

B.Sc. (Basic/Hons.) Semester 2

Title of the Course: ES 1T2 - ECOLOGY – THEORY AND PRACTICE

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 ecological principles governing the biosphere.
PSO 2	To instill a knowledge of the Ecology and develop necessary analytical skills to understand the ecological systems.
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 ecological dynamics and their influence on humans and anthropogenic endeavours.
PO 2	Demonstrate the ability to carry out ecological analysis in field conditions/laboratories and make appropriate judgements.
PO 3	Ability to understand and appreciate the role of ecology and system dynamics in specific habitats/agroecosystems.
PO 4	Be able to understand the demands and function in work environment dealing with environmental systems.

Content of Theory Course 2	52Hrs
Unit – 1	14
Levels of organization, Ecology: Divisions of Ecology - approaches in studying Ecology. Ecosystems – Definitions. Classification of ecosystem – Terrestrial and Aquatic with their divisions. Structure of the ecosystem - Function of ecosystem - food chain – food web – bio-magnification. Ecological pyramids – Types. Biogeochemical cycles: Classification. Carbon and Phosphorus cycles – anthropogenic influences on these cycles. Energy flow in an ecosystem – productivity - trophic levels; Study of pond and crop land ecosystems; homeostasis and feedback mechanisms.	
Unit – 2	14
Community Ecology: Definition, Characteristics of a Community – Species diversity, growth form and structure, dominance, relative abundance, trophic structure. Population Ecology: Definition, Characteristics of Population: Density – Natality – Mortality – Age distribution – Growth form-Population Equilibrium – Biotic potential – Carrying capacity – Dispersal – Dispersion – Population fluctuations – Population regulation.	
Unit - 3	14
Ecological succession – Primary and Secondary succession – Natural and man-influenced succession, – Hydrarch and Xerarch - Climax vegetation and their theories; Ecotone and Edge effect; Ecological equivalents; Ecotypes and Ecophenes; Ecological indicators. Ecological Niche: Concept and Types of niches: Spatial, Trophic and Multidimensional – Niche parameters: Form, Position and Width – Niche Partitioning - Realized and Fundamental Niche. Biomes: Definition and concept. Classification of biomes.	
Unit - 4	14
Biotic and Abiotic factors: Influence Temperature, Wind and Water, Edaphic, Topographic on flora and fauna. Concept of Limiting Factors: Liebig's Law of Minimum; Shelford's Law of Tolerance and the combined concept. Evolution: Definition – Darwin's postulates - Natural selection – Types – Industrial Melanism - Pesticide resistance. Co-evolution; Mimicry – Batesian and Mullerian mimicry, warningcolouration.	

References

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- Chapman, J. L. and Reiss, M. J. (1995). Ecology – Principles and Applications. Cambridge University Press.
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- Mamta Rawat, Sumit Dookia and Chandrakasan Sivaperuman. (2015). Aquatic Ecosystem:

Biodiversity, Ecology and Conservation. Springer publication.

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- Urban Wildlife Conservation - Theory and Practice. Springer publication.
- Odum, E. P. (1971). Fundamentals of Ecology. W.B. Saunders Co.
- Raven, P. H. and Johnson, G. B. (1995). Biology. Wm. C. Brown Publications. Ricklefs, R. E. and Miller, (1999). Ecology. W.H. Freeman and Co.
- Smith, T. M. and Smith, R. L. (2007). Elements of Ecology. Pearson Education. Taylor, T. J., Green, N. P. O. and Stout, G.W. (1998). Biological Science Soper, R. (ed.). Cambridge University Press.
- Wallace, R. A. (1990). Biology – The World of Life. Harper Collins Publications.

