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*
MSES301	PG	Analytical Methods in Environmental Science	3	0	0	3	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 introduce concepts of various analytical techniques.
2. To give an introduction to statistical, electrochemical, classical and optical methods of analysis, which are used in environmental and process analysis.
3. To develop the understanding of Separation techniques in Environmental Science
4. To understand the basics of experimental design.

Course Outcomes:

After the completion of course, the students should be able to:

1. Student gained insight into advanced theoretical knowledge in methodologies in environmental analysis
2. To demonstrate sound understanding of analytical techniques applied in environmental analyses.
3. To deal with QA/QC of analytical protocols.
4. To design of monitoring and analytical experiments and conclude the findings.

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-systematicand 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 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.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSES301	PG	Analytical Methods in Environmental Science	3	0	0	3	60	20	20	0	0

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

Electrochemical Analysis

Electrochemistry: Electrochemical cells, Nernst equation and applications of Debye-Huckel-theory, Electrolytic conductivity and the Debye-Hückel-Onsangar treatment.
Electro Chemical Techniques: Introduction, Types of Electro Chemical Technique, Principle, Instrumentation and Application of Polarography in Environmental Chemical Analysis, Aniodic 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 λmax. 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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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSES301	**PG**	**Analytical Methods in Environmental Science**	3	0	0	3	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.

Text / Reference Books:

1. Quantitative analysis: Day and Underwood (Prentice-Hall of India)
2. Vogel's Text Book of Quantitative iorganic 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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SEMESTER III

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME THEORY		PRACTICAL		
							ENDSEM University Exam	Two Term Exam	Teachers Assessment*	ENDSEM University Exam	Teachers Assessment*
MSES302	PG	NON-CONVENTIONAL ENERGY RESOURCES	3	0	0	3	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 basic knowledge of energy resources.
2. To understand the importance of renewable and nonrenewable energy sources and its consumption pattern.
3. To learn about principle, generation and applications of different conventional and non-conventional energy sources.
4. To understand processing and limitations of fossil fuels (coal, petroleum and natural gas) and neecessasity of harnessing alternate energy resources such as solar, wind, nuclear, geothermal, tidal and biomass.

Course Outcomes:

After the completion of course, the students should be able to:

5. To understand the significance of alternate energy sources.
6. To know the energy demand of world, nation and available resources to fulfill the demand.
7. Students will have understanding of energy crisis and different aspects of sustainability.
8. Students will have learnt methods for energy conservation and energy management at home and organization.

Syllabus:

UNIT I

Introduction various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT II:

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applicationsand performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT III:

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

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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*
MSES302	PG	NON-CONVENTIONAL ENERGY RESOURCES	3	0	0	3	60	20	20	0	0

UNIT IV:

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

UNIT V:

Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Text / Reference Books :

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning. (14)
6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

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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*
MSES303	**PG**	**Environmental Toxicology and Human Health**	3	0	0	3	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 understand the chemistry of toxic substances present in environment.
2. To create awareness about the effects of toxic chemicals on human health.
3. To get knowledge about genetic toxicology.
4. Motivating students to participate in awareness for health and education and communication of disease.

Course Outcomes:

After the completion of course, the students should be able to:

1. To acquire knowledge of the field of toxicology including the basic principles, target organ toxicity.
2. To developed basic knowledge of concept of health and disease, and its allied problems.
3. Understand the genetic effects and diseases.
4. To developed awareness for health and education and communication of disease.

Syllabus:

UNIT I:

Toxic chemicals in the environment

Organic compounds: Hydrocarbons, Chemistry of hydrocarbons, phenols, chlorofluorocarbons, pesticides, chemical fertilizers, environmental effects, effects on macro and microorganisms. Gasoline lubricants and greases, Pesticides: Classification, degradation, analysis, pollution due to pesticides and heavy metals.

UNIT-II:

Principles of toxicology

Environmental toxicology and its importance; Occurrence of Toxicants and their chronic and acute effects; Exposure, uptake, transportation, storage, metabolism and excretion of pollutants

UNIT-III:

Pollution and human health

Trace element deficiency and disorders; Occupational health hazards; Biogeochemical factors in environmental health; Epidemiological issues- Goiter, Fluorosis, Arsenic poisoning.

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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*
MSES303	PG	**Environmental Toxicology and Human Health**	3	0	0	3	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.

Unit-IV:

Linkages between Environment and Health

Understanding linkages between Environment and Public Health: Effect of quality of air, water and soil on health, Manifestations of Climate change on Public HealthBurning of Fossil fuels, automobile emissions and Acid rain. Perspective on Individual health: Nutritional, socio-cultural and developmental aspects.

Unit-V:

Genetic Toxicology

Carcinogenesis; Carcinogens, chemical carcinogenicity, mechanism of carcinogenicity, Oncogenes and tumour suppressor genes. Environmental carcinogenicity testing. Mutagenicity: Mutagens, Environmental mutagen testing- Bacterial mutagenesis assays, gene mutation chromosome damage assays, DNA damage and repair assays.

Text / Reference Books:

1. Ayres, J., (2009). Occupational industrial and environmental toxicology, 2nd edition.
2. Chatterjee, P., Progress in predictive toxicology- Clayson, Munro, Shubik & Swenderg (eds.)
3. Landis, W., Sofield, R., Yu, M.H., Wayne G. Landis, Yu, S.M.H. Introduction to Environmental Toxicology: Molecular Substructures to Ecological Landscapes, Fourth Edition
4. Niesink, R., Hollinger, M.A., Vries, J.D. (1999). Toxicology: Principles and Applications.
5. Perk, Preventive and Social Medicine

Phillip, R.B. (2001).Ecosystems and human health: toxicology and environmental hazards. 2nd edition. Boca Raton: Lewis Publishers.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSES304A	PG	**Solid Waste Handling Techniques**	3	0	0	3	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 inClass, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To ensure the protection of the environment through effective waste management measures.
2. To select the most suitable solid waste management options in a specific local context.
3. Ensure the design and manufacture of products that avoid or minimize waste generation.
4. Assess the environmental impact of solid waste management options and criticize the results

Course Outcomes:

After the completion of course, the students should be able to:

1. Promote waste minimization and recycling
2. To address the waste management processes through cradle-to-grave perspectives.
3. To demonstrate sound understanding of the waste generation process and characteristics of different types of solid wastes.
4. To apply recycling vis-à-vis resource recovery technologies for useful conversion of specific waste type to eco-friendly products.

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

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.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSES304A	PG	**Solid Waste Handling Techniques**	3	0	0	3	60	20	20	0	0

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 mininization 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.
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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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*
MSES304B	PG	Environmental Geosciences	3	0	0	3	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 understand on formation of earth and different earth processes.
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).
3. To get knowledge about hydrological and geochemical cycles.
4. To understand geological hazards and environmental land use planning and management.

Course Outcomes:

After the completion of course, the students should be able to:

1. To acquire broad knowledge about various earth processes.
2. To evaluate risks related to critical environmental issues of global importance.
3. To address acute environmental challenges.
4. 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 seasonalvariations, 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.

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.

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SEMESTER III

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME THEORY END SEM University Exam	THEORY Two Term Exam	PRACTICAL Teachers Assessment*	PRACTICAL END SEM University Exam	PRACTICAL Teachers Assessment*
MSES304B	PG	Environmental Geosciences	3	0	0	3	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.

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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