STATE EDUCATION POLICY-2024-25

(SEP-2024)

ENVIRONMENTAL STUDIES

Syllabus of 1st to 4th Semester

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Submitted

BOS approved

The Chairman - BOS
Department of Studies in Botany
Davangere University, Davanagere - 577 007

to

Davangere University
Davangere-577 007

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Bachelor of Science (B.Sc.) Semester Scheme
Curriculum Structure for Undergraduate Programme for 2024-25

Sl. No.	Course/ Paper Code	Title of the paper	Subject Category	Teaching Hours/week	Semester End Exam.	Internal Assessment	Total Marks	Credits	Exam Duration
				Semester-I					
1.	MC-I	Atmosphere and Climate Change	MC-T	03	80	20	100	03	3 Hours
	Practical-I	Atmosphere and Climate Change	MC-P	03	40	10	50	02	3 Hours
			Total	**06**	**120**	**30**	**150**	**05**	---
				Semester-II					
2.	MC-II	Ecology and Environment	MC-T	03	80	20	100	03	3 Hours
	Practical-II	Ecology and Environment	MC-P	03	40	10	50	02	3 Hours
			Total	**06**	**120**	**30**	**150**	**05**	---
				Semester-III					
3.	MC-III	Natural Resource and management	MC-T	03	80	20	100	03	3 Hours
	Practical-III	Minerology, Petrology, Energy Resource and Medicinal Plants	MC-P	03	40	10	50	02	3 Hours
	Elective/ Optional-I*	Industrial Safety and Hazards Management	EL/OP-I	02	40	10	50	02	2 Hours
Total				**08**	**160**	**40**	**200**	**07**	---
Semester-IV									
4.	MC-IV	Biodiversity, Wildlife and Conservation	MC-T	03	80	20	100	03	3 Hours
	Practical-IV	Biodiversity Assessment and Ecosystem Services	MC-P	03	40	10	50	02	3 Hours
	Elective/ Optional-II*	Disaster and Management	EL/ OP-II	02	40	10	50	02	2 Hours
			Total	**08**	**160**	**40**	**200**	**07**	---
				Semester-V					
5.	MC-VA	Environmental Chemistry and Pollution	MC-T	03	80	20	100	03	3 Hours
	MC-VB	Environmental Protection and Management	MC-T	03	80	20	100	03	3 Hours

	Practical-V	Environmental Chemistry and Pollution	MC-P	03	40	10	50	02	3 Hours
			Total	**09**	**200**	**50**	**250**	**08**	---
				Semester-VI					
6.	MC-VA	Environmental Protection and Management	MC-T	03	80	20	100	03	3 Hours
	MC-VB	Environmental Impact and Risk Assessment	MC-T	03	80	20	100	03	3 Hours
	Practical-V	Environmental Protection, Impact and Risk Assessment	MC-P	03	40	10	50	02	3 Hours
			Total	**09**	**200**	**50**	**250**	**08**	---
			Grand Total	**46**	**960**	**240**	**1200**	**40**	

MC: Major Course, MC-T: Major Course Theory, MC-P: Major Course Practical, EL/OP: Open Elective/Optional

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PROGRAMME SPECIFIC OUTCOME OF B.Sc. ENVIRONMENTAL SCIENCE

PSO1: Ability to recognize the need for learning the topic and develop foundational knowledge on the topic

PSO2: Acquisition of knowledge on structure, to develop critical thinking and problem solving skills to solve interdisciplinary issues related to the topic.

PSO3: Understanding of various. The relationships between natural and man-made systems

PSO4: Understanding of the major elements of variation that exist in the living world through apply technical methods and innovative techniques in classroom, field and laboratory to analyze scientific data

PSO5: Ability to develop lifelong learning and professional skills

PSO6: Ability to design and execute a scientific project, write scientific reports, develop research and communication skills

PSO7: Ability to spread awareness about the environment around us, sustainable development and conduct outreach activities

PSO8: Internalization of the concept of conservation and evolution through the channel of spirit of inquiry.

