Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Science (Environmental Science)

SEMESTER I

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*
MSCENV101	**PG**	**Environmental Instrumentation and Analysis**	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:
The students will be able to:
1. To give the basic knowledge of various instrumental techniques in environmental science.
2. To develop the understanding of chemistry separation techniques.

Course Outcomes:
The students should be able to:
1. Apply the principles of various instrumentation techniques.
2. Analyze instrumental methods theoretically and practically.

Syllabus:

UNIT I

Introduction and sampling techniques:
Samples preparation, preservation and processing of air, water and soil samples, sampling equipments, separation and sampling techniques, precipitation, fractional cry stallization, fractional distillation, solvent extraction, accuracy and precision, types of errors, trouble shooting of instruments.

UNIT II

Chromatographic Analysis: Principle, brief Theory and Applications of Column Chromatography, HPLC, TLC, HPTLC, GC, Introduction of UPLC.

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, X- Ray Diffraction and Neutron Diffraction Spectrometry

Thermal Analysis: Principle, Theory and Applications of Differential Thermal Analysis, Thermogravimetric 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.

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. Arnikar.
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, 4th Ed., (1989)
8. Organic Spectroscopy- P. S. Kalsi
9. Instrumental Methods of Analysis – Chatwal and Anand.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCENV102A	**PG**	**Fundamental of Ecology and Ecosystem**	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:

A student passing this module should be able to:

1. Describe how organisms are (or are not) adapted to their abiotic environment.
2. Explain the key ecological interactions of competition, predation and parasitism.
3. Relate population-level ecological processes to community or ecosystem-level processes.
4. Explain how ecological principles relate to selected areas of applied ecology.
5. Present and interpret ecological data accurately and clearly.

Course Outcomes:
By the end of the course, the student will have demonstrated an ability to:
1. Discuss ecological topics of historical and current interest and importance.
2. Describe ecological concepts at the population, community and ecosystem level.
3. Describe the scientific literature on a specific topic in written form.
4. Understand the relations between abiotic and biotic components of the environment.
5. Creatively applied acquired knowledge to the protection of environment.

Syllabus:

UNIT I

Ecology:
Definition, principle and scope of ecology, aquatic and terrestrial ecology, freshwater cology, marine ecology, estuarine ecology, Community concept, types of community, succession process, competition and Coexistence, types of interactions: predation, parasitism, antibiosis, commensalism, cooperation and mutualism, population growth.

UNIT II
Concept of Biosphere and ecosystem:
Biomes, Population parameters, structure, Growth Regulation,Interaction between populations, life, history, strategies. Types of ecosystem, eco system of India,Characteristics of ecosystem, structure of ecosystem and function of an ecosystem, population Dynamics, Carrying capacity.
Abiotic and Biotic environment, limiting factors, adaptation, Habitat and niche, nature of environment. Littoral Zones: Fauna of intertidal zones, their distribution and adaptations,

ecological importance of mangrove vegetation, distribution of mangrove areas in India. Marine Environment: Biota in different types of zones, its diversity-plankton, nekton, benthos, their adaptations and productivity, Indian marine territory, Exclusive Economic Zones (EEZ) Dynamic biogeography: routes of migration of plants and animals, their impact on local ecosystems, trade routes, shipping, accidental import, weeds, ballast water.

UNIT III

Organization of Ecological systems:

Ecosystem components, Producers, consumers and decomposer, Food chains, food web and ecological pyramids, Biotic and abiotic components, Ecological pyramids, Bioaccumulation and biomagnifications, mass and energy transfer in successive trophical level.

UNIT IV

Synecological principles:

Synecological principles, species area relations, methods of sampling and describing plant community, analytic and synthetic characters, community coefficients, association analysis, cluster analysis, gradient analysis, vegetation mapping, ecological succession,succession models, concept of climax

UNIT V

Energy and Ecological succession:

Flow and energy fixation, construction of ecological pyramids. Biogeochemical cycles: Hydrological cycles, carbon cycle, oxygen cycle, nitrogen cycle, sulfur cycle,phosphorus cycle-its importance and applications. Primary succession, secondary succession and ecological climax, impacts of development of ecosystem, population, commumnity ecology, predator and prey relationship.

Text Books:

1. M.C. Dash (1994) Fundamentals of Ecology, Tata McGraw Hill, New Delhi.
2. S.V.S. Rana (2005) Essentials of Ecology and Environmental Sciences, Prentice Hall of India, New Delhi.

