

Curriculum Framework for Environment Education at Undergraduate level

APR 2020

CONTENTS

UNIT	TITLES	HOURS
I	<p>Humans and the Environment</p> <ul style="list-style-type: none"> • Humans as Nomads, Hunter-gatherers, invention of Fire • Evolution of River Valley Civilization- origin of agriculture, Emergence of settlements- hutments, villages, cities • Middle ages and Renaissance • Modern age—Industrial revolution • Population rise and Natural resources depletion, overexploitation • Consumerist lifestyle, waste generation and its impacts on environmental quality, Global Climate change • The emergence of Environmentalism and Possibilism, Eco-centric perspectives • International efforts- UN Conference on Human Environment 1972 (UNCHE), World Commission on Environment and Development, Concept and goals of Sustainable Development, Rio summit • Role of females in environment conservation <p>References:</p> <ol style="list-style-type: none"> 1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press. 2. Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press. 3. Hughes, J. Donald (2009) An Environmental History of the World- Humankind's Changing Role in the Community of Life, 2nd Edition. Routledge. 4. Perman, R., Ma, Y., McGilvray, J., and Common, M. (2003) Natural Resource and Environmental Economics. Pearson Education. 5. Simmons, I. G. (2008). Global Environmental History: 10,000 BC to AD 2000. Edinburgh University Press 	4



II	<p>Natural Resources and Sustainable Development</p> <p>Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable.</p> <ul style="list-style-type: none"> • Biotic resources: Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges. • Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water. • Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation. • Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment. <p>Sustainable Development Goals and Issues</p> <p>Strategies and Framework for Sustainable Development The 2030 Agenda for Sustainable Development, UN Sustainable Development Knowledge Platform, Sustainable Development Goals, Criticisms in Sustainability: Women and Gender Equality, Education, Public Engagement and Sustainable Development</p> <p>Environmental Conservation and Sustainability</p> <p>Technical Skills in Environment and Sustainability, Environmental Governance and Sustainability, Environmental Economics and Sustainability, Water Conservation and Sustainable Development, Urbanization and Sustainable Cities, Challenges in Energy, Food,</p>	6
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	<p style="text-align: center;">Forest and Agriculture</p> <p>References:</p> <ol style="list-style-type: none"> 1.Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson. 2. John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd Edition, Weir Publisher (ELBS) 3. William P.Cunningham and Mary A. (2015) Cunningham Environmental Science: A Global Concern, Publisher (Mc-Graw Hill, USA) 4. Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson) 5. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006 Ecology, Environment and Resource Conservation. Anamaya Publications https://sdgs.un.org/goals 	
III	<p>Environmental Issues: Local, Regional and Global</p> <ul style="list-style-type: none"> • Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena • Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. • Pollution: Impact of sectoral processes on Environment, Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Transboundary air pollution; Acid rain; Smog. • Land use and Land cover change: land degradation, deforestation, desertification, urbanization. <p>References:</p> <ol style="list-style-type: none"> 1.Harper, Charles L. (2017) Environment and Society, Human Perspectives on Environmental Issues 6th Edition. Routledge. 2. Harris, Frances (2012) Global Environmental Issues, 2nd Edition. 	6



	<p>Wiley- Blackwell.</p> <p>3. William P. Cunningham and Mary A. (2015). Cunningham Environmental Science: A global concern, Publisher (Mc-Graw Hill, USA)</p> <p>4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238</p> <p>5. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.</p>	
IV	<p>Conservation of Biodiversity and Ecosystems</p> <p>Biodiversity Types, levels, biogeographic zones in India and its classification, values of biodiversity</p> <ul style="list-style-type: none"> • Biological Diversity at National Level, Hotspots of Biodiversity • major threats to Biodiversity: Land use and land cover change , Commercial exploitation of species , Invasive species , Fire , Disasters ,Climate change and Man- Wildlife Conflicts • Endangered and Major Endemic Species in India • Conservation of Biodiversity. In-Situ, Ex-Situ Conservation ,Major conservation policies, National and International Instruments for Biodiversity Conservation , • The laws – Environment Protection Act1986, Forest Act, Wildlife Act, Biodiversity Act 2002 , The Convention on Biological Diversity (CBD) , International Union for the Conservation of Nature (IUCN) ,United Nations Environmental Programme (UNEP) , World Wildlife Fund (WWF) • The role of traditional knowledge, People’s Participation – NBSAP, PBR , Community Participation – JFM, EDP , People’s Movement – Silent Valley Movement, Beej Bachao Andolan. ,Gender wise conservation Awareness Activities.,Importance and Need of Awareness • Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics- forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- 	6



	<p>classification and their significance.</p> <p>References:</p> <ol style="list-style-type: none"> 1. Bawa, K.S., Oomen, M.A. and Primack, R. (2011) Conservation Biology: A Primer for South Asia. Universities Press. 2. Sinha, N. (2020) Wild and Wilful. Harper Collins, India. 3. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) Conservation through Sustainable Use: Lessons from India. Routledge. 4. Bhagwat, Shonil (Editor) (2018) Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge. 5. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK 	
V	<p>Environmental Pollution and Health</p> <p>Definition of pollution; Point sources and non-point sources of pollution.</p> <ul style="list-style-type: none"> • Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants- carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards. • Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life. • Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. • Noise pollution: Noise pollution-sources; frequency, intensity and permissible ambient noise levels; effect on communication, 	6



