



**NATIONAL EDUCATION
POLICY-2020**

(NEP-2020)

*Approved
through
online consultation*

*09/07/2023
Chairman - UG - BOS*

**ENVIRONMENTAL SCIENCE
SYLLABUS**

of 1st to 4th Semester

Submitted

to

Davangere University

Davangere-577 007

Discipline Core Paper Structure (DSC)

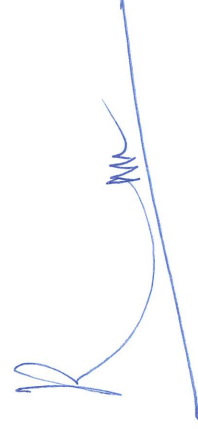
Sem	Course Category	Course Code	Course Title	Credits Assigned	Instructional Hours per week		Duration of the exam	Exam/ Evaluation pattern (Marks)		
					Theory	Practical		IA	Exam	Total
I	DSC	EV1-T1	Divisions of The Environment	4	4		2	40	60	100
		EV1-P1	Water Quality Analysis	2			3	25	25	50
II	DSC	EV2-T1	Ecology-Theory and Practices	4	4	4	2	40	60	100
		EV2-P2	Ecological Analysis	2		4	3	25	25	50
III	DSC	EV3-T3	Natural Resources and Management	4	4		2	40	60	100
		EV3-P3	Mineralogy, Petrology, Energy Resources and Medicinal Plants	2		4	3	25	25	50
IV	DSC	EV4-T4	Biodiversity, Wildlife and Conservation	4	4		2	40	60	100
		EVS4-P4	Biodiversity Assessment and Ecosystem Services	2		4	3	25	25	50



Registrar
Davangere University
Shivagangotri, Davangere

Open Elective Course Structure (OEC)

Semester	Subject	Course Code	Paper No.	Credits	Theory	Internal	Total
I	Environmental Conservation Movements	ESOE1.1	O-1	3	60	40	100
	Environment and Sustainable Agriculture	ESOE1.2	O-2	3	60	40	100
	Environmental Pollution	ESOE1.3	O-3	3	60	40	100
II	Climate Change and Its Implications	ESOE2.1	O-4	3	60	40	100
	Environment and Public Health in Contemporary Society	ESOE2.2	O-5	3	60	40	100
III	Wildlife and Conservation	ESOE2.3	O-6	3	60	40	100
	Women and Environment	ESOE3.1	O-7	3	60	40	100
IV	Environmental Disasters and Management	ESOE3.2	O-8	3	60	40	100
	Environment and Sustainable Agriculture	ESOE4.1	O-9	3	60	40	100
	Initiatives for Environmental Management	ESOE4.2	O-10	3	60	40	100




Seed Registrar
Davangere University
Shivangotri, Davangere

B.Sc. Semester I

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	60	2	4hrs/week

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 characterize 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

Contents	60 Hrs
Unit-1	
Environmental Education: Definition, Aim, Objectives and Scope. Environmental Science: Definition, Aim of study and Scope. Differences between Ecology and Environmental Science; Various approaches of studying Environmental Science. Components of the Environment: Definitions of Atmosphere, Hydrosphere, Lithosphere and Biosphere - their complex interactions and significance.	15 Hrs
Unit-2	
Atmosphere: Evolution of the atmosphere – Principal components – Permanent and variable gases. Structure of the atmosphere on the basis of temperature and composition.	15 Hrs

<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	
<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: Potomom 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>	15 Hrs
Unit-4	
<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, Sand dunes, Glaciation, Avalanches and Landslides.</p> <p>Mineralogy: Definition. Outline classification of minerals</p> <p>Petrology: Definition. 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>	15 Hrs

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 and Bartlett Publishers.

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

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

ES 1P1: WATER QUALITY ANALYSIS

(Total Teaching Hours = 60; 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

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 = 50% (50 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	50% (50 Marks)
Total	100% (50 Marks)

ES OE1: ENVIRONMENTAL CONSERVATION MOVEMENTS

Number of Theory Credits	Number of lecture hours/ semester
3	45

Contents	45 Hrs
UNIT-1	
Environment: Definition, role of environment in shaping civilisations. Interrelations between civilisation and environment – ecological economic and socio-cultural. Industrial revolution and environmental pollution. Globalisation and environmental pollution. Modern agriculture and environmental degradation. 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.	15 Hrs

UNIT-2	
<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>	15 Hrs
UNIT-3	
<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>	15 Hrs

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.
- Flanders, L. (1997). The United Nations' department for policy coordination and sustainable development (DPCSD). Global Environmental Change, 7(4), 391-394.
- McNeill, John R. (2000). Something New Under the Sun: An Environmental History of the Twentieth Century.
- 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).