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 2: List of Experiments to be conducted

ES 2P1: ECOLOGICAL ANALYSIS

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

1. Sampling technique of phytoplankton
2. Sampling technique of zooplankton
3. Quantitative estimation of phytoplankton – Sedgwick-Rafter method
4. Quantitative estimation of zooplankton – Sedgwick-Rafter method
5. Determination of organic pollution – Palmer's Algal Pollution index
6. Estimation of primary productivity of a pond – Light and Dark bottle method
7. Estimation of primary productivity of terrestrial vegetation – Chlorophyll method
8. Estimation of primary productivity of grasses – Harvest method
9. Study of plant community – Individual count method/Quadrat method
10. Study of animal community – Line transect method
11. Determination of species diversity indices – Simpson and Shannon's Wiener Index
12. Estimation of carbon capture and storage of trees
13. Identification of ecological indicators

References

- Michael, P. (1986). Ecological Methods for Field and Laboratory Investigations. Tata Mc Graw-Hill Publishing Co. Ltd.
- Rolan, R. G. (1973). Laboratory and Field Investigations in General Ecology. Macmillan Co.
- Standard Method for Examination of Water and Wastewater. (2017). APHA-WEF.
- Subrahmanyam, N. S. and Sambamurty, A. V. S. S. (2000). Ecology. Narosa Publishing House.
- Trivedi, P. K. and Goel, P. K. (1984). Chemical and Biological Methods of Water Pollution Studies. Environmental Publications.

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 OE2: CLIMATE CHANGE AND ITS IMPLICATIONS

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

Content of OPEN ELECTIVE Theory Course 2	42Hrs
Unit – 1	14
<p>Climate Change: Definition, scope and facts of climate change. Origin and evolution of the earth's atmosphere. Composition and thermal structure of atmosphere; Weather and climate; Meteorological parameters - temperature, pressure, precipitation, humidity, wind speed & direction. Introduction to the effects of various anthropogenic activities on earth's atmosphere.</p> <p>Monsoons – Definition, Indian monsoons – seasons: Cold weather season (Winter), the hot weather season (Summer), season of advancing monsoon (The rainy season) and season of retreating monsoon (The transition season). Cyclones of the Indian region; El-Nino, La Nina and their impacts.</p>	
Unit - 2	14
<p>Greenhouse effect and global warming: Definition, impacts, major greenhouse gases, sources and sinks of greenhouse gases; Urban Heat Islands; Ozone layer depletion and recovery, issues and remedies; ground level ozone and air pollution; global dimming. Carbon footprint.</p> <p>Impacts of global climate change: Increased surface mean temperature, insect outbreaks, vector borne/zoonotic diseases, forest fire, reduced water availability, influence on agriculture, increase in floods and drought incidences, loss of biodiversity and extinction of species, sea level rise. Climate change and food security. Vulnerable populations – The Kiribati story.</p>	
Unit - 3	14
<p>Climate change and policy frameworks – History of international climate change policies. United Nation Framework Convention on climate change (UNFCCC), The United Nations Conference on Environment and Development, Intergovernmental Panel on Climate Change (IPCC), Ministry of Environment, Forests & Climate Change (MoEF&CC), National Action Plan on Climate Change (NAPCC), Agenda 21, The Kyoto protocol, Paris agreement. Overview of Conference of Parties (CoP). Evolution of climate change negotiations.</p> <p>Climate change adaptation and mitigation: Definition, scope and objectives. Linkages between development, climate change impacts, their mitigation and adaptation. Clean Development Mechanisms; Green Climate Fund, The Adaptation Fund. United Nations Sustainable Development Goals. Role of individuals in achieving Sustainable Development Goals.</p>	

References

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- Agarwal K.M, Sikdar P.K. and Deb S.C. (2002). A text book of Environment – MacMiller India Ltd., Calcutta
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Delhi.

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- Romm, J. (2018). Climate Change: What Everyone Needs to Know®. Oxford University Press.