PS09: Ability to gain empirical knowledge on the topic and contribute in decision-making processes

ENVIRONMENTAL SCIENCE COURSE OUTCOMES (COs):

Semester I (A-1): Atmosphere and Climate Change

1. Students will understand the Earth's atmosphere, meteorology, pollution, gas emissions, and airborne contaminants thereby the dynamics of atmosphere.

2. Studying climate and a changing climate is important, which will affect people around the world.

3. Analysis of atmospheric circulation and/or temperature alone can be used for modelling or prediction purposes.

4. Climatic Change is important since it helps to determine future climate expectations.

5. Preparing for climate change — also known as climate change adaptation is about reducing the risk of climate change impacts to people, places and resources

Semester II (A-2): Ecology and Environment

1. Acquire new knowledge of the interdependence between people and nature that is vital for food production, maintaining clean air and water, sustaining biodiversity.

2. Understand to maintain a mosaic of habitats that ensures the survival of a rich variety of species and knowledge on ecology, and ecological dynamics.

3. Learn how Biodiversity boosts ecosystem productivity where each species, no matter how small, all have an important role to play.

4. Ability to correlate ecological dynamics and regulation of vital processes on earth as biogeochemical cycles.

5. Ability to interpret ecosystem services, ecological resilience, ecological economics, and landscape ecology.

6. Set up experiments to appreciate concepts of ecology.

7. Critically examine the forces impacting ecosystems viz., climate change, stress, population, consumerism, globalization, land use change

Subject	**Atmosphere and Climate Change**	Semester	I
Number hr/week	4 hours	Total hours	56
Duration of the exam	3 hours	Credits	3

Unit	Content	Hours
I	**Introduction to Environmental Science:** Definition and Scope. Theoretical and applied aspects of Environmental Science. Types of Environment - Natural and Artificial Environment. **Environmental segments**: Atmosphere:. Nature, origin and evolution of atmosphere. Atmospheric structure and composition. Hydrosphere- definition, Types and forms precipitation, Bergeron process – Cloud formation and classification. Forms of condensation. Cloud seeding for artificial rain. Lithosphere: Definition. Internal structure of the earth.	14
II	**Weather and Climate:** Definition, scope and importance. Meteorological parameters - temperature, pressure, precipitation, humidity, wind speed & direction. Nature of solar energy radiations, Insolation-Factors affecting the insolation, transfer of insolation – absorption, scattering. Reflectance, diffusion and transmission. Terrestrial radiation and heat budget of the earth atmosphere. Monsoons Climates – Definition, Tropical cyclone-formation, structure, movement and path and its effects. Anticyclones -characteristics and origin. Thunder storms and tornadoes. Weather forecasting and modification, El Nino and La Nina effect. Indian monsoon climate.	14
III	**Greenhouse effect and global warming:** Definition, impacts, major greenhouse gases, sources and sinks of greenhouse gases; Urban Heat Islands; global dimming. Carbon foot print. Impacts of global climate change-Increased surface mean temperature, vector borne/zoonotic diseases, forest fire, influence on agriculture, increase in floods and drought, loss of biodiversity and extinction of species, sea level rise. Climate change and food security. Vulnerable populations – The Kiribati story.	14
IV	**Climate change and policy frame works:** Kyoto protocol 1997; 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. Copenhagen; Convention on climate change; carbon credit and carbon trading; Earth summit. Green Climate Fund. Role of individuals in achieving Sustainable Development Goals.	14

I BSc, I Semester, Paper I
Practical Syllabus
Paper I: **Atmosphere and Climate Change**

Duration of practical: **4 hours**
Syllabus based on theory paper syllabus

1. Determination of pH of Rain water sample
2. Determination of Humidity: Principle and use of dry & wet bulb thermometer.
3. Pressure: Aneroid barometer
4. Wind: direction and speed –wind vane and anemometer.
5. Construction of wind rose diagram
6. Demonstration of Rain gauge.
7. Mean rainfall calculation over a drainage basin using Thiessen's Polygon method and Isohyetal method.
8. Demonstration of Altimeter
9. Evaporation & transpiration problems.
10. Determination of solar radiation.
11. Measurement of noise level in different localities.

