



# STATE EDUCATION POLICY- 2024-25

(SEP-2024)

## ENVIRONMENTAL STUDIES

### Syllabus of 1<sup>st</sup> to 4<sup>th</sup> 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/<br>Paper Code     | Title of the paper                                          | Subject<br>Category | Teaching<br>Hours/week | Semester End<br>Exam. | Internal<br>Assessment | Total<br>Marks | Credits   | Exam<br>Duration |
|---------------------|---------------------------|-------------------------------------------------------------|---------------------|------------------------|-----------------------|------------------------|----------------|-----------|------------------|
| <b>Semester-I</b>   |                           |                                                             |                     |                        |                       |                        |                |           |                  |
| 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          |
|                     |                           | <b>Total</b>                                                |                     | <b>06</b>              | <b>120</b>            | <b>30</b>              | <b>150</b>     | <b>05</b> | <b>---</b>       |
| <b>Semester-II</b>  |                           |                                                             |                     |                        |                       |                        |                |           |                  |
| 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          |
|                     |                           | <b>Total</b>                                                |                     | <b>06</b>              | <b>120</b>            | <b>30</b>              | <b>150</b>     | <b>05</b> | <b>---</b>       |
| <b>Semester-III</b> |                           |                                                             |                     |                        |                       |                        |                |           |                  |
| 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/<br>Optional-I*  | Industrial Safety and Hazards Management                    | EL/OP-I             | 02                     | 40                    | 10                     | 50             | 02        | 2 Hours          |
|                     | <b>Total</b>              |                                                             |                     | <b>08</b>              | <b>160</b>            | <b>40</b>              | <b>200</b>     | <b>07</b> | <b>---</b>       |
| <b>Semester-IV</b>  |                           |                                                             |                     |                        |                       |                        |                |           |                  |
| 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/<br>Optional-II* | Disaster and Management                                     | EL/<br>OP-II        | 02                     | 40                    | 10                     | 50             | 02        | 2 Hours          |
|                     |                           | <b>Total</b>                                                |                     | <b>08</b>              | <b>160</b>            | <b>40</b>              | <b>200</b>     | <b>07</b> | <b>---</b>       |
| <b>Semester-V</b>   |                           |                                                             |                     |                        |                       |                        |                |           |                  |
| 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    |
|--------------------|---------------------------------------|------------------------------------------------------|-----------|------------|------------|-------------|-----------|------------|
| <b>Total</b>       |                                       | <b>09</b>                                            | <b>09</b> | <b>200</b> | <b>50</b>  | <b>250</b>  | <b>08</b> | <b>---</b> |
| <b>Semester-VI</b> |                                       |                                                      |           |            |            |             |           |            |
| 6.                 | MC-VA                                 | Environmental Protection and Management              | MC-T      | 03         | 80         | 20          | 100       | 03         |
|                    | MC-VB                                 | Environmental Impact and Risk Assessment             | MC-T      | 03         | 80         | 20          | 100       | 03         |
|                    | Practical-V                           | Environmental Protection, Impact and Risk Assessment | MC-P      | 03         | 40         | 10          | 50        | 02         |
| <b>Total</b>       |                                       | <b>09</b>                                            | <b>09</b> | <b>200</b> | <b>50</b>  | <b>250</b>  | <b>08</b> | <b>---</b> |
| <b>Grand Total</b> |                                       | <b>46</b>                                            | <b>46</b> | <b>960</b> | <b>240</b> | <b>1200</b> | <b>40</b> |            |

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.