	<p>impacts on life forms and humans - working efficiency, physical and mental health; control measures.</p> <ul style="list-style-type: none"> • Thermal and Radioactive pollution: Sources and impact on human health and ecosystems. <p>uggested Readings</p> <ol style="list-style-type: none"> 1. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education. 2. Masters, G. M., & Ela, W. P. (2008). <i>Introduction to environmental engineering and science</i> (No. 60457). Englewood Cliffs, NJ: Prentice Hall. 3. Miller, G. T., & Spoolman, S. (2015) Environmental Science. Cengage Learning. 4. Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/standards/ 5. Ahluwalia, V. K. (2015). <i>Environmental Pollution, and Health</i>. The Energy and Resources Institute (TERI). 	
VI	<p>Climate Change: Impacts, Adaptation and Mitigation</p> <ul style="list-style-type: none"> • Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions– past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. <p>Impacts, vulnerability and adaptation to climate change:</p> <ul style="list-style-type: none"> • ocean and land systems; • Sea level rise, changes in marine and coastal ecosystems; • Impacts on forests and natural ecosystems; • Impacts on animal species, • agriculture, • health, • urban infrastructure 	6



	<p>The concept of vulnerability and its assessment:</p> <ul style="list-style-type: none"> • Adaptation vs. resilience; • Climate-resilient development; <p>Indigenous knowledge for adaptation to climate change.</p> <p>Mitigation of climate change</p> <p>Green House Gas (GHG); Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and <i>Intended Nationally Determined Contributions</i> (INDCs); Climate justice.</p> <p>References:</p> <ol style="list-style-type: none"> 1. Pittock, Barrie (2009) <i>Climate Change: The Science, Impacts and Solutions</i>. 2nd Edition. Routledge. 2. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/. 3. Adenle A., Azadi H., Arbiol J. (2015). Global assessment of technological innovation for climate change adaptation and mitigation in developing world, <i>Journal of Environmental Management</i>, 161 (15): 261-275. 4. Barnett, J. & S. O'Neill (2010). Maladaptation. <i>Global Environmental Change—Human and Policy Dimensions</i> 20: 211-213. 5. Berrang-Ford, L., J.D. Ford & J. Paterson (2011). Are we adapting to climate change ? <i>Global Environmental Change—Human and Policy Dimensions</i> 21: 25-33. 	
VII	<p>Environmental Management</p> <ul style="list-style-type: none"> • Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; • Role of environmental management in sustainable development, tools of environmental management • Environmental Management System, background of ISO 14000 	6



	<p>series, Goal & scope of EMS, Plan-do-check-act model, benefits of implementing EMS</p> <ul style="list-style-type: none"> • Environmental Audit- definition, importance for industry, Rule 14 of EPA (1986) and form V • Life Cycle Analysis, definition, goal & scope, stages in LCA, benefits and limitation of LCA • Environmental Impact Assessment- concept & definition, EIA as a planning tool, stages in EIA, EIA notification (2006), public participation, benefits & limitations of EIA • Environmental design, reducing waste through 3Rs- (Reduce, Reuse & Recycle), circular economy vs linear economy, eco-labelling/eco-mark scheme • Environmental management system: ISO 14001 <p>References:</p> <ol style="list-style-type: none"> 1. Jørgensen, Sven Marques, Erik João Carlos and Nielsen, Søren Nors (2016) Integrated Environmental Management, A transdisciplinary Approach. CRC Press. 2. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press. 3. Barrow, C. J. (1999). Environmental management: Principles and practice. Routledge. 4. Tiefenbacher, J (ed.) (2022), Environmental Management - Pollution, Habitat, Ecology, and Sustainability, Intech Open, London. 10.5772/ 5. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press. 	
VIII	<p>Environmental Treaties and Legislation</p> <p>Constitutional Provisions and National Policies</p> <p>Constitutional Provisions for Environmental Protection:</p> <ul style="list-style-type: none"> • National Environmental Policy, 	6



- Forest Policy
- Eco mark Scheme,
- Conservation Strategy and Policy Statement,
- Public Interest Litigation

Anti-pollution Acts with Important Amendments

- The Air (Prevention and Control of Pollution) Act, 1981,
- The Water (Prevention and Control of Pollution) Act, 1974,
- Anti-pollution Rules the Noise Pollution (Regulation and Control) Rules, 2000
- E-waste (Management) Rules, 2016,
- Hazardous Waste Management Rules, 2016, Bio-Medical Waste Management Rules, 1999,
- Solid Waste Management Rules 2016,
- Regulatory framework for Genetically Engineered Plants in India

Conventions and Treaties

- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Basel, 1989
- Cartagena Protocol on Biosafety 2000
- Convention on Biological Diversity (CBD), Nairobi, 1992
- Convention to Combat Desertification (CCD), Paris, 1994
- Framework Convention on Climate Change (UNFCCC), New York, 1992
- Kyoto Protocol - greenhouse gas emission reductions
- Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1989

IX	Case Studies and Field Work	6
	Discussion on one national and one international case study	



related to the environment and sustainable development.

- Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.
- Documentation of campus biodiversity.
- Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.



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