Reference Books:

1. M.C. Molles Jr. (1999) Ecology- Concepts and Application, McGraw Hill, New Delhi.
2. V. Ingegnoli (2002) Landscape Ecology: a widening foundation, Springer, Bonn.
3. E.J. Kormondi (1999) Concepts of Ecology, Prentice Hall of India, New Delhi.
4. Chapman, J.L. and Reiss M.J. (2005) Ecology Principles and Applications, Cambridge University Press,London.
5. E.P. Odum and G. W. Barrett (2005) Fundamentals of Ecology, Thomson Asia Pvt. Ltd., Singapore.
6. Environment And Ecology-EAS105/EAS 205-R.Rajagopalan.

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							THEORY		PRACTICAL		
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MSCENV102B	**PG**	**Atmospheric 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. Understanding of the different regions of the atmosphere and the flow of air within the atmosphere.

2. Understand the balance of energy and heat in the atmosphere and how this related to climate

3. Understand the specific chemistry of urban environments.

Course Outcomes:

After completing this course, the student should be able to:

1. Predict fate of molecules and radicals under typical atmospheric conditions.
2. Qualitatively explain and quantitatively compute trends in photolysis rate constants with altitude, season, and time of day for molecules whose photochemistry is known. 3

Syllabus:

Unit-I:

Chemical composition and Meterological 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 turbulance.

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).

Unit-Ill:

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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SEMESTER I

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCENV103	**PG**	**Biodiversity Concept and Components**	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:

A student passing this module should be able to:

1. Understand the concept and components of biodiversity.
2. Understand the importance of biodiversity and its conservation.
3. Evaluate the level of biodiversity.
4. Understand biodiversity convention and Act.

Course Outcomes:
By the end of the course, the student will have demonstrated an ability to:
1. Explain the importance of biodiversity conservation.
2. Articulate the causes and consequences of anthropogenic disturbances on biodiversity.
3. Analyze responses of biological communities to past disturbances.
4. Predict responses of biological communities to future disturbances.
5. Assess the potential of conservation strategies to help protect biodiversity.

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, extinct species and endemic species. Climate change, induced losses. common flora and fauna in India-Aquatic: phytoplankton, Zooplankton and macrophyes. 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 Naeem, Daniel E. Bunker, Andy Hector and Michel Loreau (2009)Biodiversity, ecosystem fuctioning and human well being: An ecological and economic perspective.

2. S.K. Agarwal et al (1996) Biodiversity and Environment, APH, 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.

6. P.S. Ramakrishnan (2000) Mountain Biodiversity, Land Use Dynamics and Traditional Ecological Knowledge, Oxford and IBH, New Delhi.

7. Global Biodiversity strategy: WRI, IUCN & UNEP.

8. Ecotourism and Sustainable Development: Singh; Abhijeet Pub.

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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCENV104	**PG**	**Environment and Natural Resources**	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.

Objectives

1. Familiarize the students with complex array of stakeholders, interests and institutions in managing natural resources.

2. Introduce to the students various conceptual and analytical perspectives (drawn from different academic disciplines) to look at environmental problems.

Outcomes

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

1. Describe the evolution of environment and its composition.
2. Explain geographical classification, distribution and zones.
3. Explain mode of mass and energy transfer in environment.
4. Understand climate of India.
5. Understand types of natural resources and their conservation.

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 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.

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SEMESTER I

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 prodution, 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 Energy: S. Vandana; APH Publishing Corporation.
2. Nuclear Energy - Principles, practice and prospects: S. K. Agarwal; APH Publishing Corporation.
3. S. Glassstone, 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- Astudy of Inter relationships, WCB Publication.
6. Bio-Energy Resources: Chaturvedi; Concept Pub.
7.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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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCENV105	**PG**	**Environmental Pollution**	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.

Objectives

At the end of this module, students will:

1. Have gained awareness of current forms of environmental pollution and an overview of both their causes and consequences to natural, economic and social systems.
2. Have been exposed to learning examples of good practice of technologies and options used to remediate reduce/eliminate pollution of the environment,
3. Be able to analyse, synthesise, and evaluate evidence to understand problems in order to select control measures and techniques concerning atmospheric, water or terrestrial challenges.

Outcomes

By the end of the course, students will have a broad, integrated understanding of the major problems associated with pollution of the atmosphere, water, the land surface and the food chain. Students will be expected to be familiar with and have an understanding of;
1. The causes of global warming, ozone depletion, enhanced N and S emissions and urban air pollution;
2. How pollution is caused by nuclear fuel production, processing of spent fuel and disposal of radioactive wastes;
3. Problems of noise and thermal pollution;
4. The difference between persistent and biodegradable pesticides and how pesticides residues may be quantified;
5.Procedures and prospects for reducing unwanted emissions to the environment and remediation of already polluted systems.

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 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, 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, New Delhi.

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