

DISCIPLINE SPECIFIC ELECTIVE (DSE-EVS-14): ENERGY AND ENVIRONMENT

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-14: ENERGY AND ENVIRONMENT	4	2	0	2	Class XII pass	NA

Learning objectives

The Learning Objectives of this course are as follows:

- Introduce fundamental concepts and principles related to the energy and environment
- Gain knowledge of the sources of energy and the impacts of its production and consumption
- Identify the technological, economic, and social perspective of energy
- Analyze the environmental and social implications of energy sources and evaluate policies related to energy for sustainable environmental practices
- Foster awareness of the interconnectedness of global energy and environmental issues

Learning outcomes:

After the course, students will be able to

- Explain the principles and concepts of energy and its impacts on environment
- Evaluate the merit and demerits of different energy sources and associated technologies
- Analyze the environmental and social implications of energy production and consumption
- Evaluate the effectiveness of policies and strategies for promoting sustainable energy and environmental practices.
- Advocate for sustainable energy and environmental practices as informed and active citizens

SYLLABUS OF DSE-EVS-14

Theory (02 Credits: 30 lectures)

UNIT – I Concepts of Energy and Environment (1 Weeks) (2 lectures)

Definition and scope of energy and environment, Types of energy and their environmental impacts, Energy production and consumption trends, Global warming and climate change, Ecological footprint, Energy and environmental policies, Environmental impact assessment, Sustainable development

UNIT – I Fossil Fuels and their Environmental Impact (1 Weeks) (2 lectures)

Coal, oil, and gas extraction and processing, Greenhouse gas emissions and climate change, Air pollution from fossil fuels, Water pollution from fossil fuels, Environmental impacts of oil spills, Acid rain, Land degradation from mining, Fossil fuel dependence and energy security

UNIT – II Renewable Energy Sources (1 Weeks) (2 lectures)

Solar energy, Wind energy, Geothermal energy, Hydroelectric power, Ocean energy, Bioenergy, Biomass and biofuels, Renewable energy technologies and their environmental impact

UNIT – III Energy Efficiency and Conservation (2 Weeks) (4 lectures)

Energy efficiency in buildings, Energy-efficient appliances and electronics, Transportation efficiency and fuel economy, Energy conservation behaviours, Energy audits and retrofits, Green building design and construction, Smart grids and energy storage, Energy-efficient lighting

UNIT – IV Energy and the Environment in Developing Countries (3½ Weeks) (7 lectures)

Energy access and poverty alleviation, Energy consumption patterns in developing countries, Clean energy technologies for developing countries, Environmental impacts of energy in developing countries, Energy and sustainable development, Energy financing and investment in developing countries, Capacity building and technology transfer, International cooperation on energy and the environment, India's efforts for a sustainable sources of energy and self-reliance

UNIT – V Environmental Impacts of Nuclear Energy (2½ Weeks) (5 lectures)

Nuclear power generation and its environmental impact, Nuclear accidents and their environmental impact, Nuclear waste management and disposal, Nuclear proliferation and security risks, Alternatives to nuclear energy, Public perception of nuclear energy, Nuclear energy and climate change, Nuclear energy policies and regulations

UNIT –VI Energy Policy and Regulation (2½ Weeks) (5 lectures)

International energy policies and agreements, National energy policies and goals, Renewable energy incentives and subsidies, Fossil fuel subsidies and taxation, Energy market regulation, Energy efficiency standards and labelling, Carbon pricing and emissions trading, Energy security and geopolitical considerations

UNIT – VII Emerging Energy Technologies and Future Prospects (1½ Weeks) (3 lectures)

Energy storage technologies, Carbon capture and storage, Artificial photosynthesis, Fusion energy, Energy from waste, Smart cities and energy systems, Future energy scenarios and modelling, Technological innovation and energy transitions

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. Measure energy consumption of household appliances and calculate the energy savings from switching to energy-efficient appliances and recommend the most efficient options
2. Conduct an energy audit of a building to identify areas of energy waste in a building and recommend energy-saving measures
3. Analyze the carbon footprint of a household or business and recommend ways to reduce it
4. Evaluate the environmental impact of different waste disposal methods in your city and recommend the most sustainable options
5. Investigate the impact of water usage on the environment and energy sector and recommend ways to conserve water sustainably
6. Analyze the impact of energy policy on the environment and recommend more sustainable policies.
7. Investigate the impact of transportation choices on energy and the environment and develop a sustainable plan for the city
8. Measure the efficiency of solar panels under different light intensities and angles of incidence
9. Assess the environmental impacts of a product or process throughout its entire life cycle, from raw materials extraction to disposal.
10. Measure the concentration of different greenhouse gases in the atmosphere and track their trends over time
11. Set up to convert waste materials into energy using selected biological method(s)
12. Analyze using of electric vehicles or public transportation in your city as sustainable transportation options and evaluate their environmental impacts

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

- Hoffert, M. I. (2021). *Energy and climate change: How to achieve a successful energy transition*. Cham, Switzerland: Springer.
- Mebratu, D. (2021). *Energy, environment, and sustainable development: A socio-economic approach*. Abingdon, UK: Routledge.
- Smil, V. (2020). *Growth: From microorganisms to megacities*. Cambridge, MA: MIT Press.
- Sovacool, B. K., Heffron, R. J., & McCauley, D. (Eds.). (2020). *Energy democracy: Goals and policies*. Cham, Switzerland: Palgrave Macmillan.
- Westra, L., & Carbonnier, G. (2021). *Energy transition, capitalism and the environment: Problems and solutions*. Abingdon, UK: Routledge.

Suggested readings

- Burchell, K., & Rettie, R. (2021). *Energy ethics: Conceptualizing a moral compass for energy transitions*. London, UK: Palgrave Pivot.
- Levi, M. A. (2021). *The power surge: Energy, opportunity, and the battle for America's future*. New York, NY: Oxford University Press.
- Monbiot, G. (2021). *Heat: How to stop the planet burning*. London, UK: Penguin.
- Nye, D. E. (2021). *Powering the new civilization: Energy, civilization, and the demands of the future*. New York, NY: HarperCollins.
- Raza, S. A. (2021). *The political ecology of energy transitions: A political economy approach*. Abingdon, UK: Routledge.
- Rifkin, J. (2020). *The Green New Deal: Why the fossil fuel civilization will collapse by 2028, and the bold economic plan to save life on Earth*. New York, NY: St. Martin's Press.

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