



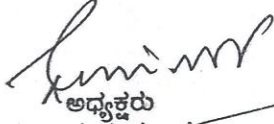
Government of Karnataka

NATIONAL EDUCATION POLICY-2020

**CURRICULUM CONTENTS  
IN  
ENVIRONMENTAL SCIENCE  
2022-23**

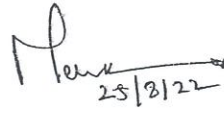
**Undergraduate Course B.Sc.,  
(Basic/Honors)  
3<sup>rd</sup> and 4<sup>th</sup> Semester**

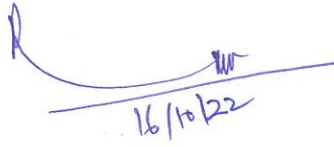
**Davangere University  
Shivagangothri  
Davangere-577007**

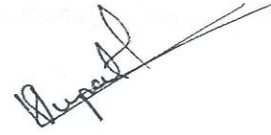
  
ಅಧ್ಯಕ್ಷರು  
ಅಧ್ಯಯನ ಮಂಡಳಿ

ಪರಿಸರ ವಿಜ್ಞಾನ ಅಭ್ಯಯನ ವಿಭಾಗ  
ದಾಖಲೆಗರೆ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ  
ಶಿವಗಂಗೋತ್ರಿ, ದಾವಣಗೆರೆ-577007



  
25/12/22

  
16/10/22



  
**Registrar**  
**Davangere University**  
**Shivagangothri, Davangere**

### B.Sc. (Basic/Hons.) Semester 3

Title of the Course: **ES 3T1 - NATURAL RESOURCES AND MANAGEMENT**

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 the understanding of role of natural resources in economic and ecological development.
PSO 2	To instill a knowledge of quantifying and evaluating contribution of natural resources management in human development.
PSO 3	To motivate and inspire to acquire contemporary understanding and skills leading to issue identification and management of natural resources.
PSO 4	To inculcate creativity and innovative spirit in the domain of human- development and natural resource utilisation efficiency.

Programme Outcomes	
PO 1	Demonstrate competence in understanding the significance of natural resources in economic/ecological development.
PO 2	Demonstrate the ability to carry out the process of identification of, data procurement and interpretation with reference to natural resources.
PO 3	Ability to understand and appreciate the role of quantification of resource use pattern in contemporary/sustainable development paradigms.
PO 4	Be able to understand the demands of data analysis and reporting in natural resource management domain.

Content of Theory Course 3		52 Hours
<b>Unit - 1</b>		<b>14</b>
Resource: Definition; Resource and wealth. Functional theory of resource and dynamic theory of resource. Classification of resources - Organic and inorganic resources; exhaustible and inexhaustible resources; International, National and Individual resources; Ubiquitous and localised resources. Factors influencing resource availability, distribution and utilisation		
patterns - Nature, Culture and Man. Phantom pile concept. Resources scarcity: Definition; types of resources scarcity - Demand- induced, supply-induced, and structural. Conservation of resources: Methods of conservation - Refuse, reduce, reuse, recycle and recovery - Methods of waste reduction (Increasing the durability of products, utilising material substitution, recycling and marketability of industrial waste). Case studies on energy and paper conservation. Natural Resources: Definition, Classification of natural resources based on utility potential.		
<b>Unit - 2</b>		<b>14</b>
Water Resources: Fresh water - Water budget of India - Dams: Impact on environment-alternatives; Droughts and Floods: Causes and Control Strategies- Watershed Management; Rain Water Harvesting and ground water recharge; River linking – pros and cons. Marine water – Ocean as a resource <ul style="list-style-type: none"> <li>- Fisheries, aquaculture – prawns and oysters</li> <li>- Transportation–Shipping (people, goods and oil) and its impacts.</li> <li>- Desalinisation– Importance and impacts</li> <li>- Coastal erosion and reclamation</li> <li>- Coastal Regulation Zone (CRZ)</li> </ul> Ground Water: Impacts of extraction: uplifting and seismic activities, land subsidence, vegetation degradation and food security implications. Water and agriculture: Irrigated and rain-fed cultivation; Types of irrigation. Irrigation and drainage. Nutrient delivery through irrigation. Environmental implications of Conventional Agriculture – Soil degradation, surface and ground water pollution, loss of natural biodiversity, water logging and soil salinity. Hydroponics – Soil-water conservation practices in agriculture.		
<b>Unit - 3</b>		<b>14</b>

