DISCIPLINE SPECIFIC ELECTIVES (DSE-EVS-11): ENVIRONMENTAL INDICATORS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
DSE-EVS-11: ENVIRONMENTAL INDICATORS	4	2	0	2	Class XII pass	NA

Learning objectives

The Learning Objectives of this course are as follows:

- Understand the concept of environmental indicators and their role in measuring and assessing environmental quality
- Learn how to select, analyze, and interpret various types of environmental indicators to evaluate the condition of natural resources and ecosystems
- Develop an understanding of select and use environmental indicators in environmental policy and decision-making
- Learn about the practical applications of environmental indicators in different sectors such as government, business, and non-governmental organizations.
- Gain an appreciation of the interdisciplinary nature of environmental indicators, and the importance of collaboration among different disciplines to address environmental issues

Learning outcomes

After successful completion of this course, students will be able to:

- Define, describe and identify environmental indicators to measure and assess environmental quality
- Select appropriate environmental indicators based on specific environmental issues, and apply appropriate methods for data collection and analysis
- Evaluate the effectiveness of different environmental indicators and their relevance to environmental policy and decision-making.
- Communicate environmental indicator data effectively to different audiences using appropriate formats and techniques.
- Apply knowledge and skills in business, society, policy formulation and implementation, to address environmental issues

SYLLABUS OF DSE-EVS-11

Theory (02 Credits: 30 lectures)

UNIT – I Introduction to Environmental Indicators (2 Weeks) (4 lectures)
Environmental Indicators: overview, types, relevance in environmental sustainability, environmental health and social justice, Principles of Environmental Indicator Selection, Environmental Monitoring and Data Collection. Environmental Indicator Reporting and Communication

UNIT – II Air Quality Indicators (2 Weeks) (4 lectures)
Air Pollution Sources and Emissions, Criteria Air Pollutants and their Health Effects, Ozone Depletion and Stratospheric Ozone Protection, Indoor Air Quality and Health; Air Quality: standards, guidelines, monitoring, sampling, management strategies, policies, trends and projections, Quality parameters: particulate matter, ozone, nitrogen oxides, sulfur dioxide, carbon monoxide, volatile organic compounds, lead, radon, and carbon dioxide
.

UNIT – III Water Quality Indicators (2½ Weeks) (5 lectures)
Water Pollution Sources and Pathways, Surface Water and Groundwater Quality Indicators, Drinking Water Quality and Treatment, Water Pollution Control Strategies and Policies, Non-Point Source Pollution and Best Management Practices, Water Quality: standards, guidelines, monitoring, sampling, trends and projections; Quality parameters: dissolved oxygen, pH, temperature, turbidity, nutrient concentrations, chlorophyll-a, biological oxygen demand, fecal coliform bacteria, total dissolved solids, and toxic substances

UNIT – IV Biodiversity Indicators (2½ Weeks) (5 lectures)
Biodiversity: concepts, definitions, components, levels, measurement, assessment, threats, conservation strategies and policies, trends and projections; Ecosystem Services and Biodiversity, Biodiversity and Climate Change, Parameters: species richness and diversity, genetic diversity, endemic species, threatened species, habitat extent, fragmentation and quality, ecosystem services

UNIT – V Land Use and Soil Indicators (3½ Weeks) (7 lectures)
Land Use and Land Cover Change, Urbanization and Suburbanization Trends, Productivity of Agricultural and Forests, Wilderness Management, Mining and Mineral Extraction Impacts, Land Use and Ecosystem Services, Land Use Planning and Policy, Land Use Change and Climate Change; Soil health: soil organic matter, texture, pH, nutrients, biodiversity and microbial activity, respiration aggregate stability, compaction, and water holding capacity

UNIT – VI Climate Change Indicators (2½ Weeks) (5 lectures)
Greenhouse Gas Emissions and Sinks, Climate Change: science, impacts mitigation strategies and policies, adaptation strategies and policies, vulnerability and risk assessment; Climate Change Indicators: for terrestrial and aquatic ecosystems, for human health and societal well-being (average global temperature, sea-level rise, ocean acidification, carbon dioxide concentrations, extreme weather events, arctic sea ice and glaciers and ice sheets,

ecosystem productivity and species phenology, heat-related and mediated illnesses, total energy consumption); and Climate Change and Global Environmental Governance

