S. 1987, Environmental Geology.
2. Keller, E.A. Environmental Geology & Turk and Turk. UoP, revised M.Sc. (Env.Sci.) Syllabus - 2008



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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCENV304A	PG	Solid Waste Management	4	1	2	6	60	20	20	30	20

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

1. To ensure the protection of the environment through effective waste management measures.
2. Ensure the design and manufacture of products that avoid or minimize waste generation.
3. Increase reuse and recycling rates of products.

Outcomes

By the end of the course, the student will have demonstrated ability to:

1. Develop national and local awareness on the social importance of waste management
2. Promote waste minimization and recycling.

Syllabus:

UNIT I

SOURCES AND TYPES

Sources and generation of solid wastes, their characterization, chemical composition and classification. Different methods of disposal and management of solid wastes (Hospital Wastes and Hazardous Wastes). Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO's.

UNIT II



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SEMESTER III

ON-SITE STORAGE AND PROCESSING

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

UNIT III

COLLECTION AND TRANSFER

Methods of Residential and commercial waste collection – Collection vehicles – Manpower– Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

UNIT IV

OFF-SITE PROCESSING

Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V

DISPOSAL

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor– Dumpsite Rehabilitation. Recycling of waste material. Waste minimization technologies.

Text Books/References

1. Tchobanoglous, G., Theisen, H. M., and Eliassen, R. “Solid. Wastes: Engineering Principles and Management Issues”. McGraw Hill, New York, 1993.
2. Vesilind, P.A. and Rimer, A.E., “Unit Operations in Resource Recovery Engineering”, Prentice Hall, Inc., 1981.
3. Paul T Willams, “Waste Treatment and Disposal”, John Wiley and Sons, 2000.
4. Government of India, “Manual on Municipal Solid Waste Management”, CPHEEO, Ministry of Urban Development, New Delhi, 2000.
5. Bhide A.D. and Sundaresan, B.B. “Solid Waste Management Collection”, Processing and Disposal, 2001.



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6. Manser A.G.R. and Keeling A.A.,” Practical Handbook of Processing and Recycling of Municipal solid Wastes”, Lewis Publishers, CRC Press, 1996.

7. George Tchobanoglous and Frank Kreith”Handbook of Solidwaste Management”, McGraw Hill, New York, 2002.

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							THEORY		PRACTICAL		
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MSCENV304B	PG	Organic Pollutants	4	1	2	6	60	20	20	30	20

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Objectives

1. To understand the chemistry of organic pollutants.
2. To make students aware about adverse effects of pollutants.

Outcomes

By the end of the course, the student will have ability to understand various kinds of organic pollutants and their prevention.

Syllabus:

Unit-I:

Organochlorine insecticides, DDT, accumulation and the fate of organochlorine in biological systems, chlorinated cyclopentadiene, detection of pesticides by gas chromatography, organophosphate and carbamate insecticides, biopesticides, new generation pesticides.

Unit-II:

Herbicides, triazine herbicides, phenoxy herbicides, dioxine contamination of herbicides and wood preservatives, polychlorinated biphenyls (PCBs), furan contamination of PCBs, toxicology of PCBs, trioxins and furans, biodiesel, biofertilizers.

Unit-III

(A) Polynuclear aromatic hydrocarbons (PAHs) as pollutants, mechanism of PAH carcinogenic, environmental estrogens.

(B) A brief idea of the following: Recycling of household and commercial waste, recycling of paper, recycling of tire, recycling of plastics, green chemistry, bioremediation, phytoremediation.

Unit-IV:



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Mutation, effect of mutations, induction of mutation (UV-light), ionizing radiations, chemical mutagens, metabolism of chemical carcinogens.

Unit-V:

Electrochemistry of water splitting, large-scale solar hydrogen production, fixing of CO₂, electrochemical removal of wastes (waste water, SO₂, removal of metals, destruction of nitrates, organic wastes, sewage disposal).