<p>Forest Resources: Importance of Forestry – Types of Forests of India and Karnataka – Pressures on forest areas – <i>encroachments, forest fires, land use change (allocation for agriculture, industry and housing)</i> and over utilisation of forest resources (harvesting of NTFPs, overgrazing, other anthropogenic pressures).</p> <p>Impacts of Deforestation: – Forest Fires and their Control; Forest conservation: Sacred Groves – Chipko and Appiko Movements; Joint Forest Management; Afforestation and Reforestation (Social forestry, Agro forestry, Urban forestry), Major and Minor Forest Products; Forest based industries (Plywood, Pulp and Paper and Cottage industries).</p> <p>Ecotourism and its impacts.</p>	
<p>Captive plantations and Energy plantations</p> <p>Forest and wildlife conservation - Protected areas – Sanctuaries - National Parks – Biosphere Reserves.</p>	
<b>Unit - 4</b>	<b>14</b>
<p>Land resources: Land-use patterns in India. Agro-climatic zones of India and Karnataka. Types of agriculture and cropping patterns. Implications of agriculture on soil- Soil erosion – causes, types, impacts, control measures. Desertification: causes, impacts and control measures.</p> <p>Mineral resources: Mining and Quarrying and their impacts; Ecological conflicts of mineral extraction; Deep sea mining and off shore oil exploration. Case studies on Coal and stone quarries.</p> <p>Energy Resources: Definition. Conventional, non-conventional and alternative energy resources. Energy sources and their impacts: Biomass burning (Fuelwood, Agriculture residue, Cow dung), Fossil fuels, Hydel, Geothermal, Nuclear energy; Solar (Thermal and Photovoltaic), Wind, Tidal, Microhydel. Briquettes, Wood gas, Energy from waste (Pyrolysis and Biogas), Agri-based fuels (<i>Biodiesel, Gasohol</i>), Hydrogen fuels.</p> <p>Cogeneration.</p>	

## References

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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 3: List of Experiments to be conducted

### ES 3P1 - MINERALOGY, PETROLOGY, ENERGY RESOURCES AND MEDICINAL PLANTS

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

1. Mineralogy: Identification properties of Minerals
2. Description of Minerals
3. Petrology: Identification properties of Rocks
4. Description of Rocks – Igneous, Sedimentary and Metamorphic
5. Introduction to Mapping – Direction, scale and conventional signs and symbols
6. Properties of Maps – Latitude & Longitude; Grid references
7. Representation of Relief
8. Study of drainage pattern and settlement pattern
9. Geolocation of resources – Mineral, ore, petroleum and energy resources
10. Characteristics and delineation of watershed using topo sheets
11. Identification of medicinal plants of Karnataka
12. Identification of locally available NTFP's
13. Introduction to agro climatic zones of Karnataka and mapping of local agricultural diversity (District level)

