


B.Sc. (Basic/Hons.) Semester 1

Title of the Course: **ES 1T1 - DIVISIONS OF THE ENVIRONMENT**

Number of Theory Credits	Number of lecture hours/ semester	Number of Practical Credits	Number of practical hours/ semester
4	52	2	52

PROGRAMME SPECIFIC OBJECTIVES	
PSO 1	To develop competency in understanding the interrelatedness of the divisions of the Environment.
PSO 2	To instill an introductory knowledge of the divisions of Environment and develop necessary analytical skills to characterise their variations.
PSO 3	To motivate and inspire to acquire contemporary understanding and skills leading to issue identification.
PSO 4	To inculcate creativity and innovative spirit in the domain of human-environment interface leading to vocation/entrepreneurial opportunities.

PROGRAMME OUTCOMES	
PO 1	Demonstrate an entry level competence in understanding the environmental divisions and associated processes.
PO 2	Demonstrate the ability to carry out water quality analysis in the laboratory and interpret the results.
PO 3	Ability to understand and appreciate the role of environmental parameters in specific day-to-day activities.
PO 4	Be able to understand the demands and function in work environment dealing with environmental systems


DEAN

Content of Theory Course 1	52Hrs
Unit - 1	08
<p>Environmental Education: Definition, Aim, Objectives and Scope.</p> <p>Environmental Science: Definition, Aim of study and Scope. Differences between Ecology and Environmental Science; Various approaches of studying Environmental Science.</p> <p>Components of the Environment: Definitions of Atmosphere, Hydrosphere, Lithosphere and Biosphere - their complex interactions and significance.</p>	
Unit - 2	16
<p>Atmosphere: Evolution of the atmosphere – Principal components – Permanent and variable gases. Structure of the atmosphere on the basis of temperature and composition.</p> <p>Ozone chemistry - Depletion and recovery of stratospheric ozone – monitoring, effects and control measures.</p> <p>Climatology: Differences between weather and climate; Insolation - Factors affecting the distribution. Solar (short-wave) and terrestrial (long-wave) radiations. Earth's Albedo and Heat budget of the earth. Tropical monsoon climate – Tropical cyclones and their impacts. Weather forecasting and modification. El-Nino and La-Nina effect.</p> <p>Global warming, effects and control measures; Global dimming - Definition, causes and implications; Urban Heat Islands.</p>	
Unit - 3	14
<p>Hydrosphere: Hydrologic cycle - process of heat energy transfer - Radiation, Conduction and Convection. Types of lifting and precipitation - Bergeron process – Cloud formation and classification. Forms of condensation; Forms of precipitation. Cloud seeding.</p> <p>Limnology: Definition – Lotic and Lentic environment. Differences between Lotic and Lentic systems.</p> <p>Lotic environment: Springs, Stream profile: Potomoc and Rhithron.</p> <p>Lentic environment: Ponds, lakes and estuaries – their types. Photic and thermal stratification of Lentic systems.</p> <p>Marine environment: Zonation, Salinity status of marine environment, biotic communities of oceanic zones, acidification of sea water; ocean currents and tides –significance; Polymetallic nodules.</p> <p>Ground water: Definition. Zonation; Types of wells. Salinization of ground water in coastal regions.</p>	
Unit - 4	14
<p>Lithosphere: Definition. Internal structure of the earth.</p> <p>Endogenic processes: Plate Tectonics – Earthquake and Volcanism – Causes, Effects, and Management.</p> <p>Exogenic processes: River, Wind, and Glacier as geological agents; Avalanches and Landslides.</p> <p>Mineralogy: Definition. Outline classification of minerals</p> <p>Petrology: Definition, Rock Cycle, Classification - Igneous, Sedimentary and Metamorphic rocks – their formation – types – uses.</p> <p>Pedology: Soil – definition – formation – soil profile. Types – Alluvial; Black; Red and Laterite; Arid and Desert; Saline and Alkaline; Peaty and Marshy; Grassland, Forest and Mountain Soils. A brief account of Soil biota. Soil weathering and erosion – Types, effects and management.</p>	