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

ES OE1: ENVIRONMENT AND SUSTAINABLE AGRICULTURE

Number of Theory Credits	Number of lecture hours/ semester
3	45

Contents	45 Hrs
UNIT-1	
<p>Environment – Definition, scope and significance.</p> <p>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.</p> <p>Types of agriculture – rain-fed cultivation and irrigation – water intensive agriculture – Reservoirs and ground water exploitation. Conventional and mechanised agriculture.</p> <p>Natural and chemical agriculture. Subsistence and commercial agriculture. Environmental effects of land use and landscape changes.</p>	15 Hrs
Unit-2	
<p>Environmental determinants of agriculture – role of rainfall, humidity, wind, topography and edaphic factors in crop selection.</p> <p>Animal husbandry – Dairy and poultry – role of transboundary species of cattle in Indian scenario.</p> <p>Pisciculture – Environmental effects of intensive pisciculture.</p> <p>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.</p>	15 Hrs
Unit-3	
<p>Environmental impacts of agriculture – Loss of biodiversity – soil salinity – fertiliser and pesticide pollution, Climate change and global warming. Erosion and problems of deposition in irrigation systems. Desertification. Biomagnification – Case studies.</p> <p>Contemporary issues and management – Farmer distress – market mechanisms – natural farming methods/organic farming. Urban agriculture and hydroponics.</p>	15 Hrs

Ecological principles of farming – Sustainable agriculture – Significance of indigenous crops and cattle varieties. Watershed management. Agricultural policies of India.	
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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.

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

ES OE1: ENVIRONMENTAL POLLUTION

Number of Theory Credits	Number of lecture hours/ semester
3	45

Contents	45 Hrs
Unit-1	
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. Air pollution: Definition, sources of air pollution and their effects on flora, fauna, human-beings and materials. Indoor pollution, automobile pollution,	15 Hrs

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.	
Unit-2	
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. 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.	15 Hrs
Unit-3	
Noise pollution: Definition, sources and effects. Noise induced hearing loss. Decibel scale. Noise control measures. 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. E-waste: Definition, sources, composition, recycling and disposal methods. Hazardous waste: Definition, sources, classification, effects and disposal methods.	15 Hrs

References

- Bhatia H. S. (2003). A Textbook on Environmental Pollution and Control. Galgotia Publications Private Limited, Delhi.
- Mark L. Brusseau, Ian L. Pepper and Charles P. Gerba. (2019). Environmental and Pollution Science. Academic Press.
- Marquita K. Hill. (2012). Understanding Environmental Pollution. Cambridge University Press
- Nandini, N. (2019). A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.
- Peirce, J. J., Vesilind, P. A., & Weiner, R. (1998). Environmental pollution and control. Butterworth-Heinemann.
- 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.
- Trivedi P. R. (2004). Environmental Pollution and Control. Ashish Publishing House - APH Publishing Corporation.

- Yogendra N Srivastava. (2009). Environmental Pollution. Ashish Publishing House. APH Publishing Corporation.

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

B.Sc. 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	60	2	60 (4 hours/ week)

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.

Contents	60 Hrs
Unit-1	
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	15 Hrs

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	
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.	15 Hrs
Unit-3	
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.	15 Hrs
Unit-4	
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, warning colouration.	15 Hrs

References

- Agarwal, K. C. (1999). Environmental Biology. Agro Botanica.
- Beck, W. S., Liem, K. F. and Simpson, G. G. (1991). Life – Introduction to Biology.
- Harper Collins Publications.
- Chapman, J. L. and Reiss, M. J. (1995). Ecology – Principles and Applications.
- Cambridge University Press.
- Dash, M. C. (2001). Fundamentals of Ecology. Tata McGraw-Hill Publishing Co.
- Kormondy, E. J. (1996). Concepts of Ecology. Prentice Hall of India.
- Mamta Rawat, Sumit Dookia and Chandrakasan Sivaperuman. (2015). Aquatic Ecosystem: Biodiversity, Ecology and Conservation. Springer publication.
- McCleery, Robert A., Moorman, Christopher, Peterson, M. Nils (Eds.). (2014).