#### References

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

### ES 3OE3: WOMEN AND ENVIRONMENT

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

Content of OPEN ELECTIVE Theory Course 3	42Hrs
<b>Unit - 1</b>	<b>14</b>
<p>Ecology and Environment: Definitions, meaning and significance. Ecosystem: Structure and function. Natural resources – definition, their local availability, harvest and utility.</p> <p>Gender ideology, Gender inequality and gender justice in India. Women studies: Concept, Objectives of women studies. Nature and Feminine principle - basic human needs from rural and urban environment. Interaction of women with the local ecosystems for household water collection, fuelwood, fodder, medicinal plants, livestock management, food security and non-timber forest produce.</p> <p>Rural women: Role in agriculture sector – Soil-water conservation, chemical free food and food storage. Role in social forestry (Achieving the 5F objectives – Food, Fodder, Firewood, Fiber and Fertiliser). Conservation of indigenous species.</p> <p>Urban women: Role in urban climate management, lifestyle choices and resource conservation – water, electricity, food, fuel resources and development of conservation culture among young generation.</p> <p>Sustainable Development Goals: Goal No. 5 - Gender equality.</p>	
<b>Unit - 2</b>	<b>14</b>
<p>Eco-feminism: Meaning and concept, Emergence and branches of Eco- feminism, Eco-feminism in the global economy, Eco-feminist power, politics and resistance to war and violence.</p> <p>Women and resource scarcity: Impacts of Natural resource depletion, Climate change and environmental degradation on women.</p> <p>Impacts of commonly used chemicals on Women and Environment: Endocrine-disrupting chemicals (EDCs), household chemicals, pesticides, cosmetics, food additives, food preservatives, organic pollutants, Volatile Organic Compounds (VOC's) and indoor air pollution from cooking activities.</p> <p>Climate change and women's health: Vector borne diseases, poor air quality and extreme variance in climatic temperatures (<i>Anemia, malnutrition and food insecurity - reduced cognitive skills, poor attention span, reduced working memory and poor education outcomes. Respiratory distress, cardiovascular disease, negative birth outcomes and reduced mental health in</i></p>	

<p>children).</p> <p>Post-disaster impacts on women: Higher risk of physical, sexual, and domestic violence in the aftermath of disasters. Increased stress due to forced migration, mood disorders and poor economic recovery.</p>	
<b>Unit - 3</b>	<b>14</b>
<p>Women response to environmental degradation: Case studies of collective empowerment – The Chipko Movement (Gaura Devi - Mahila Mangal Dal), Silent Valley Conservation Movement (Sugathakumari), Neem Patent Victory (World's First Case Against Biopiracy), Narmada Bachao Andolan (NBA).</p> <p>Women and Environmental Conservation: Joint Forest Management (JFM), Social Forestry, Agroforestry, Agriculture, Community nurseries and seed banks, Household Solid Waste Management, Home gardens/rooftop gardening, United Nations Clean Development Mechanism (CDM).</p> <p>Women empowerment through Ecotourism, Cottage industries (NTFP and forest produce processing and value addition), Eco-entrepreneurship (Handicrafts, Case studies of Desi-Charaka and Hasiru Dala).</p> <p>Prominent women environmentalists: Rachel Carson, Wangari Maathai, Gro Harlem Brundtland, Elinor Ostrom, Amritha Devi Bishnoi, Medha Patkar, Sunita Narain, Tulsi Gowda and Saalumarada Thimmakka.</p>	

## References

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FormativeAssessment–ContinuousInternalAssessment=40%(40Marks)	
Assessment Occasion/ type	Weightage inMarks
End SemesterExamination	60% (60Marks)
Total	100% (100Marks)