***Visit to any regional Meteorological centre**

I BSc, I Semester, Paper I
Practical Internal Assessment (10 Marks)
Paper I: **Atmosphere and Climate Change**

Practical Attendance: 05 Marks Practical Record: 05 Marks

Scheme for Practical Examination for Ist Semester
Practical Internal Assessment (10 Marks)

(MAX MARKS: 50)

Time: **3hours** Max Marks **40**

I. Major Experiment **20 Marks**
(Preparation, Identification/ Estimation/Quantification)

II. Identification and Comments **10 Marks**

III. Record **05 Marks**

IV. Viva voce examination **05 Marks**

Subject	**Ecology and Environment**	Semester	II
Number hr/week	4hours	Total hours	56
Duration of the exam	3 hours	Credits	3

Unit	**Content**	**Hours**
I	**Fundamentals of Ecology:** Definition, types of ecosystem. Structure and function of an ecosystem – abiotic and biotic components of an ecosystem. Energy flow – Laws of Thermodynamics in relation to energy flow. Food chain - Grazing and detritus. Food web. Ecological pyramids - Pyramid of number, biomass and energy. Productivity - Primary secondary and net productivity. Bio magnification. **Major Ecosystem:** Types and characteristics of Terrestrial ecosystem - Forest ecosystem, Mangrove, grassland, arid land, wetland, aquatic ecosystem-ponds, rivers, estuaries and Marine ecosystem. Cropland ecosystem.	14
II	**Abiotic factors:** Nature of response of organisms to abiotic factors. Essential elements and limiting factors; Liebig-Black Man Laws of limiting factors and Shelford's Law of Tolerance. Classification of organisms according to temperature tolerance and regulation. Thermal adaptation of plants and animals. Effect of light on plants and animals. **Ecological succession** – Primary and Secondary succession – Natural and man-influenced succession, – Hydrarch and Xerarch. Ecotone and Edge effect; Ecotypes and Ecophenes; Ecological indicators. Ecological Niche: Concept and Types of niches	14
III	**Biogeochemical cycles :** Definition, types, organic and biotic phases of geochemical cycles; types of biogeochemical cycles, water cycle, gaseous cycle-the carbon cycle, the nitrogen cycle, oxygen cycle; sedimentary cycles - sulphur cycle and phosphorous cycle.	14
IV	**Population Ecology:** Population definition, density, nasality, mortality, life table, age distribution; age pyramids, sex ratio, biotic potential and environmental resistance; population growth rate, dispersion-emigration, immigration, migration and regulation of population size.	14

I BSc, II Semester, Paper II
Practical Syllabus
Paper II: **Ecology and Environment**

Duration of practical: 4 hours
Syllabus based on theory paper syllabus

1. Demonstration of Microscope
2. Observation and identification of Micro-flora and fauna
3. Observation & Identification of Macro-flora and fauna
4. Study of ecological adaptations, morphology and anatomy of leaf and stem of
    a. Hydrophytes
    b. Xerophytes
    c. Epiphytes
5. Study of plant community- quadrat method and calculate the frequency percentage of different species of plants in an area.
6. A study of artificial ecosystem.
7. Estimation of carbon capture and storage of trees.
8. Estimation of primary productivity of a pond – Light and Dark bottle method
9. Estimation of primary productivity of terrestrial vegetation–chlorophysis method.
10. Estimation of primary productivity of grasses – Harvest method
11. Determination of turbidity of water sample using Sacchi disc.
12. Study of physical parameters of ponds and lakes (Color, odor, temperature and turbidity) water.
13. Visit to national parks/social forestry/urban forestry/ wild life sanctuary/forest ecosystem.