References

- Allaby, M. (2002). Basics of Environmental Science. Routledge.
- Barry, G. R. and Chorley, J. R. (2003). Atmosphere, Weather and Climate. Routledge, London.
- Critchfield, H. J. (1995). General Climatology. Printice Hall of India.
- Horne, A. J., & Goldman, C. R. (1994). Limnology (Vol. 2). New York: McGraw-Hill.
- Lutgens, F. K. and Tarbuck, E. J. (1982). Atmosphere – Introduction to Meteorology. Prentice Hall Inc.
- Manahan, S. E. (2011). Fundamentals of environmental chemistry. CRC press.
- Miller, G. T., & Spoolman, S. (2015). Environmental Science. Cengage Learning.
- Miller, Jr. G. T. (1994). Living in the Environment: Principles, Connections and Solutions. Wadsworth Publishing Co.
- Miller, R. W. and Donahue, R. L. (1992). Soils – Introduction to Soils and Plant Growth. Prentice Hall of India.
- Mitra, A., & Chaudhuri, T. R. (2020). Basics of Environmental Science. New Central Book Agency.
- Nandini, N. (2019). A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.
- Wright, R. T. (2007). Environmental science: toward a sustainable future. Jones & Bartlett Publishers.

Formative Assessment – Continuous Internal Assessment = 30% (30 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	70% (70 Marks)
Total	100% (100 Marks)

Content of Practical Course 1: List of experiments to be conducted

ES 1P1: WATER QUALITY ANALYSIS

(Total Teaching Hours = 52; Total Credits = 2)

- 1) Sampling technique of water
- 2) Determination of pH – pH metric method
- 3) Determination of Electrical Conductance – Conductivity meter method
- 4) Estimation of Turbidity – Nephelometric method
- 5) TS, TSS & TDS – Gravimetric and Filtration method
- 6) Estimation of Acidity – Alkalimetric method / CO₂ – NaOH titration method
- 7) Estimation of Alkalinity – Acidimetric method
- 8) Estimation of Hardness – EDTA Complexometric method
- 9) Estimation of Chlorides – Argentometric method
- 10) Estimation of Dissolved Oxygen – Modified Winkler's method
- 11) Estimation of Nitrates – Phenoldisulfonic Acid method
- 12) Estimation of Fluorides – Fluoride meter method/SPADNS Reagent method
- 13) Estimation of Sulphates – Barium chloride method
- 14) Determination of Density, Surface Tension and Viscosity of water and other liquid samples

References

- Nandini, N. (2009). Handbook on water quality monitoring and Assessment. Sapna Book House, Bengaluru.
- Sawyer, C. N. and Mc Carty, P. L. (1978). Chemistry for Environmental Engineering. Mc Graw – Hill International.
- Saxena M M. (1990). Environmental Analysis: Water, Soil and Air. Edition, 2. Publisher, Agro Botanical Pub.
- Standard Methods for Examination of Water and Wastewater. (2017). APHA – WEF.
- Trivedi, P. K. and Goel, P. K. (1984). Chemical and Biological Methods of Water Pollution Studies. Environmental Publication.
- Zhang, C. (2007). Fundamentals of environmental sampling and analysis. John Wiley & Sons.