### ES 3OE3: ENVIRONMENTAL DISASTERS AND MANAGEMENT

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

Content of OPEN ELECTIVE Theory Course 3		42Hrs
<b>Unit - 1</b>		<b>14</b>
<p><b>Disasters:</b> Definition, History of disasters; Components of disasters.</p> <p>Weather parameters: Concept, Definition, Units and measurements of Temperature, Pressure, Precipitation (Rain, snow, hail), Wind (Speed and direction) and Relative humidity.</p> <p>Types of disasters: Natural disasters and Man-made disasters.</p> <p>Natural disasters: Definitions and introduction to Earthquakes, Tropical cyclones, Cloud bursts, Floods, Drought, Land subsidence, Landslides, Mudslides, Volcanoes, Tsunami, Avalanches, Heat waves, Cold waves, Dust storms, and Locust attacks.</p> <p>Man-made disasters: Definitions and introduction to Gas leaks, Toxic and Hazardous wastes, Nuclear and radiation accidents, Oil spills, Forest fires, Pandemics, Weather Extremes &amp; Climate Change and Wars.</p> <p>Definitions of Risk, Hazard, Exposure, Vulnerability, Response, Mitigation, Preparedness and Prevention.</p> <p>Mitigation and Management techniques of Disaster: Basic principles of disaster management, Disaster Management cycle, Disaster management policy. Disaster Management Authority at National, State and District levels; Roles and responsibilities of Govt. Authorities including Local Self Govt. at various levels.</p>		
<b>Unit - 2</b>		<b>14</b>
<p><b>Natural Disasters</b></p> <p>Earthquakes - types and causes, magnitude and intensity, seismic zones of India and Karnataka. Earthquake measurements (Richter Scale) and predications. Earthquake preparedness and management.</p> <p>Tropical Cyclones - Types and causes. Cyclone naming. Cyclone prediction, warning, Preparedness and Management.</p> <p>Floods - Types and causes, Flash floods. Cloud bursts, Floods warning, Preparedness and Management.</p> <p>Land subsidence - Types and causes, Landslides and Mudslides and Avalanches. Land subsidence preparedness and management.</p>		

<p>Tsunami - types and causes. Tsunami prediction, warning, preparedness and management.</p> <p>Heat waves and Cold waves – Causes and effects, Warning, preparedness and management.</p> <p>Locust attacks – Causes and effects Preparedness and management.</p>	
<b>Unit - 3</b>	<b>14</b>
<p><b>Man-made disasters</b></p> <p>Nuclear disaster: Chernobyl and Fukushima - Episode and effects. Exxon Valdez oil spill - Episode, effects and management.</p> <p>Indonesia's land and forest fires – Episode, effects and management.</p> <p>Bhopal Gas Tragedy - Episode, causative agent, effects and recovery. Damage and compensation.</p> <p>Visakhapatnam gas leak - Episode, causative agent and effects. Damage and compensation.</p> <p>Endosulfan disaster in Karnataka and Kerala - Episode and effects. Damage and compensation.</p> <p>Ennore oil spill - Episode and effects.</p> <p>Uttarakhand and Kerala floods - Episode, effects and management. Kodagu</p> <p>Landslides/Recent/Local episodes, effects and management</p> <p>Bandipur Forest fires/Recent/Local episodes, effects and management.</p> <p>Bengaluru Urban floods/Recent/Local episodes, causes, effects, and management.</p> <p>Epidemics, Pandemics and Zoonoses.</p>	

## References

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

## B.Sc. (Basic/Hons.) Semester 4

Title of the Course: **ES 4T1 - BIODIVERSITY, WILDLIFE AND CONSERVATION**

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/ semester
<b>4</b>	<b>52</b>	<b>2</b>	<b>52</b>

Programme Specific Objectives	
PSO 1	To develop competency in understanding biodiversity and wildlife.
PSO 2	To instill a knowledge about human interactions with uncultivated varieties and develop necessary analytical skills to appreciate these interactions.
PSO 3	To motivate and inspire to acquire contemporary understanding and skills leading to issue identification and conservation.
PSO 4	To inculcate creativity and innovative spirit in identifying appropriate conservation tools and their timely implementation.

Programme Outcomes	
PO 1	Demonstrate competence in understanding the ecological, social and legal dimensions of biodiversity and wildlife.
PO 2	Demonstrate the ability to carry out data collection procedures and analysis in field conditions/laboratories and make appropriate interpretations.
PO 3	Ability to understand and appreciate the role of biodiversity in specific natural habitats and agroecosystems.
PO 4	Be able to develop competence and academic skills in contributing towards biodiversity and wildlife conservation.

