ENVIRONMENTAL SCINECE (MINOR)
Syllabus for Undergraduate Course
Under NEP 2020
First Semester (4 credits)
Total Marks 100

Course I: FUNDAMENTALS OF ENVIRONMENTAL SCINECE

COURSE OBJECTIVES:

To Study:

1. Origin and Evolution of Earth
2. Ecosystem Dynamics
3. Natural Resources and their Management
4. Biodiversity and their Conservation

COURSE CODE: ENSG - 1(TH) (3 Credits)

COURSE OUTCOME: After successful completion of the course, the students will develop following attribute.

COURSE OUT COME	ATTRIBUTES
CO1	Students will be acquainted with history of earth and begging of life on earth. They will also gain knowledge on structure and function of ecosystem.
CO2	They will know natural resources, their use and management.
CO3	They will learn the importance of biodiversity. They will also learn the sustainable use and protection of biodiversity

Unit wise detail content		
Unit 1	**16 hours**	**Title of Unit: Origin and Evolution of Earth**
Formation of the Earth: Formation and composition of Core, Mantle, Crust, Atmosphere and Hydrosphere, Chemical composition of Earth, Geological time scale and major changes on the Earth's surface. Movement of lithosphere plates: Mantle convection and Plate tectonics, Earthquakes, Volcanic activities, Orogenesis, Isostasy, Continental drift, Pangaea and present- day continents, Paleontological evidences of evolution of life on earth.		

Unit 2	**16 hours**	**Title of Unit: Ecosystem Dynamics**
Definition and types of Ecosystems, Biotic and Abiotic components of Ecosystem, Ecological amplitude, Liebig's Law of the Minimum, Shelford's Law of Tolerance, Ecosystem metabolism, primary production and models of energy flow, secondary production and Trophic Efficiency, Food chain, Food web, Detritus pathway of energy flow and decomposition processes, Ecological efficiencies, Ecological pyramids, Cybernetic nature of Ecosystem.		
Unit 3	**16 hours**	**Title of Unit: Natural resources and their Management**
Classification of natural resources: Renewable and Non-renewable resources, Overexploitation of forest resources and management strategies, Sustainable forestry, Water resources: Water conservation strategies, Soil as a resource: Soil conservation strategies, Food resources, Mineral resources, Mining: Surface, Sub-surface, Open-pit, Dredging, Strip, Environmental effects of Mineral exploration. Occupational health. Environment and Public Health in Contemporary Society		
Unit 4	**16 hours**	**Title of Unit: Biodiversity and their Conservation**
Biodiversity: Hierarchical levels (Genetic diversity, Species diversity, Ecosystem diversity), Latitudinal Gradients of biodiversity, Biodiversity as a resource, Productive and consumptive values, Causes of biodiversity loss, Rare, Threatened and Endangered flora and fauna, Concept of Endemism and Invasive species, Biodiversity Hotspots of India, Strategies for Biodiversity Conservation, Ex-situ, In-situ strategies (Wild life sanctuaries, National Parks and Biosphere reserves, Gene bank and Seed bank), Biodiversity documentation, Convention on Biological Diversity, Role of local communities and Traditional Knowledge in conservation.		

Suggested Reading:

1. Allaby, M. (2002). Basics of Environmental Science. Routledge.
2. Barry, G. R. and Chorley, J. R. (2003). Atmosphere, Weather and Climate. Routledge, London.
3. Critchfield, H. J. (1995). General Climatology. Printice Hall of India.
4. Horne, A. J., & Goldman, C. R. (1994). Limnology (Vol. 2). New York: McGraw-Hill.
5. Lutgens, F. K. and Tarbuck, E. J. (1982). Atmosphere Introduction to Meteorology. Prentice Hall Inc.
6. Manahan, S. E. (2011). Fundamentals of environmental chemistry. CRC press.
7. Miller, G. T., & Spoolman, S. (2015). Environmental Science. Cengage Learning.

8. Miller, Jr. G. T. (1994). Living in the Environment: Principles, Connections and Solutions. Wadsworth Publishing Co.
9. Miller, R. W. and Donahue, R. L. (1992). Soils Introduction to Soils and Plant Growth. Prentice Hall of India.
10. Mitra, A., & Chaudhuri, T. R. (2020). Basics of Environmental Science. New Central Book Agency.
11. Nandini, N. (2019). A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.
12. Wright, R. T. (2007). Environmental science: toward a sustainable future. Jones & Bartlett Publishers.

COURSE CODE: ENSG - 1(PR) (1 Credit)

COURSE OUTCOME: After successful completion of the course, the students will develop following attribute.

COURSE OUT COME	ATTRIBUTES
CO1	Students will be able to identify various rocks & minerals and method of their formation.
CO2	They will be able to estimate the population size of flora and fauna of vegetation.
Detail content of Practical	
1. Identification of Rocks and Minerals. 2. Identification and submission of report on Non-Timber Forest Products. 3. Preparation of model on Earth processes. 4. Preparation of land use map of an area. 5. Visit to Biodiversity Conservation site and preparation of report. 6. Preparation of Herbarium and preparation of Geo-tagged Vegetation map.	