I BSc, I Semester, Paper II
Practical Internal Assessment (10 Marks)
Paper II: **Ecology and Environment**

Practical Attendance: 05 Marks

Practical Record: 05 Marks

Scheme for Practical Examination for 2nd Semester

Practical Internal Assessment (10 Marks)

(MAX MARKS: 50)

Time: **3hours**

Max Marks **40**

I. Major Experiment **20 Marks**
(Preparation, Identification/ Estimation/Quantification)

II. Identification and Comments **10 Marks**

III. Record **05 Marks**

IV. Viva voce examination **05 Marks**

Environmental Science I/II Semester

Subject	**Environmental Studies**	Semester	I/II
Number hr/week	4 hours	Total hours	56
Duration of the exam	3 hours	Credits	3

Unit	Content	Hours
1	**Introduction to Environmental Studies:** Multidisciplinary nature of environmental studies, scope and importance; Concept of sustainability and sustainable development. **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)	14
2	**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 tribalpopulations. **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. **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 ofbiodiversity: In-situ and Ex-situ conservation of biodiversity. **Ecosystem and biodiversity services**: Ecological, economic, social, ethical, aesthetic and Informational value.	14
3	**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 andindustrial waste Pollution case studies.	14

	Environmental Policies & Practices: Climate change, global warming, ozone layer depletion, acidrain 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	
4	**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 andlandslides. **Environmental movements**: Chipko, Silent valley, Bishnoisof Rajasthan **Environmental ethics**: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, casestudies (e.g., CNG vehicles in Delhi). **Field work**	14

B Sc I Semester Degree Examination, 2024-25
(Semester Scheme, New Syllabus: 2024-25)
Subject **Environmental Science**
Paper: **Atmosphere and Climate Change**
Paper Code:

Time : 3 Hours Max Marks: 80

Instructions to the Students

1. All sections are compulsory
2. Draw neat and labeled diagrams wherever necessary

SECTION-A

1. Answer **ALL** the following questions (2 x 10= 20)

a)
b)
c)
d)
e)
f)
g)
h)
i)
j)

SECTION-B

Answer any **SIX** of the following (5 x 6= 30)

2.
3.
4.
5.
6.
7.
8.
9.

SECTION-C

Answer any **THREE** of the following (10 x 3= 30)

10.
11.
12.

13.

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B.Sc. 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	**4**	**3**	**3**

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	**56 Hours**
Unit - 1	**14**

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, utilizing material substitution, recycling and marketability of industrial waste). Case studies on energy (Institutional Buildings, Energy efficient building) and paper conservation (The paper conservation project at the National library of India). Natural Resources: Definition, Classification of natural resources based on utility potential.	
Unit – 2	**14**
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 - Fisheries, aquaculture – prawns and oysters - Transportation – Shipping (people, goods and oil) and its impacts - Desalinisation – Importance and impacts - Coastal erosion and reclamation - Coastal Regulation Zone (CRZ) 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.	
Unit - 3	**14**

Forest Resources: Importance of Forestry – Types of Forests of India and Karnataka – Pressures on forest areas – *encroachments, forest fires, land use change (allocation for agriculture, industry and housing*)and over utilization of forest resources (Unsustainable harvesting of NTFPs, overgrazing, other anthropogenic pressures). 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). Forest based industries (Plywood, Pulp and Paper and Cottage industries). Ecotourism and its impacts. Captive plantations and Energy plantations Forest and wildlife conservation - Protected areas – Sanctuaries - National Parks – Biosphere Reserves.	
Unit - 4	**14**
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. 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. Energy Resources: Definition. Conventional, non-conventional and alternative energy resources. Energy sources and their impacts: Biomass burning (Fuel wood, Agriculture residue, Cow dung), Fossil fuels, Hydel, Geothermal, Nuclear energy; Solar (Thermal and Photovoltaic), Wind, Tidal, Micro hydel. Briquettes, Wood gas, Energy from waste (Pyrolysis and Biogas), Agri-based fuels (*Biodiesel, Gasohal*), Hydrogen fuels.Cogeneration.	