Content of Theory Course 4	52 Hours
<b>Unit - 1</b>	<b>14</b>
<p>Biodiversity: Definition: Levels of Biodiversity - genetic diversity, species diversity and ecosystem diversity. Values of Biodiversity: Direct uses - consumptive use value, productive use value; Non-consumptive values - social value, ethical value, aesthetic value, option values and ecosystem service value.</p> <p>Biodiversity Hotspots: Global and Indian centers. Biogeography of India. Biodiversity profile of India: Forests and Grasslands; Wetlands and</p>	

<p>Riverine ecosystems; Marine and coastal diversity; Agrobiodiversity; Urban Biodiversity; Invasive Alien species.</p> <p>Threats to biodiversity: Over exploitation, Habitat destruction, fragmentation, urbanisation, agriculture extension, river valley projects, industrialisation, deforestation, invasive species, pollution, acidification of soil and water, mining activities, desertification and climate change.</p> <p>Traditional Knowledge and ethics in conservation of biodiversity.</p> <p>A locally relevant case study on biodiversity related aspects. People's Biodiversity Register.</p> <p>Bio-piracy. The Biological Diversity Bill, 2000 and The Biological Diversity (Amendment) Bill, 2021. Convention on Biological Diversity and Agenda 21. National Biodiversity Action Plan (NBAP).</p>	
<b>Unit - 2</b>	<b>14</b>
<p>Wildlife: Definition. Wildlife of India. Values of wildlife. Values of wildlife:</p> <ul style="list-style-type: none"> <li>- <i>Physical utility, economic/monetary value, recreational value, scientific value, ecological value, existence value.</i></li> <li>- <i>Wildlife damage, human animal conflict, loss of economic productivity, wildlife diseases to man and competition effect.</i></li> </ul> <p>Importance of wildlife: Ecological, economic, socio-cultural, investigatory, medicinal, conservation of biological diversities, importance in agriculture.</p> <p>Threats to wildlife: Over exploitation, habitat loss, encroachment and fragmentation, disease, pollution, invasive and exotic species, Illegal trapping and poaching, agricultural/unrestricted/ over grazing, urbanisation and climate change.</p> <p>Endangered species – Definition, characteristics and reasons for engendering. <i>Species with a narrow (or single) geographic range, Species with only one or few populations, Species with a small population size, Species with a declining population size, Species hunted or harvested by people, Species with low reproductive ability and/or germplasm-dispersal-ability, Species that require specialised habitat and niche conditions.</i> Endangered species of India.</p> <p>Endemic species – Concept, types, characteristics, theories of endemism. Endemic Wildlife Species of India.</p> <p>Wildlife (Protection) Act, 1972.</p>	
<b>Unit - 3</b>	<b>14</b>
<p>Ecosystem Services: Concept and Definition.</p> <p>Regulating services: <i>Purification of water and air; Carbon sequestration and climate regulation; Waste decomposition and detoxification; Regulation of prey</i></p>	