**PSO9:** Ability to gain empirical knowledge on the topic and contribute in decision-making processes

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## **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              | <b>Atmosphere and Climate Change</b> | Semester    | I  |
| Number hr/week       | 4 hours                              | Total hours | 56 |
| Duration of the exam | 3 hours                              | Credits     | 3  |

| Unit | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Hours |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| I    | <p><b>Introduction to Environmental Science:</b> Definition and Scope. Theoretical and applied aspects of Environmental Science. Types of Environment - Natural and Artificial Environment.</p> <p><b>Environmental segments:</b> 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.</p>                                                                                                                                 | 14    |
| II   | <p><b>Weather and Climate:</b> Definition, scope and importance. Meteorological parameters - temperature, pressure, precipitation, humidity, wind speed &amp; direction.</p> <p>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.</p> | 14    |
| III  | <p><b>Greenhouse effect and global warming:</b> Definition, impacts, major greenhouse gases, sources and sinks of greenhouse gases; Urban Heat Islands; global dimming. Carbon foot print.</p> <p>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.</p>                                                                                                                                                                         | 14    |
| IV   | <p><b>Climate change and policy frame works:</b> Kyoto protocol 1997;</p> <p>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 &amp; Climate Change (MoEF&amp;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.</p>    | 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 I<sup>st</sup> Semester**  
Practical Internal Assessment (10 Marks)

(MAX MARKS: 50)

Time: **3hours**

Max Marks **40**

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

**20 Marks**

**II. Identification and Comments**

**10 Marks**

**III. Record**

**05 Marks**

**IV. Viva voce examination**

**05 Marks**

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|                      |                                |             |    |
|----------------------|--------------------------------|-------------|----|
| Subject              | <b>Ecology and Environment</b> | Semester    | II |
| Number hr/week       | 4hours                         | Total hours | 56 |
| Duration of the exam | 3 hours                        | Credits     | 3  |

| Unit | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Hours |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| I    | <p><b>Fundamentals of Ecology:</b> 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.</p> <p><b>Major Ecosystem:</b> Types and characteristics of Terrestrial ecosystem - Forest ecosystem, Mangrove, grassland, arid land, wetland, aquatic ecosystem-ponds, rivers, estuaries and Marine ecosystem. Cropland ecosystem.</p> | 14    |
| II   | <p><b>Abiotic factors:</b> 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.</p> <p><b>Ecological succession</b> – 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</p>                    | 14    |
| III  | <p><b>Biogeochemical cycles</b> : 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.</p>                                                                                                                                                                                                                                                                                                                                                                     | 14    |
| IV   | <p><b>Population Ecology:</b> 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.</p>                                                                                                                                                                                                                                                                                                                                                   | 14    |



## 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–chlorophyll 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 2<sup>nd</sup> 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**

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## Environmental Studies I/II Semester

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

| Unit | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Hours |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1    | <p><b>Introduction to Environmental Studies:</b> Multidisciplinary nature of environmental studies, scope and importance; Concept of sustainability and sustainable development.</p> <p><b>Ecosystem:</b> Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food-webs, and ecological succession. Case studies of the following ecosystems:</p> <ul style="list-style-type: none"> <li>a) Forest ecosystem,</li> <li>b) Grassland ecosystem,</li> <li>c) Desert ecosystem,</li> </ul> <p>Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 14    |
| 2    | <p><b>Natural Resources: Renewable and Non-Renewable Resources:</b> Land resources and land-use change; Land degradation, Soil erosion, and desertification.</p> <p><b>Deforestation:</b> Causes and impacts due to mining, dam building on environment, forests, biodiversity, and tribal populations.</p> <p><b>Water:</b> Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international &amp; inter-state).</p> <p><b>Energy resources:</b> Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.</p> <p><b>Biodiversity and Conservation:</b> 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.</p> <p><b>Threats to biodiversity:</b> Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.</p> <p><b>Ecosystem and biodiversity services:</b> Ecological, economic, social, ethical, aesthetic and Informational value.</p> | 14    |
| 3    | <p><b>Environmental Pollution:</b> 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.</p> <p><b>Environmental Policies &amp; Practices:</b> Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.</p> <p><b>Environment Laws:</b> Environment Protection Act; Air (Prevention &amp; 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).</p> <p>Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context</p>                                                                                                                                                                                                                                                                                                                                                                | 14    |