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Content of Practical Course 3: List of Experiments to be conducted

ES 3P1 – MINERALOGY, PETROLOGY, ENERGY RESOURCES AND MEDICINAL PLANTS

Duration of practical: **4 hours**

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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Ramakrishna TL. 1998. Mineral Rock Guide of Karnataka. Bharat Geo Guides Publ. Bangalore.

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Sathyanarayanswami BS. 1985. Engineering Geology – Laboratory Manual.

Eurasia Publishing House Pvt. Ltd.

Elective: III Semester
Industrial safety and hazards management

Unit	Course Content	32 Hours
Unit-1	**Concepts and Techniques**: History of safety movement –Evolution of modern safety concept - Incident Recall Technique (IRT), disaster control, safety analysis, safety survey, safety inspection, safety sampling. Safety Audits-components of safety audit, types of audit, audit methodology, non-conformity reporting (NCR), audit checklist- identification of unsafe acts of workers and unsafe conditions in the industry.	8
Uni-2	**Hazards Identification and Risk Assessment**: The process of risk management, hazard identification, evaluation (risk assessment, risk matrix), risk control implementation, action and recommendation	8
Uni-3	**Occupational Health and Toxicology**: Concept and spectrum of health, functional units and activities of occupational health services, occupational related diseases and levels of prevention of diseases. Toxicology- local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems **Acts and Rules:** Indian boiler Act 1923, Static and Mobile Pressure Vessel rules (SMPV), Motor Vehicle rules-1989, Mines Act-1952 with amendments in 2000- the building and other construction workers act 1996., Petroleum rules, Explosives Act 1983-Insecticide Act-1968, Factories Act 1948, Air Act 1981 and Water Act 1974.	8
Unit-4	**Safety Education and Training:** Importance of training-identification of training needs-training methods – programmes, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – domestic Safety and Training.	8

B.Sc. 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
4	**4**	**2**	**3**

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	**56 Hours**
Unit - 1	**14**
Biodiversity: Definition: Levels of Biodiversity - genetic diversity, species diversity, ecosystem diversity, Alpha, beeta and gama diversity. Biodiversity Hotspots: Global and Indian centres. Biogeography of India. Biodiversity profile of India: Forests, Grasslands, Wetlands and Riverine ecosystems; Marine and coastal diversity; Agro biodiversity; Urban Biodiversity; Invasive Alien species. 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. Traditional Knowledge and ethics in conservation of biodiversity. A locally relevant case study on biodiversity related aspects. People's Biodiversity Register. 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).	
UNIT-2	14
Ecosystem Services: Concept and Definition. Regulating services: Purification of water and air; Carbon sequestration and climate regulation; Waste decomposition and detoxification; Regulation of prey populations; Pollination; Biological pest and disease control; Disturbance regulation (Flood protection). Provisioning services: Food (crops, wild foods and spices); Raw materials (Timber, fuel wood, 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, jewellery, pets, worship, decoration, and souvenirs). 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). Supporting services: Nutrient cycling, Soil formation, Primary production and Habitat provision.	
UNIT-3	**14**
Wildlife: Definition. Wildlife of India. Values of wildlife: - Physical utility, economic/monetary value, recreational value, scientific value, ecological value, existence value. - Wildlife damage, human animal conflict, loss of economic productivity, wildlife diseases to man and competition effect. Importance of wildlife: Ecological, economic, socio-cultural, investigatory, medicinal, conservation of biological diversities, importance in agriculture. 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. Endangered species – Definition, characteristics and reasons for endangering. 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. Endangered species of India. Endemic species – Concept, types, characteristics, theories of endemism. Endemic Wildlife Species of India. Wildlife (Protection) Act, 1972.	
UNIT-4	**14**
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. 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. IUCN Red Listed species - Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild and Extinct. 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. Ex-situ conservation: Captive breeding (Botanical gardens, zoological parks, seed banks). Case study of Ailuropoda melanoleuca (Giant panda), Ramosmania heterophylla and Madhuca insignis. Cryopreservation, pollen storage, tissue culture, genetic engineering, field gene banks. Case study of Indian rhinoceros and black rhinoceros. 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+.	