<p>populations; Pollination; Biological pest and disease control; Disturbance regulation (Flood protection).</p> <p>Provisioning services: Food (crops, wild foods and spices); Raw materials (Timber, fuelwood, organic matter, fodder, and fertiliser); Genetic resources (crop improvement genes, and health care); Biogenic minerals; Medicinal resources (Pharmaceuticals, chemical models, and bioassay organisms); Energy (Hydropower, biomass fuels); Ornamental resources (Fashion, handicrafts, jewelry, pets, worship, decoration, and souvenirs).</p> <p>Cultural services: Cultural (Nature motifs in books, film, painting, folklore, national symbols, advertising); Aesthetics, spiritual and historical (Art, religious and heritage value); Recreational experiences (Ecotourism, outdoor sports and recreation); Science and education (Academic excursions and scientific discovery); Therapeutic (Ecotherapy, social forestry and animal assisted therapy).</p> <p>Supporting services: Nutrient cycling, Soil formation, Primary production and Habitat provision.</p>	
<p><b>Unit - 4</b></p>	<p><b>14</b></p>
<p>Conservation (Biodiversity and Wildlife): Definition, need and significance. Conservation vs. Preservation. Conservation goals - Habitat conservation, Prevention of deforestation, Preventing species from extinction, Sustainable harvest of biological resources and climate change mitigation.</p> <p>Terminologies of conservation significance: Keystone species, Foundation species, Umbrella Species and Flagship species, Edge species, Critical link species, Indicator species, Priority species and Rare species.</p> <p>IUCN Red Listed species - Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild and Extinct.</p> <p>In-situ conservation: Protected areas – Sanctuaries - National Parks – Biosphere Reserves - Project Tiger and Project Elephant; Ramadevarabetta Vulture Sanctuary. Community Conserved Areas – case studies on Black Buck, Snow leopard, Amur falcon and Sarus Crane.</p> <p>Ex-situ conservation: Captive breeding (Botanical gardens, zoological parks, seed banks). Case study of <i>Ailuropoda melanoleuca</i> (Giant panda), <i>Ramosmania heterophylla</i> and <i>Madhuca insignis</i>. Cryopreservation, pollen storage, tissue culture, genetic engineering, field gene banks. Case study of Indian rhinoceros and black rhinoceros.</p> <p>International conservation efforts - Ramsar Convention, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on the Conservation of Migratory Species of Wild Animals (CMS), Trade Records Analysis of Flora and Fauna in Commerce (TRAFFIC). Reducing Emissions from Deforestation and Forest Degradation (REDD) and REDD+.</p>	

## References

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

## Content of Practical Course 4: List of Experiments to be conducted

### ES 4P1 - BIODIVERSITY ASSESSMENT AND ECOSYSTEM SERVICES

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

1. Documentation and assessment of tree diversity – Census method/Point- centered quarter method
2. Documentation and assessment of avian faunal diversity – Line transect method
3. Documentation and assessment of winged insect fauna – Light trap/Sticky trap method
4. Documentation and assessment of Butterflies – Visual encounter /Photographic survey
5. Documentation and assessment of soil fauna – Pitfall trap method
6. Documentation and assessment of crop diversity – Sampling method
7. Identification and documentation of aquatic macroflora – Visual encounter survey
8. Estimation of animal population size – Mark, Release and Recapture method
9. Assessment of regulatory services of terrestrial ecosystems (Green spaces) – Comparison method (air temperature, relative humidity and solar influx).
10. Assessment of provisional services of wetland ecosystems – Questionnaire survey method.
11. Introduction to global biodiversity databases – Global Biodiversity Information Facility (GBIF), Integrated Biodiversity Assessment Tool (IBAT-alliance)
12. Hands-on experience with biodiversity assessment software...- Paleontological Statistics Software Package for Education and Data Analysis (PAST). *Note: Data from experiment No 1 to 8 can be used for analysis.*
13. Mapping of International, National and State-wise biodiversity and wildlife conservation sites – Hotspots, Ramsar convention sites, Biosphere reserves, National parks, Sanctuaries, Protected areas and Ecologically significant zones.

### References

- Henderson, P. A., & Southwood, T. R. E. (2016). *Ecological methods*. John Wiley & Sons.
- Michael, P. (1986). *Ecological Methods for Field and Laboratory Investigations*. TataMcGraw-Hill Publishing Co. Ltd.
- Ravindranath, S., & Premnath, S. (1997). *Biomass studies: field methods for monitoring biomass*. Mohan Primlani.
- Rolan, R. G. (1973). *Laboratory and Field Investigations in General Ecology*. Macmillan Co.
- Sutherland, W. J. (Ed.). (2006). *Ecological census techniques: a handbook*. Cambridge university press.