- 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 = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

Content of Practical Course 2: List of Experiments to be conducted

ES 2P1: ECOLOGICAL ANALYSIS

(Total Teaching Hours = 60; 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 WaterPollution Studies. Environmental Publications.

Formative Assessment – Practical Internal Assessment = 50% (25 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	50% (25 Marks)
Total	100% (50 Marks)

DAVANGERE UNIVERSITY
I Semester B.Sc. Environmental Science Degree Examination- January
2022
(NEP-2020)

Paper-I: Divisions of The Environment

Time: 2 Hours

Maximum Marks: 60

Note:

1. All Parts are compulsory
2. Draw labeled diagram whenever necessary

PART-A

I. Write brief note on any **FIVE** of the following

2x 10=10 M

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

PART-B

II. Write short notes on any **FIVE** of the following

5x4=20 M

- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.

PART-C

Answer any **THREE** of the following

3x10=30 M

- 17.
- 18.
- 19.
- 20.
- 21.

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ES OE2: CLIMATE CHANGE AND ITS IMPLICATIONS

Number of Theory Credits	Number of lecture hours/ semester
3	45

Contents	45 Hrs
Unit-1	
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. 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.	15 Hrs
Unit-2	
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. 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.	15 Hrs
Unit-3	
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. 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.	15 Hrs

References

- Abhishek Tiwary and Jerem Colls. (2010). Air Pollution: Measurement, Modelling and Mitigation. III Edition, Routledge Publication.

- Agarwal K.M, Sikdar P.K. and Deb S.C. (2002). A text book of Environment –
- MacMiller India Ltd., Calcutta
- Climate Change: Science and Politics. (2021). Centre Science and Environment, New Delhi.
- Donald Ahrens.C. (2008). Essentials of Meteorology: An Invitation to the Atmosphere. Cengage Learning publication.
- Howard J. Critchfield. (1983). General Climatology (Fourth Edition), Phi Learning Pvt Ltd.
- IPCC. (2006). Guidelines for National Greenhouse gas Inventories. Published by the Institute for Global Environmental Strategies (IGES), Hayama, Japan on behalf of the IPCC.
- John E. Oliver, John J. Hidore. (2002). Climatology: An Atmospheric Science, Second Edition. Prentice Hall publication.
- John T. Hardy. (2003). Climate Change: Causes, Effects and Solution. John Wiley & Sons publications.
- Mann, M. E. (2021). The New Climate War: the fight to take back our planet.
- Hachette UK. Nicholas Stern. (2008). The Economics of Climate Change: The Stern Review. Cambridge University Press. Great Britain.
- Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: InFigures. Centre Science and Environment, New Delhi.
- Roger G. Barry and Richard J. Chorley. (2007). Atmosphere, weather and Climate, 8th Edition, Routledge Publishers.
- Romm, J. (2018). Climate Change: What Everyone Needs to Know®. Oxford University Press.

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

ES OE2: ENVIRONMENT AND PUBLIC HEALTH IN CONTEMPORARY SOCIETY

Number of Theory Credits	Number of lecture hours/semester
3	45

Contents	45 Hrs
Unit-1	
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,	15 Hrs

respiratory, cardiovascular and cancer. Personal hygiene- food- balanced diet. Health effects of smoking, drugs and alcohol consumption.	
Unit-2	
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.	15 Hrs
Unit-3	
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.	15 Hrs

References

- Akhtar, R. (Ed.). (2019). Extreme weather events and human health: International case studies. Springer Nature.
- Bedi and Yashpal. (1971). Handbook of Hygiene and Public Health. Atma Ram & Sons, Delhi.
- Kessel, A. (2006). Air, the environment and public health. Cambridge University Press.
- Lopez, R. P. (2012). The built environment and public health (Vol. 16). John Wiley & Sons.
- Nandini N. (2018). Environment and public Health. Sapna Book House, Bengaluru.
- O'Carroll, P. W., Yasnoff, W. A., Ward, M. E., Ripp, L. H., & Martin, E. L. (Eds.). (2003). Public health informatics and information systems.
- Park, K. (2009). Park's Textbook of Preventive and Social Medicine, 20th Edition.
- Misc Publication.
- Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: In Figures. Centre Science and Environment, New Delhi.
- 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.