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 OE2: ENVIRONMENT AND PUBLIC HEALTH IN CONTEMPORARY SOCIETY

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

Content of OPEN ELECTIVE Theory Course 2	42Hrs
Unit – 1	14
Environment and public health: Definitions of health and disease. Perspectives on individual health: Nutritional, socio-cultural and developmental aspects, Dietary diversity for good health; Human developmental indices for public health. Effect of quality of air, water and soil on human health. Diseases in contemporary society: Need for good health - factors affecting health. Types of diseases - deficiency, infection, pollution diseases - allergies, respiratory, cardiovascular and cancer. Personal hygiene- food- balanced diet. Health effects of smoking, drugs and alcohol consumption.	
Unit - 2	14
Malnutrition: Vitamin deficiency diseases and Mineral deficiency diseases; Folic acid requirement during pregnancy; Food Safety- Adulterants and preservatives; Pesticide Toxicity: Endosulfan and DDT; Genetically Modified Food. Non-communicable diseases and Lifestyle diseases - Diabetes and Hypertension. Communicable diseases: Definition, mode of transmission – pandemic, epidemic and endemic diseases. Vector borne diseases: Plague and Malaria; emerging diseases: Dengue, Chikungunya, Zika, Ebola, Swine Flu, Bird Flu, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS); Zoonosis- Leptospirosis; Kyasanur Forest Disease (KFD) Toxoplasmosis and Nipah.	
Unit - 3	14
Occupational health: Sick Building Syndrome; Noise and Radiation; Ergonomics - Stress and Fatigue; Carpal tunnel syndrome (CTS); Methyl mercury and cerebral palsy; Synergistic effect; Irritable bowel syndrome; Crohn's disease. Environmental Sanitation and Hygiene: Safe disposal of human excreta; Solid waste disposal; Sanitation value chain. Drug safeties: Thalidomide Tragedy; Antibiotic stewardship; New Delhi Antibiotic-Resistant superbug.	

References

- Akhtar, R. (Ed.). (2019). Extreme weather events and human health: International case studies. Springer Nature.
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- Park, K. (2009). Park's Textbook of Preventive and Social Medicine, 20th Edition. Misc Publication.
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- Van den Bosch, M., & Bird, W. (Eds.). (2018). Oxford textbook of nature and public health: The role of nature in improving the health of a population. Oxford University Press.
- Walton, M. (2017). One Planet, One Health. Sydney University Press.

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End Semester Examination	70% (70 Marks)
Total	100% (100 Marks)

ES OE2: WILDLIFE AND CONSERVATION

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

Content of OPEN ELECTIVE Theory Course 2	42Hrs
Unit – 1	14
<p>Wildlife: Definition, significance – Values of wildlife: Ecological, Economic, Cultural, Aesthetic, Scientific, Recreational and Medicinal. Biogeographical zones of India. Significant wildlife of India. Causes for wildlife depletion – HIPPO (Habitat destruction, Invasive species, Pollution, Population (human overpopulation), Overharvesting by hunting and fishing. Forest fires and wildlife depletion. Effects of depletion of wildlife – Ecological, Economic Socio-cultural. Urban wildlife. Human-wildlife conflict and management.</p> <p>Categories of Wildlife: IUCN Red data categories - Extinct, Extinct in wild, Critically endangered, Endangered, Vulnerable, Near threatened, Least concerned, Data deficient, Not evaluated. IUCN Red data book. Keystone species, Flagship species, Umbrella species. Priority species, Indicator species.</p>	
Unit - 2	14
<p>Wildlife conservation: Need for conservation of wildlife. History of wildlife conservation in India. Biosphere reserves, National parks, Wildlife sanctuaries, wildlife reserves, protected areas, privately owned wildlife reserves &, Single species/single habitat-based conservation areas, Area of special scientific interest (ASSI). Conservation practices - <i>Ex-situ</i> and <i>in-situ</i> conservation. Captive breeding - Role of Zoos in conservation. Community conserved areas – <i>Devarakadu</i> and <i>Pavitra Vana</i>. Case studies: Project tiger, Project elephant. Role of BSI and ZSI in conservation.</p> <p>People and conservation: Traditional knowledge, Traditions and cultures, Women and people's participation in managing protected areas. Role of NGOs in conservation. Conservation Institutions – Bird Life International, GEF, IUCN, UNEP, WCS, WWF; BNHS, WTI.</p>	
Unit - 3	14
<p>Wildlife tourism: Definition, scope and relevance. Role of Zoos and Botanical parks in tourism and awareness creation. Bird and butterfly watching. Positive and negative impacts of wildlife tourism. Conflicts related to wildlife tourism. Wildlife trade and legislation: Wildlife trade and impacts. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Wildlife Trade Monitoring Network (TRAFFIC). Salient features of Indian wildlife act 1972.</p>	

References

- Bindra, P. S. (2017). *The Vanishing: India's Wildlife Crisis*. Penguin Random House India.
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- Nagendra, H., & Mundoli, S. (2019). Cities and canopies: trees in Indian cities. Penguin Random House India Private Limited.
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