Suggested reading:

1. Nandini, N. (2009). Handbook on water quality monitoring and Assessment. Sapna Book House, Bengaluru.

2. Sawyer, C. N. and Mc Carty, P. L. (1978). Chemistry for Environmental Engineering. Mc Graw Hill International.
3. Saxena M M. (1990). Environmental Analysis: Water, Soil and Air. Edition, 2. Publisher, Agro Botanical Pub.
4. Standard Methods for Examination of Water and Wastewater. (2017). APHAWEF.
5. Trivedi, P. K. and Goel, P. K. (1984). Chemical and Biological Methods of Water Pollution Studies. Environmental Publication.
6. Zhang, C. (2007). Fundamentals of environmental sampling and analysis. John Wiley & Sons.

ENVIRONMENTAL STUDIES (INTERDISCIPLINARY COURSE)
Syllabus for Undergraduate Course
Under NEP 2020
First Semester (3 Credits)
Total marks-100

Unit-1. Basic Concepts of Environmental Studies (16 hours)

Definitions and principles of Environment; Structure and components of Environment- Atmosphere, Hydrosphere, Lithosphere, Biosphere; Multi disciplinary nature of Environmental Studies; Scope and importance of Environmental Studies- different environment related day celebration and their significance; Need for environmental awareness among general public.

Unit-2. Natural Resources (16 hours)

Concept of Renewable and Non-renewable resources; Land resources – Land degradation, soil erosion and desertification; Forest Resource - Deforestation: Causes, consequences and remedial measures; Water Resources: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state); Energy resources: Environmental impacts of energy generation use of alternative and nonconventional energy sources.

Unit-3. Environmental Problems and global environmental issues (16 hours)

Classification of environmental problems; Green House effect; Climate change; Acid deposition; Desertification; Ozone layer depletion. Mitigation processes of Environmental issues.

Unit-4. Environmental Sustainability & Environmental Literacy (16 hours)

Environmental Sustainability: Millennium Development Goals, Sustainable Development Goals; National and International Conventions: Earth Summit 1992 , United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, Convention on Biological Diversity , United Nations Convention to Combat Desertification (UNCCD) ,Vienna Convention on the Protection of the Ozone Layer ,Convention on Migratory Species (CMS) , International Union for Conservation of Nature (IUCN), Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES), Ramsar Convention on Wetlands, Basel Convention on Transboundary Movement of Hazardous Substances; Environmental Ethics: Anthropocentric View, Bio-centric View, Eco-centric View; Environmental literacy (Formal and Non-formal education)

Suggested Reading :

- Asthana, D. K. (2006).Text Book of Environmental Studies. S. Chand Publishing.
- Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
- Bharucha, E. (2015). Textbook of Environmental Studies.
- Barry, R. G. 2003. Atmosphere, Weather and Climate. Routledge Press, UK.
- Mastters GM. Introduction to Environmental Engineering & Science. Prentice Hall of India
- Cunningham, W.P. and Cunningham, M.A., 2007. Principles of Environmental Science, Inquiry and Solutions. Special Indian Edition. McGraw Hill Education (India) Pvt. Ltd., New Delhi.
- Fehling, M., Nelson, B.D., and Venkatapuram, S., 2013. Limitations of the Millennium Development Goals: a literature review. Global Public Health. Vol.8 (10), pp. 1109- 1122.
- Miller, G.T. and Spoolman, S.E., 2013. Environmental Science. 14th edition. Environmental Science. Brooks/Cole Cengage Learning, USA.
- Miller, Jr., G.T., 2007, Living in the Environment, Principles, Connections and Solutions. 15th edition. Brooks/Cole Cengage Learning, USA.
- Misra, S.P. and Pandey, S.N., 2018. Essential Environmental Studies. 4th edition. Ane Publications, New Delhi.
- Sharma, P.D., 2015-16. Ecology and Environment.12th edition. Rastogi Publications, Meerut
- Wright, R. T. and Boorse, D.F., 2015. Environmental Science: Towards a Sustainable Future. 12th edition. Pearson India Education Services Pvt. Ltd., NOIDA, India

Important Links

- Agenda 21, a comprehensive document.
- https://sustainabledevelopment.un.org/ content/documents/Agenda21.pdf International Union for Conservation of Nature,
- https://www.iucn.org/about The Basel Convention on Transboundary Movement of Hazardous Substances,
- http:/ /www.basel.int/theconvention/overview/tabid/1271/default.aspx The Convention on Biodiversity,
- https://www.cbd.int/ The Convention on International Trade of Endangered Species,

- https://www.cites.org/ eng/disc/what.php The Convention on Migratory Species,
- https://www.cms.int/ The Millennium Development Goals and indicators,
- http://mdgs.un.org/unsd/mdg/ Host.aspx?Content=Indicators/OfficialList.htm. 87 The Montreal Protocol,
- https://www.environment.gov.au/protection/ozone/ Environmental Sustainability montreal-protocol The Ramsar Convention on Wetlands,
- https://www.ramsar.org/about/. The report of World Commission on Environment and Development, "Our Common Future",
- https://sustainabledevelopment.un.org/content/documents/5987ourcommon-future.pdf The SDGs India report,
- https://sustainabledevelopment.un.org/content/documents/ 16693India.pdf The Stockholm Declaration.
- https://www.ipcc.ch/apps/njlite/srex/njlite_ download.php?id=6471 The Sustainable Development Goals indicators,
- https://unstats.un.org/sdgs/ indicators/indicators-list/ The United Nations Convention to Combat Desertification,
- https://www.unccd.int. The United Nations Framework Convention on Climate Change (UNFCCC), https:/ /unfccc.int/about-us/about-the-secretariat