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

ES OE2: WILDLIFE AND CONSERVATION

Number of Theory Credits	Number of lecture hours/ semester
3	45

Contents	45 Hrs
Unit-1	
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. 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.	15 Hrs
Unit-2	
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. 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.	15 Hrs
Unit-3	
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.	15 Hrs

References

- Bindra, P. S. (2017). The Vanishing: India's Wildlife Crisis. Penguin Random House India.
- Donald Letcher Goddard and Sam Swope. (1995). Saving Wildlife: A Century of Conservation. Wildlife Conservation Society.
- E.P. Gee. (2002). The Wild Life of India. HarperCollins India
- Goutam Kumar Saha , Subhendu Mazumdar. (2017). Wildlife Biology: An Indian Perspective, PHI Learning Pvt. Ltd. India
- Herbert H. T. Prins, Jan Geu Grootenhuis and Thomas T. Dolan. (2000). Wildlife Conservation by Sustainable Use. Springer publication.
- Jedediah F. Brodie, Eric S. Post, and Daniel F. Doak. (2012). Wildlife Conservation in a Changing Climate. The University of Chicago Press.
- Manfredo, Michael J. (2008). Who Cares About Wildlife?. Springer publication.
- Morrison, M.L., Block, W.M., Strickland, M.D., Collier, B.A., Peterson, M.J. (2008). Wildlife Study Design, Springer publication.
- Nagendra, H., & Mundoli, S. (2019). Cities and canopies: trees in Indian cities.
- Penguin Random House India Private Limited.
- Roth, Harald H., Merz, Gunter (Eds.). 1997. Wildlife Resources - A Global Account of Economic Use. Springer publication.
- Underkoffler, Susan C, Adams, Hayley R. (Eds.). (2021). Wildlife Biodiversity Conservation - Multidisciplinary and Forensic Approaches, Springer publication.

Formative Assessment – Continuous Internal Assessment = 40% (40 Marks)	
Assessment Occasion/ type	Weightage in Marks
End Semester Examination	60% (60 Marks)
Total	100% (100 Marks)

AECC-Environmental Studies Syllabus

Number of Theory Credits	Number of lecture hours	Number of field work hours
2	45	5

	Content of AECC – Environmental Studies	45 hours
Unit 1	Introduction to Environmental Studies	2

	Multidisciplinary nature of environmental studies Scope and importance; Concept of sustainability and sustainable development.	
Unit 2	Ecosystems What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems: a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	6
Unit 3	Natural Resources: Renewable and Non-Renewable Resources Land resources and land-use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.	8
Unit 4	Biodiversity and Conservation Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.	8
Unit 5	Environmental Pollution Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks Solid waste management, Control measures of urban and industrial waste Pollution case studies.	8
Unit 6	Environmental Policies & Practices Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context	7

Unit 7	Human Communities and the Environment Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan Environmental ethics: Role of Indian and other religions and cultures in environmental conservation Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).	6
	Fieldwork	5

Reference

- Carson, R. (2002). Silent Spring. Houghton Mifflin Harcourt.
- Gadgil, M., & Guha, R. (1993). This Fissured Land: An Ecological History of India. Univ. of California Press.
- Gleeson, B. and Low, N. (eds.) (1999). Global Ethics and Environment, London, Routledge.
- Gleick, P. H. (1993). Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
- Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. (2006). Principles of Conservation Biology. Sunderland: Sinauer Associates.
- Grumbine, R. Edward, and Pandit, M.K. (2013). Threats from India's Himalayas. Science, 339: 36-37.
- McCully, P. (1996). Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
- McNeill, John R. (2000). Something New Under the Sun: An Environmental History of the Twentieth Century.
- Nandini, N. (2019). A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.
- Odum, E.P., Odum, H.T. & Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders.
- Pepper, I.L, Gerba, C.P. & Brusseau, M.L. (2011). Environmental and Pollution Science. Academic Press.
- Rao, M.N. & Datta, A.K. (1987). Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
- Raven, P.H., Hassenzahl, D.M. & Berg, L.R. (2012). Environment. 8th edition. John Wiley & Sons.
- Rosencranz, A., Divan, S., & Noble, M. L. (2001). Environmental law and policy in India. Tripathi 1992.
- Sengupta, R. (2003). Ecology and economics: An approach to sustainable

development. OUP.

- Singh, J.S., Singh, S.P. and Gupta, S.R. (2014). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
- Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). (2013). Conservation Biology: Voices from the Tropics. John Wiley & Sons.
- Thapar, V. (1998). Land of the Tiger: A Natural History of the Indian Subcontinent. Warren, C. E. (1971). Biology and Water Pollution Control. WB Saunders.
- Wilson, E. O. (2006). The Creation: An appeal to save life on earth. New York: Norton.
- World Commission on Environment and Development. (1987). Our Common Future. Oxford University Press.