|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 4 | <p><b>Human Communities and the Environment:</b> Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies.</p> <p><b>Disaster management:</b> floods, earthquake, cyclones and landslides.</p> <p><b>Environmental movements:</b> Chipko, Silent valley, Bishnoi of Rajasthan</p> <p><b>Environmental ethics:</b> Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).</p> <p><b>Field work</b></p> | 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  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <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. |           |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <p>patterns - Nature, Culture and Man. Phantom pile concept.</p> <p>Resources scarcity: Definition; types of resources scarcity - Demand- induced, supply-induced, and structural.</p> <p><b>Conservation of resources:</b> 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).</p> <p>Natural Resources: Definition, Classification of natural resources based on utility potential.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |
| <b>Unit – 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>14</b> |
| <p>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.</p> <p>Marine water – Ocean as a resource</p> <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> <p>Ground Water: Impacts of extraction: uplifting and seismic activities, land subsidence, vegetation degradation and food security implications.</p> <p>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.</p> |           |
| <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 utilization of forest resources (Unsustainable harvesting of NTFPs, overgrazing, other anthropogenic pressures).</p> <p>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).</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> |
| Land resources: Land-use patterns in India. Agro-climatic zones of India and                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |



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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>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 (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 (<i>Biodiesel</i>, <i>Gasohal</i>), Hydrogen fuels. Cogeneration.</p> |  |
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## References

- Arnab B, Jhariya MK, Meena RS, Meena SN. 2021. Natural Resources Conservation and Advances for Sustainability. Elsevier Science
- Bettinger P, Boston K, Siry J, Grebner D.L. 2016. Forest management and planning. Academic press.
- Davie T, Quinn NW. 2019. Fundamentals of hydrology. Routledge.
- Evans J. (Ed.). 2008. The Forests Handbook, Volume 1: An Overview of Forest Science.
- Goel PK. 2006. Water pollution: causes, effects and control. New Age International.
- Grebner DL, Bettinger P, Siry J, Boston K. 2021. Introduction to forestry and natural resources. Academic press.
- Innes JL, Tikina AV. (Eds.). 2016. Sustainable forest management: From concept to practice. Taylor & Francis.
- Jermar MK. 1987. Water resources and water management. Elsevier.
- Misra HN. (Ed.). 2014. Managing Natural Resources: Focus on land and water. PHI Learning Pvt. Ltd.
- Murty JVS. 1998. Watershed management. New Age International.
- Nandini N, Sunitha N, Tandon S. 2019. A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.
- Pandey BW. (Ed.). 2005. Natural resource management. Mittal Publications.
- Pennington KL, Cech TV. 2021. Introduction to water resources and environmental issues. Cambridge University Press.
- Peshin R, Dhawan AK. (Eds.). 2019. Natural Resource Management: Ecological Perspectives. Springer International Publishing.
- Shit PK, Pourghasemi HR, Adhikary PP, Bhunia GS, Sati VP. (Eds.). 2021. Forest resources resilience and conflicts. Elsevier.
- Viswanathan B. 2016. Energy sources: fundamentals of chemical conversion processes and applications. Newnes.
- Walther JV. 2014. Earth's natural resources. Jones & Bartlett Publishers. World Bank. 2008. Sustainable land management sourcebook. The World Bank.
- Young A. 2000. Land resources: now and for the future. Cambridge University Press.



### **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)

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#### **References**

- Ahuja JS, Virk MJS. 1993. Map Education. Survey of India.
- Ramakrishna TL. 1998. Mineral Rock Guide of Karnataka. Bharat Geo Guides Publ. Bangalore.
- Ramakrishna TL. 1998. Manual of Rocks, Minerals and Ores of Karnataka. Bharat Geo Guides Publ. Bangalore.
- Sathyanarayanswami BS. 1985. Engineering Geology – Laboratory Manual. Eurasia Publishing House Pvt. Ltd.