Teaching and learning interface for theoretical concepts

To achieve the course objectives and match with the contents, a wide range of teaching and learning tools will be employed, including (a) Formal lectures; (b) Interactive sessions using visual aid; (c) Case study analyses; (d) Hypothetical scenario building; (e) Group discussion on key topics; and (f) documentary screening and critical analyses.

Practicals/Hands-on Exercises – based on theory (02 Credits: 60 hours)

1. Investigate variations in different surfaces to absorb and reflect heat
2. Determine pattern of sea-level rise at selected coastal location over time and propose its causes and potential impacts
3. Investigate the sources and concentrations of carbon dioxide in different indoor and outdoor environments and explore ways to reduce carbon dioxide emissions
4. Collect and analyze data on weather patterns and events over time and investigate the impacts of extreme weather events on human communities and ecosystems
5. Monitor changes in Arctic sea ice extent and thickness over time and investigate the impacts of sea ice loss on Arctic ecosystems and global climate
6. Conduct field surveys to measure plant and animal diversity and abundance in different habitats and investigate the impacts of habitat loss and fragmentation on biodiversity
7. Analyze air and water quality data in different urban and rural environments and investigate the links between environmental pollution and human health outcomes
8. Monitor energy consumption and greenhouse gas emissions in different households, buildings, and industries and investigate strategies for reducing energy use and transitioning to renewable energy sources
9. Compare different land use change for variations in soil health and fertility
10. Analyze the impact of land use on health of selected water bodies
11. Conduct surveys to identify the links between environmental exposure of noise or air pollution and onset of stress and anxiety in humans
12. Monitor glacier and thickness of ice sheet using GIS and identify the changes in glacier and water resources and rise in sea level
13. Analyze the relationship between economic growth and environmental impacts using temporal data from economics and environment and suggest ways to promote sustainable development
14. Use the case study method to analyze companies having prioritized environmental and social concerns in their business practices and their impacts on society, environment, and economy

Teaching and learning interface for practical skills

To impart training on technical and analytical skills related to the course objectives, a wide range of learning methods will be used, including (a) laboratory practicals; (b) field-work exercises; (c) customized exercises based on available

data; (d) survey analyses; and (e) developing case studies; (f) demonstration and critical analyses; and (h) experiential learning individually and collectively.

Essential/recommended readings

- Hák, T., Moldan, B., & Dahl, A. L. (2020). Sustainability indicators: A scientific assessment. Springer.
- Mulder, K. F. (2018). Environmental sustainability indicators: An introduction. Routledge.
- Murgante, B., Misra, S., Carullo, A., & Torre, C. M. (Eds.). (2019). Environmental sustainability indicators for industry: Methods and tools. Springer.
- Saad-Sulonen, J., & Horelli, L. (2020). Urban environmental indicators: Tools for liveability and sustainability. Routledge.
- Sala, S., & Farioli, F. (2020). Environmental Indicators: Tools for Evaluation and Decision Making in Resource Management. Springer.

Suggestive readings

- Brouwer, R., & van Ek, R. (Eds.). (2021). Environmental and Resource Valuation with Revealed Preferences: Approaches and Methods. Routledge.
- Campbell, L. M., Gray, N. J., & Fairbanks, L. W. (Eds.). (2021). The Routledge Handbook of Environmental Governance and Sustainability. Routledge.
- Farinha-Marques, P., & Pina, A. (2019). Green supply chain management: Environmental sustainability indicators. Springer.
- Singh, R. B., & Mallick, J. (2019). Eco-friendly and sustainable agriculture: Environmental sustainability indicators. Springer.
- Tukker, A., & Dietz, F. (Eds.). (2020). Environmental Indicator Frameworks for Policy: A Comparative Analysis of Approaches in Europe. Routledge.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.