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Reddy GV, Karanth KU, Kumar NS, Krishnaswamy J, Karanth KK. 2016. Recovering biodiversity in Indian forests. Singapore: Springer.

Singh SK. 2005. Textbook of Wildlife Management Text Book Library Edition. International Book Distributing Company.

Tandon U, Parasaran M, Luthra S. (Eds.). 2017. Biodiversity: Law, Policy and Governance. Taylor & Francis.

Weathers KC, Strayer DL, Likens GE. (Eds.). 2021. Fundamentals of ecosystem science. Academic Press.

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

BIODIVERSITY ASSESSMENT AND ECOSYSTEM SERVICES

Duration of practical: **4 hours**

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.

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Elective: IV Semester
Disasters and Management

Unit	Course Content	32 Hours
Unit-1	**Understanding Disasters** :Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management Types, Trends, Causes, Consequences and Control of Disasters :Geological Disasters; Hydro-Meteorological Disasters, Biological Disasters and Man -made Disasters Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters	8
Uni-2	**Disaster Management Cycle and Framework** :Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation –Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy , Hyogo Framework of Action	8
Uni-3	**Disaster Management in India** :Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter- Governmental Agencies	8
Unit-4	**Applications of Science and Technology for Disaster Management** :Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India	8

B Sc III Semester Degree Examination, 2024-25
(Semester Scheme, New Syllabus: 2024-25)
Subject **Environmental Science**
Paper: **Natural Resource and Management**
Paper Code:

Time : 3 Hours Max Marks: 80

Instructions to the Students

1. All sections are compulsory
2. Draw neat and labeled diagrams wherever necessary

SECTION-A

Answer **ALL** the following questions (2 x 10= 20)

a)
b)
c)
d)
e)
f)
g)
h)
i)
j)

SECTION-B

Answer any **SIX** of the following (5 x 6= 30)

2.
3.
4.
5.
6.
7.
8.
9.

SECTION-C

Answer any **THREE** of the following (10 x 3= 30)

10.
11.
12.
13.

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B Sc III Semester Degree Examination, 2024-25
(Semester Scheme, New Syllabus: 2024-25)
Subject **Environmental Science**
Open Elective Paper: **Industrial Safety Management**
Paper Code:

Time : 3 Hours Max Marks: 40

Instructions to the Students

1. All sections are compulsory
2. Draw neat and labeled diagrams wherever necessary

SECTION-A

Answer **ALL** the following questions (2 x 5= 10)

1.
2.
3.
4.
5.

SECTION-B

Answer any **SIX** of the following (5 x 6= 30)

6.
7.
8.
9.
10.
11.
12
13.

****

B Sc III Semester Degree Examination, 2024-25
(Semester Scheme, New Syllabus: 2024-25)
Subject **Environmental Science**
Open Elective Paper: **Industrial Safety Management**
Paper Code:

Time : 3 Hours | Max Marks: 40

Instructions to the Students

1. All sections are compulsory
2. Draw neat and labeled diagrams wherever necessary

SECTION-A

Answer **ALL** the following questions (2 x 5= 10)

1.
2.
3.
4.
5.

SECTION-B

Answer any **SIX** of the following (5 x 6= 30)

6.
7.
8.
9.
10.
11.
12
13.

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The Chairman - BOS
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