Formative Assessment – Practical Internal Assessment = 30% (15 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	70% (35 Marks)
Total	100% (50 Marks)

ES OE1: ENVIRONMENTAL CONSERVATION MOVEMENTS

Number of Theory Credits	Number of lecture hours/ semester
3	42

Content of OPEN ELECTIVE Theory Course 1	42Hrs
Unit – 1	14
<p>Environment: Definition, role of environment in shaping civilizations. Interrelations between civilization and environment – ecological economic and socio-cultural. Industrial revolution and environmental pollution. Globalization and environmental pollution. Modern agriculture and environmental degradation.</p> <p>Development: Definition, Growth and development. Population growth and its impact on natural resources, Modernization and population. Causes for industrialization, changing life styles, regulatory aspects of industrialization, overall impact of industrialization on quality of human life, negative impacts of industrialization and urbanization.</p>	
Unit - 2	14
<p>Development and Environment: Types of development. Sustainable development – Need, relevance in contemporary society.</p> <p>Principles of Sustainable Development: History and emergence of the concept of Sustainable Development, Definitions, Environmental issues and crisis, Resource degradation, greenhouse gases, desertification, invasive species, wildlife depletion and social insecurity.</p> <p>United Nations Sustainable Development Goals. Strategies for implementing eco-development programmes, Sustainable development through - trade, economic growth, carrying capacity and public participation.</p>	
Unit - 3	14
<p>People movements: Types – Concept of environmental movements, Definition, levels of collective action, the local grassroots movement level; the social movement level; a cycle of protest.</p> <p>Environmental Movements: United Nations Conference on Human Environment, 1972 – 'Limits to Growth'. The Brundtland Commission, 1987 – 'Our Common Future'. The United Nations Conference on Environment and Development, 1992.</p> <p>Environmental Movements of India: Bishnoi Movement, The Chipko Movement, Appiko Movement, Silent Valley Movement, Narmada Bachao Andolan, Jungle Bachao Andolan, Beej Bachao Andolan.</p> <p>Urban-based Environmental Movements – Local case studies.</p>	

References

- Bindra, P. S. (2017). The Vanishing: India's Wildlife Crisis. Penguin Random House India.
- Climate Change: Science and Politics. (2021). Centre Science and Environment, New Delhi.
- Edwards, Andres R. (2005). The Sustainability Revolution: Portrait of a Paradigm Shift. New Society Publishers.

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- Nagendra, H., & Mundoli, S. (2019). Cities and canopies: trees in Indian cities. Penguin Random House India Private Limited.
- Nepal, Padam. (2009). Environmental Movements in India: Politics of Dynamism and Transformations, Authors press, Delhi.
- Rachel Carson. (2002). Silent spring. Houghton Mifflin Harcourt.
- Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: In Figures. Centre Science and Environment.
- Sustainable development in India: Stocktaking in the run up to Rio+20. (2011). TERI for MoEF&CC.

Formative Assessment – Continuous Internal Assessment = 30% (30 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	70% (70 Marks)
Total	100% (100 Marks)

ES OE1: ENVIRONMENT AND SUSTAINABLE AGRICULTURE

Number of Theory Credits	Number of lecture hours/ semester
3	42

Content of OPEN ELECTIVE Theory Course 1	42Hrs
Unit – 1	14
Environment – Definition, scope and significance. Agriculture – Definition, scope and significance. Environmental basis for agriculture and food. Agricultural patterns in India. Socio-economic pressures on agriculture. Food security and food scarcity. Types of agriculture – rain-fed cultivation and irrigation – water intensive agriculture – Reservoirs and ground water exploitation. Conventional and mechanised agriculture. Natural and chemical agriculture. Subsistence and commercial agriculture. Environmental effects of land use and landscape changes.	
Unit - 2	14
Environmental determinants of agriculture – role of rainfall, humidity, wind, topography and edaphic factors in crop selection. Animal husbandry – Dairy and poultry – role of transboundary species of cattle in Indian scenario. Pisciculture – Environmental effects of intensive pisciculture. Agricultural biodiversity: Crop diversity – Definition and significance. Poly culture and mono culture. Influences of green revolution on modern agricultural practices of India – Loss of agrobiodiversity – Influence of transboundary crops. Agricultural biotechnology – Genetically Modified Crops – Influence on environment. Pollination crisis. Integrated pest management.	
Unit - 3	14
Environmental impacts of agriculture – Loss of biodiversity – soil salinity – Fertilizer and pesticide pollution, Climate change and global warming. Erosion and problems of deposition in irrigation systems. Desertification. Biomagnification – Case studies. Contemporary issues and management – Farmer distress – market mechanisms – natural farming methods/organic farming. Urban agriculture and hydroponics. Ecological principles of farming – Sustainable agriculture – Significance of indigenous crops and cattle varieties. Watershed management. Agricultural policies of India.	