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

## ES 40E4: ENVIRONMENT AND SUSTAINABLE AGRICULTURE

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

Content of OPEN ELECTIVE Theory Course 4		42 Hours
<b>Unit - 1</b>		14
<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>		
<b>Unit - 2</b>		14
<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>		
<b>Unit - 3</b>		14
<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> <p>Ecological principles of farming – Sustainable agriculture – Significance of indigenous crops and cattle varieties. Watershed management. Agricultural policies of India.</p>		

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

## ES 4OE4: INITIATIVES FOR ENVIRONMENTAL MANAGEMENT

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

Content of OPEN ELECTIVE Theory Course 4		42 Hours
<b>Unit - 1</b>		14
<p>Environment: Definition and components of the environment – Atmosphere, hydrosphere, lithosphere and biosphere – Definitions and influences on human beings.</p> <p>Environmental issues: Natural resource overuse and depletion, pollution, loss of biodiversity, Degradation of air, water and land.</p> <p>Water and wastewater management: Household water demand and uses. Availability of water for household uses. Centralised supply system – Rivers. Water treatment for portable purposes. Decentralised sources – Bore wells. Sustainable use of water – Reuse and recycling, rooftop rainwater harvesting. Greywater management – Septic tanks.</p> <p>Energy conservation: Sources of energy – Electricity, LPG, Other petroleum fuels and feasible alternative sources (Solar heating and photovoltaic). Measures to conserve energy – LED, energy efficient electrical appliances. Bureau of Energy Efficiency standards and labelling.</p> <p>Domestic solid waste management: Biodegradable – Kitchen waste - Issues and management. Compositing – Composters – Bin composter, three tier composters, pipe composting and mechanical composters. Human excreta - Issues and management. Bio-toilets, Dry/waterless toilets.</p> <p>Non- Biodegradable – Issues and management. Segregation – Dry, recyclables and sanitary wastes – Incinerators, pyrolysis and sanitary landfills:</p>		
<b>Unit - 2</b>		14
<p>Agriculture: Implications on soil water management – Fertiliser pollution – Soil salinity, Eutrophication and Bio-magnification. Pesticide pollution - DDT and Endosulphan - Integrated Pest Management (IPM), Bio- pesticides, Genetic Modified Crops (GMCs). Natural farming methods. Irrigation and drainage systems (Israel Model), Hydroponics and Aeroponics.</p> <p>Alternative cultivation methods: Negative impacts of food grown by conventional agriculture methods. Minimizing fertiliser use and preventing chemical pesticide usage. Role of rooftop gardens and kitchen gardens in regulating microclimate. Biofertilisers – <i>Rhizobium</i>,</p>		

<p><i>Azotobacter, Azospirillum, Bluegreenalgae, Azolla, Mycorrhizae.</i></p> <p>Livestock management: Dung and urine management – Biogas plants, Farm Yard Manure (FYM) and Vermi-composting.</p> <p>Human dwellings as micro climatic regimes: Variations in temperature and relative humidity in indoor and outdoor environment. Impacts of increased temperatures. Role of vegetation in micro climate regulation and Carbon capture. Green buildings and micro climateregulations.</p>	
<b>Unit - 3</b>	<b>14</b>
<p>Environmental Management: Definition, need, significance and applications. Environmental Technology vs. Technology for Environment.</p> <p>Technological solutions for environmental degradation: Concept, advantages and limitations. Remedial actions - Waste recycling; Preventive actions - pollution prevention and Management actions - Environmental Management System (ISO 14000 series).</p> <p>Factors influencing transfer of Environmental technology - developer to technology user: Information, Research and Marketing.</p> <p>Factors influencing technology development: Localisation, Customisation and Contextualisation.</p> <p>External factors influencing technology transfer: Laws and legislation; Administrative/Management systems; Information management; and Codes and Standards (<i>Eco-labelling and Green ratings</i>).</p> <p>Role of individuals in Environmental management: Resource measurements and monitoring, Ecological footprint analysis, Carbon footprint analysis, Water footprint analysis, Micro-climate monitoring and Participation in ecofriendly and sustainable endeavours.</p>	

## References

- Baskar, S., & Baskar, R. (2007). *Environmental Studies For Undergraduate Courses*. Unicorn Books.
- Behera, B. K., & Prasad, R. (2020). *Environmental technology and sustainability: Physical, chemical and biological technologies for clean environmental management*. Elsevier.
- Broniewicz, E. (Ed.). (2011). *Environmental management in practice*. BoD–Books on Demand.
- Kreith, F., & Tchobanoglous, G. (2002). *Handbook of solid waste management*. Mcgraw-hill.
- Mitchell, B. (2013). *Resource and environmental management*. Routledge.
- Nandini, N., Sunitha N., & Sucharita Tandon (2019). *A text book on Environmental Studies (AECC)*. Sapna Book House, Bengaluru.