**Open Elective: III Semester**  
**Industrial safety and hazards management**

| Unit   | Course Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 32<br>Hours |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Unit-1 | <b>Concepts and Techniques:</b> 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           |
| Unit-2 | <b>Hazards Identification and Risk Assessment:</b> The process of risk management, hazard identification, evaluation (risk assessment, risk matrix), risk control implementation, action and recommendation                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 8           |
| Unit-3 | <b>Occupational Health and Toxicology:</b> 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<br><b>Acts and Rules:</b> 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 | <b>Safety Education and Training:</b> 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  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit - 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>14</b> |
| Biodiversity: Definition: Levels of Biodiversity - genetic diversity, species diversity, ecosystem diversity, Alpha, beeta and gama diversity.<br>Biodiversity Hotspots: Global and Indian centres. Biogeography of India.<br>Biodiversity profile of India: Forests, Grasslands, Wetlands and Riverine ecosystems; Marine and coastal diversity; Agro biodiversity; Urban Biodiversity; Invasive Alien species.<br><br>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.<br>Traditional Knowledge and ethics in conservation of biodiversity. |           |



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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <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>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 14 |
| <p>Ecosystem Services: Concept and Definition.</p> <p>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).</p> <p>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).</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>                                                                                                    |    |
| <b>UNIT-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 14 |
| <p>Wildlife: Definition. Wildlife of India.</p> <p>Values of wildlife:</p> <ul style="list-style-type: none"> <li>- Physical utility, economic/monetary value, recreational value, scientific value, ecological value, existence value.</li> <li>- Wildlife damage, human animal conflict, loss of economic productivity, wildlife diseases to man and competition effect.</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 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.</p> <p>Endemic species – Concept, types, characteristics, theories of endemism. Endemic Wildlife Species of India.</p> |    |



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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Wildlife (Protection) Act, 1972.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |
| <b>UNIT-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>14</b> |
| <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

- Bharucha E. 2002. The Biodiversity of India (Vol. 1). Mapin Publishing Pvt Ltd.
- Boenigk J, Wodniok S, Glücksman E. 2015. Biodiversity and earth history. Springer.
- Saha GK, Mazumdar S. 2017. Wildlife Biology - An Indian Perspective. Prentice Hall India Pvt., Limited
- Grunewald K, Bastian O. (Eds.). 2015. Ecosystem services—concept, methods and case studies. Springer.
- Jacobs S, Dendoncker N, Keune H. (Eds.). 2013. Ecosystem services: global issues, local practices. Elsevier.
- Krishnamurthy KV. 2003. Textbook of biodiversity. Science Publishers.
- Krishnamurthy KV. 2018. Advanced textbook on Biodiversity: Principles and Practice. CBS Publ & Dist PVT Limited I.
- MacLaurin J, Sterelny K. 2008. What is biodiversity?. In What Is Biodiversity?. University of Chicago Press.
- Nandini N, Sunitha N, Tandon S. 2019. A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.



- Negi SS. 1993. Biodiversity and its Conservation in India. Indus Publishing.
- 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.
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## **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.

## **References**



- Henderson PA, Southwood TRE. 2016. Ecological methods. John Wiley & Sons.
- Michael P. 1986. Ecological Methods for Field and Laboratory Investigations.  
Tata Mc Graw-Hill Publishing Co. Ltd.
- Ravindranath S, Premnath S. 1997. Biomass studies: field methods for monitoring biomass. Mohan Primlani.
- Rolan RG. 1973. Laboratory and Field Investigations in General Ecology.  
Macmillan Co.
- Sutherland WJ. (Ed.). 2006. Ecological census techniques: a handbook.  
Cambridge university press.
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**Open Elective: IV Semester  
Disasters and Management**



| Unit   | Course Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 32<br>Hours |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Unit-1 | <b>Understanding Disasters</b> :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  | <b>Disaster Management Cycle and Framework</b> :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  | <b>Disaster Management in India</b> :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 | <b>Applications of Science and Technology for Disaster Management</b> :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.

\*\*\*\*\*

  
**The Chairman - BOS**  
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**Registrar**  
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