Text Books/References

1. S.P. Mahajan, Pollution Control in Process Industries, 10th ed., Tata Mc Graw Hill (1998).
2. J.O'M. Bockris and A.K.N. Reddy, Modern Electrochemistry, (volumes 1 & 2), Plenum Press, N.Y. (2001).
3. M.H.Yu., Environmental Toxicology, Lewis Publisher, Washington DC. (2001).



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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCENV305	PG	Forestry and Water Resources	4	1	2	6	60	20	20	30	20

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

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Objectives

1. To express the need of water conservation.
2. To understand the importance of forests and its resources.
3. To make aware of the Principles of forest management and their applications.
4. To understand the Physical, Chemical and Biological Characteristics of Water and determination of important physical and chemical parameters of water quality.

Outcomes

By the end of the course, the student will have demonstrated ability to:

1. Understand the importance of forests and its resources.
2. Express the need of water conservation.

Syllabus:

UNIT I

Forest Management

Introduction: definition and scope. Principles of forest management and their applications. Objects of management, purpose and policy. General definitions – management and administrative units, felling cycle, cutting section. Rotations: definition, kinds of rotations, choice of rotations, length of



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rotations and conversion period. Normal forest: definition and concept. Even aged and unevenaged models.

UNIT II

Introduction to Agroforestry

Agroforestry - definition, aims, objectives, need and scope. Classification of agroforestry system - structural, functional, socio-economic and ecological basis. Traditional agroforestry systems: Taungya system, Shifting cultivation, wind break, shelterbelts, Homestead gardens'. Multipurpose tree species and their characteristics. Tree architecture. Agroforestry for coastal and hilly areas.

UNIT III

Water Resources:

Hydrology, the hydrological cycle and its components, drainage systems, classification of water resources, characteristics of water resources. Surface run-off, stream flow estimation, problems of water and ground water resource depletion, watershed types and Functions .

Water Quality Characteristics: Physical, Chemical and Biological Characteristics of Water. Standard methods of determination of important physical and chemical parameters of water quality, eg. PH, turbidity, electrical conductivity, total Solids, alkalinity, hardness etc., Units of measurements and expression of results, Bacteriological Indicators, and determination of Coliforms.

UNIT IV

Types of Hydropower Plants:

Classification of hydropower plants, Run-of-river plants, Valley dam plants, High head diversion plants, Diversion Canal plants, Pumped storage plants, Tidal power plants.

Dams:

Selection of site, preliminary investigations, Final investigations, Types of dams:- Rigid dams, Gravity dams, Arch and buttress dams, Basic principles of design and details of construction.

UNIT V

Natural Hazards:



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Flood types and causes, drainage basins, nature and frequency of floods, effects. Flood hydrographs., types and causes of landslides, coastal hazards including cyclones, tsunamis, the effects of tides and tidal effect prediction, nature of destruction, causes and consequences of forest fires.

Text Books/References

1. Ram Prakash. Forest management, 2006, IBD Publication, Dehradun
2. Osmaston, F.C. Management of Forests, 1984. IBD Publication, Dehradun B.ScSc.Forestry Syllabus, School of Forestry and Environment SHIATS-DU, Allahabad 44
3. Speight, M.S. and D. Wainhouse 1989. Ecology and Management of Forest Insects. Clarendon Press, Oxford.
4. Brown, A. 1990. Forest Fire and its Control. Natraj Publishers, Dehra Dun.
5. Gupta, V.K. and N.K. Sharma. 1988. Tree Protection. Indian Society of Tree Scientists, Solan.
6. Herrick, G.W. 1988. Insect Enemies of Trees. Pioneer Publishers, Jaipur.
7. Khanna, L.S. 1984. Forest Protection, Khanna Bandhu, Dehra Dun.
8. Kumar, V. 1995. Nursery and Plantation practices in Forestry. Scientific Publishers Jodhpur.
9. Metcalf And Edduy, Inc.; Waste Water Engineering, Treatment, Disposal, Reuse, Tata McGraw Hill.
10. Masters G.M.; Introduction to Environmental Engineering and Science, Pretice hall of India, 1994.
11. Garg, S.K.” Water Supply Engineering”, Vol.1, Khanna Publishers,New Delhi,2003.