References

- Altieri, M. A. (2018). Agroecology: the science of sustainable agriculture. CRC Press.
- Campanhola, C., & Pandey, S. (Eds.). (2018). Sustainable food and agriculture: An integrated approach. Academic Press.
- de Zeeuw, H., & Drechsel, P. (Eds.). (2015). Cities and agriculture: Developing resilient

urban food systems. Routledge.

- Eric Lichtfouse, Mireille Navarrete, Philippe Debaeke, Souchere Veronique, Caroline Alberola. (2009). Sustainable Agriculture. Springer Science & Business Media.
- Kazim B. Rahim Debash Sarkar Bidhan Chand. (2012). Sustainable Agriculture and Environment. New Delhi Publishers.
- Satyanarayana, T., Johri, B. N., & Prakash, A. (Eds.). (2012). Microorganisms in sustainable agriculture and biotechnology. Springer Science & Business Media.
- Songstad, D. D., Hatfield, J. L., & Tomes, D. T. (Eds.). (2014). Convergence of food security, energy security and sustainable agriculture (Vol. 67). New York: Springer.

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ES OE1: ENVIRONMENTAL POLLUTION

Number of Theory Credits	Number of lecture hours/ semester
3	42

Content of OPEN ELECTIVE Theory Course 1	42Hrs
Unit – 1	14
<p>Environmental pollution: Definition, Types. Environmental contaminants and environmental pollutants. Classification of pollutants – on the basis of physical properties and forms of their existence. Primary and secondary pollutants, degradable and non-degradable, point and non-point sources of pollution. Xenobiotics and persistent organic chemicals. Characteristics of pollution – Large production quantities, usage involving leakages, toxicity, persistence and accumulation.</p> <p>Air pollution: Definition, sources of air pollution and their effects on flora, fauna, human-beings and materials. Indoor pollution, automobile pollution, ozone depletion and recovery, global warming and climate change. London smog, Bhopal gas tragedy, Visakhapatnam gas leak and endosulphan tragedy in Karnataka. Air quality standards – NAAQS, AQI, Bharat Stage - VI Emission standards. Air pollution control measures.</p>	
Unit - 2	14
<p>Water pollution: Definition, sources of water pollution and their effects on flora, fauna, human-beings and materials. Surface water pollution – Dissolved oxygen, biochemical oxygen demand and chemical oxygen demand. Agriculture runoff and detergents as pollutants. Eutrophication. Heavy metal pollution – Minamata episode. Ground water pollution – fluoride, nitrate, Arsenic pollution and their control. Water quality criteria – specifications for drinking and inland surface waters. Water Quality Indices.</p> <p>Soil pollution: Definition, sources and types. Soil pollutants – metals, inorganic ions and salts; and organic substance. Effects of pollution on soil health and productivity. Effects of pesticides on soil. Soil erosion, types and control.</p>	
Unit - 3	14
<p>Noise pollution: Definition, sources and effects. Noise induced hearingloss. Decibel scale. Noise control measures.</p> <p>Solid waste pollution: Definition, origin, classification and characteristics of solid waste. Segregation, collection, transportation and disposal of solid waste. Solid waste treatment and disposal – Composting, open dumping, sanitary landfill, incineration, recycling and recovery.</p> <p>E-waste: Definition, sources, composition, recycling and disposal methods.</p> <p>Hazardous waste: Definition, sources, classification, effects and disposal methods.</p>	

References

- Bhatia H. S. (2003). A Textbook on Environmental Pollution and Control. Galgotia Publications Private Limited, Delhi.
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