National Research Council. (1999). *Technologies for Environmental Management*, The Department of Energy's Office of Science and Technology.

Theodore, M. K., & Theodore, L. (2021). *Introduction to environmental management*. CRC Press.

Waite, R. (2013). *Household waste recycling*. Routledge.

Wong, J. W., Surampalli, R. Y., Zhang, T. C., Tyagi, R. D., & Selvam, A. (Eds.). (2016, January). *Sustainable solid waste management*. Reston, VA: American Society of Civil Engineers.

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

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13/10/22

Registrar  
Davangere University  
Shivangotri, Davangere

  
**DAVANGERE UNIVERSITY**  
Department of Studies in Environmental Science  
Shivangangothri, Davangere-577 007.

**Prof. Gopinath S. M.**  
**Chairman -BoS**

**Mob: 8660793877**

**No: DU: EVS: 2022-23**

**Date: 25-08-2022**

**Proceedings of Board of Studies (BoS) meeting of U.G. Environmental Science Board**  
**Davangere University (2021-22)**

Board of Studies (BoS) meeting of U.G. Environmental Science board of Davangere University was held in the Department of Studies in Environmental Science, Davangere University, Shivangangothri, on 25-08-2022 (Wednesday) at 2.30 P.M.

**MEMBERS PRESENT:**

1. Prof. Gopinath S M  
Professor,  
Department of Studies in Environmental Science,  
Davangere University,  
Davangere
2. Prof. Govindappa M  
Professor,  
Department of Studies in Botany,  
Davangere University,  
Davangere
3. Prof. Mamatha  
Professor,  
Department of Studies in Chemistry,  
Davangere University,  
Davangere
4. Prof. Ravikumar Patil H S  
Professor  
Department of Studies in Food Technology  
Davangere University,  
Davangere
5. Dr. Yogendra K  
Dept of Environmental Science  
Kuvempu University  
Shankaraghatta
6. Dr. Prakash Kariyajjanavra  
Dept of Environmental Science  
Gulbarga University  
Gulbarga





Prof. Gopinath S.M. Chairman, BoS welcomed the board members to the meeting. The Chairman of the board briefed the agenda to the members and invited for discussion. The board has thoroughly discussed about each Topics in the curriculum. Proceedings have been recorded and provided hereunder.

- U.G. Environmental Science syllabus preparation (NEP) 2022-23. 3<sup>rd</sup> & 4<sup>th</sup> Semester.

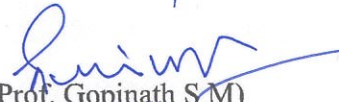


No changes were made from that of the model curriculum prepared by the subject wise expert committee and the same curriculum contents in UG Syllabus is approved.

The Chairman thanked all the members for their active participation and kind cooperation.

Chairman and members in the board of Studies		Signature
Prof. Gopinath S M	Chairman	
Prof. Govindappa M	Internal Member	
Prof. Mamatha	Internal Member	
Prof. Ravikumar Patil H S	Internal Member	
Dr. Prakash Kariyajjanavara	External Member	Attended on line
Dr. Yogendra K	External Member	ABSENT

  
DEAN

  
(Prof. Gopinath S M)  
ಅಧ್ಯಕ್ಷರು  
ಅಧ್ಯಯನ ಸುಂಡಳಿ  
ಪರಿಸರ ವಿಜ್ಞಾನ ಅಭ್ಯಯನ ವಿಭಾಗ  
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