

DISCIPLINE SPECIFIC CORE COURSE – 18 (DSC-EVS-18) URBAN ECOSYSTEMS

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 (if any)
		Lecture	Tutorial	Practical/ Practice		
DSC-EVS-18: URBAN ECOSYSTEMS	4	2	0	2	Class XII pass	NA

Learning objectives

The Learning Objectives of this course are as follows:

- Gain insights into the concepts and principles of sustainability of urban ecosystems and development
- In-depth understanding of the interactions in socio-ecological systems in urban settings
- Equip with skills to analyze urban environmental problems and provide effective solutions
- Encourage to critically evaluate policies and practices related to urban ecosystems and suggest ecologically sound alternative strategies
- Foster appreciation for urban biodiversity and ecosystems and its linkages with human well-being and social equity

Learning outcomes

After this course, students will be able to

- Explain key concepts of urban ecosystems and its linkages with sustainable urban development.
- Analyze interactions between socio-ecological systems in urban settings and its impacts on ecosystem services
- Apply socio-ecological methods to assess urban environmental problems, including pollution, water scarcity and habitat fragmentation
- Recommend green urban development strategies, such as green infrastructure, and ecosystem-based adaptation
- Communicate the relevance of urban biodiversity with reference to human well-being and social equity

SYLLABUS OF DSC-EVS-18

UNIT – I Introduction to Urban Ecosystems (3½ Weeks) (7 lectures)

Definition and scope of urban ecosystems, Historical and cultural contexts of urbanization, Ecological approach to urban systems, Urbanization process and its impacts on ecosystems, Concept of sustainability and its application to urban ecosystems, Urban environmental issues and challenges, Methods and tools for studying urban ecosystems, Urban ecosystem services and benefits

UNIT – II Urban Ecology and Biodiversity (3½ Weeks) (7 lectures)

Principles of urban ecology, Biodiversity in urban ecosystems, Urban habitats and their characteristics, Ecological interactions in urban ecosystems, Species adaptation and evolution in urban environments, Urban wildlife and conservation, Urban agriculture and gardening, Urban forestry and green infrastructure

UNIT – III Urban Hydrology and Water Management (3½ Weeks) (7 lectures)

Urban water cycle, Water demand and supply in urban areas, Stormwater management and green infrastructure, Water quality and pollution control, Groundwater management in urban areas, Urban wetlands and their functions, Water conservation and efficiency in urban areas, Water governance and policy in urban areas

UNIT – IV Urban Air Quality and Pollution (3½ Weeks) (7 lectures)

Sources and types of urban air pollution, Health effects of urban air pollution, Atmospheric chemistry and pollution transport, Air quality monitoring and modelling, Urban heat island effects and mitigation, Energy and transportation systems and air pollution, Indoor air quality in urban areas, Policy and regulation for air quality in urban areas

UNIT – V Urban Waste Management and Recycling (3½ Weeks) (7 lectures)

Urban waste generation and composition, Waste reduction and recycling strategies, Municipal solid waste management and disposal, Hazardous waste management in urban areas, Electronic waste and recycling, Construction and demolition waste management, Composting and organic waste management, Waste-to-energy and alternative waste management technologies

UNIT – VI Urban Land Use and Planning (3½ Weeks) (7 lectures)

Urban land use patterns and dynamics, Urban sprawl and its impacts, Smart growth and compact cities, Sustainable urban development and planning, Land use regulations and zoning, Brownfields and urban redevelopment, Transit-oriented development and walkability, Public participation and community-based planning

UNIT – VII Urban Social and Economic Systems

(3½ Weeks) (7 lectures)

Urbanization and Urban Demography linked with: social diversity, homelessness, inequality and poverty, education and workforce, health, entrepreneurship, innovation and well-being

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. Assess magnitude of urban heat island effects and the role of urban forests in mitigating them
2. Quantify the ecological and economic benefits of urban trees and understand the importance of urban forestry
3. Assess the impact of urbanization on soil quality and understand the principles of soil health in urban landscapes
4. Analyze the impact of urbanization on water quality and understand the principles of stream health in urban environments
5. Determine the effects of urbanization on bird populations and understand the importance of bird conservation in urban areas
6. Identify opportunities for green infrastructure improvements in a neighborhood and understand the principles of green infrastructure planning and implementation
7. Quantify the economic benefits of urban agriculture and understand the principles of sustainable food systems.
8. Determine the effects of air pollution on plant health and understand the impact of air pollution on urban ecosystems
9. Examine the impact of urbanization on insect populations and understand the importance of insect biodiversity in urban areas
10. Analyze the impact of urbanization on carbon cycling and understand the role of urban ecosystems in climate change mitigation.
11. Assess the impact of urbanization on amphibian populations and understand the importance of amphibian conservation in urban environments
12. Determine the effects of urbanization on soil microbial communities and understand the role of soil microbiota in urban ecosystems
13. Design and implement a green infrastructure project for a specific urban site or neighborhood and understand the principles of green infrastructure planning and implementation.

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

- Colding, J. (2018). *Ecological Landscapes in the Anthropocene*. Cambridge University Press.
- Colding, J., & Barthel, S. (2021). *Urban Greening for Health and Well-Being*. Cambridge University Press.
- McDonnell, M. J., & Hahs, A. K. (2020). *Ecology of Cities and Towns: A Comparative Approach*. Cambridge University Press.
- Miller, J. R. (2019). *The Nature of Cities: The Ecological Imperative in Urban Design and Planning*. Routledge.
- Wu, J., & Zhang, Y. (2020). *Urban Ecology: An Introduction*. Springer.
- Zhang, Y. (2019). *Urban Ecosystems: Ecological Principles for the Built Environment*. Routledge.

Suggestive readings

- Andersson, E., Barthel, S., & Borgström, S. (Eds.). (2020). *Urban Ecosystems: Ecological Principles for the Built Environment*. Cambridge University Press.
- Escobedo, F. J., Clerici, N., & Staudhammer, C. L. (Eds.). (2019). *The Urban Forest: Cultivating Green Infrastructure for People and the Environment*. Springer.
- Heynen, N. (2019). *The Political Ecology of Green Spaces*. Routledge.
- Kowarik, I., & Körner, S. (Eds.). (2019). *Wild Urban Woodlands: New Perspectives for Urban Forestry*. Springer.
- Li, Y. (2018). *Sustainable Cities and Communities Design Handbook: Green Engineering, Architecture, and Technology*. Butterworth-Heinemann.
- Schellnhuber, H. J., & Grimm, N. B. (Eds.). (2018). *Urban Planet: Knowledge Towards Sustainable Cities*. Cambridge University Press.

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