

KUVEMPU



UNIVERSITY

B. Sc., ENVIRONMENTAL SCIENCE SYLLABUS

(Case 1: 3 Majors with a General Degree)

for

2026

Board of Studies in Environmental Science
Department of P.G. Studies and Research in Environmental Science
Kuvempu University
Jnanasahyadri, Shankaraghatta-577451
Shivamogga, Karnataka, INDIA.

Undergraduate Environmental Science Syllabus

Practical Knowledge and Skill Development Course (Compulsory)

Paper code	Paper type	Title of the paper	Credits Assigned	Instructional hours per week
SEMESTER – IV				
UGES-PS-I	Practical Knowledge and Skill Development Course	Biodiversity Assessment and Conservation	2	4
SEMESTER – V				
UGES-PS-II	Practical Knowledge and Skill Development Course	Water and Wastewater Treatment	2	4
SEMESTER – VI				
UGES-PS-III	Practical Knowledge and Skill Development Course	Solid waste and Bio medical waste Treatment	2	4

SEMESTER-IV

Practical Knowledge and Skill Development Course (Compulsory)

UGES-PS-I: Biodiversity Assessment and Conservation

Course learning Objectives:

- This course aims to equip students with comprehensive practical knowledge and skills, and to develop their capacity to assess biodiversity through hands-on sampling techniques (quadrats, transects) for campus flora and fauna.
- Build expertise in species identification using digital mobile apps (PlantNet, Seek by iNaturalist, PictureThis) and traditional field guides for plants, insects, birds, fish, and crop diversity.
- Gain field exposure to wildlife monitoring techniques including camera traps, animal evidence identification (pugmarks, scat analysis), and transect surveys for birds, butterflies, and mammals.
- Apply IUCN Red List criteria for species classification (CR/EN/VU/NT) and create conservation documentation including Local Red Data Books, GIS mapping, and field assessment reports.

Course Outcome:

Upon completion, students will be able to:

- Execute biodiversity sampling protocols and calculate species richness, Simpson (D), and Shannon (H') diversity indices for ecosystem comparisons.
- Identify and document local flora/fauna using mobile apps and prepare herbaria specimens with accurate scientific classification.
- Analyze wildlife populations through camera trap data, behavioral studies, and protected area assessments (National Parks, Wildlife Sanctuaries).
- Prepare comprehensive field reports on local biodiversity, human-wildlife conflicts, and conservation priorities, including threat analysis and mitigation recommendations.

Core Practical Components

1. Biodiversity Assessment: Sampling techniques (quadrats, transects) for campus flora and fauna.
2. Identify and record plant species of an ecosystem/campus using mobile apps (*PlantNet*, *Picture This*, *leafsnap*, *Seek by iNaturalist*, *Plantsnap* app and field guides).
3. Study of local fish species (Fish catch method/Fish market survey method)
4. To study flowering plants diversity around you
5. To Study bird diversity around you
6. Documentation and assessment of crop diversity of a local area– Sampling method
7. Calculate the species richness of an ecosystem/campus
8. Calculate the Simpson (D) and Shannon (H) diversity index of an Ecosystem/campus.
9. Compare two forest patches using Shannon & Simpson indices.
10. Classify Species of a National park/Wildlife sanctuary/ State/Country. Categorize them based on IUCN criteria: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Near Threatened (NT).
11. To study case studies on human-wildlife conflict and mitigation measures.
12. To study animal evidence identification (pugmarks, hoof marks, scat/pellet counting).
13. To study bird, butterfly, and mammal transect monitoring for diversity and abundance estimation.
14. Study of RED DATA book and create a "Local Red Data Book" Project
15. Survey Local Biodiversity: Identify plants and animals in your area/town.
Research & Document: Research the population trends, habitats, and threats to these local species.
16. Field Report: Documenting observations, habitat characteristics, and threats to species during field trips.

Field Visit Report Format

Students are often required to document their findings in a structured report. Key sections typically include:

1. **Title Page:** Location and purpose of the visit.
2. **Introduction:** Background on the site and objectives.
3. **Methodology:** Tools used for data collection or observation.
4. **Observations:** Detailed accounts of what was seen (e.g., specific species or industrial processes).
5. **Findings & Analysis:** Interpretation of the data collected.
6. **Conclusion:** Summary of the visit's impact on environmental awareness and responsibility.

*Note: **Minimum 10 Practicals + 1 Field Visit**

References:

1. Magurran, A. E. (2013). *Measuring Biological Diversity* (2nd ed.). Wiley-Blackwell.
2. Southwood, T. R. E., & Henderson, P. A. (2000). *Ecological Methods* (3rd ed.). Blackwell Science.

3. IUCN. (2024). The IUCN Red List of Threatened Species (Version 2024-1). Criteria for CR/EN/VU/NT categories. <https://www.iucnredlist.org/resources/categories-and-criteria> .
4. MoEFCC, Govt. of India. (2014). National Biodiversity Action Plan. Guidelines for protected areas and human-
. https://nbaindia.org/uploaded/BiodiversityIndia/15_10_2014_NBAPFinal.pdf .
5. CPCB. (2022). Guidelines for Biodiversity Monitoring in Urban Areas. <http://cpcb.nic.in/biodiversity-monitoring-guidelines> .
6. iNaturalist.org. (2024). Seek by iNaturalist App Documentation. AI-based species ID; accuracy validated in peer studies. https://www.inaturalist.org/pages/seek_app .
7. PlantNet. (2024). User Guide and Validation Studies. <https://plantnet.org/en/> .
8. Global Biodiversity Information Facility (GBIF). (2024). Open database for species distribution mapping. <https://www.gbif.org> .
9. Krishnamurthy, K. V. (2018). Methods in Ecology (Quantitative Ecology). Narendra Publishing House. (Herbaria, crop diversity; Karnataka-focused examples).
10. Wildlife Institute of India (WII). (2023). Camera Trapping Manual for Mammals/Birds. https://wii.gov.in/camera_trapping .
11. FSI (Forest Survey of India). (2023). India State of Forest Report. Species richness data for NPs/WS. <https://fsi.nic.in/isfr-2023> .

Kuvempu University
Scheme for BSc, IV Semester
Practical Knowledge and Skill Development Course
Practical Examination

(MAX MARKS: 50 (C1:05 (Assignment) + C2:05 (Class Seminar) + C3:40)

Time: **3hours**

Max Marks: 40

I. Preparation, Identification/ Estimation/Quantification/ Calculation/Report	20 Marks
II. Writing Comments/Project Report Submission and Presentation	10 Marks
III. Record / Project write up	05 Marks
IV. Viva-voce examination	05 Marks

SEMESTER-V

Practical Knowledge and Skill Development Course (Compulsory)

UGES-PS-II: Water and Wastewater Treatment

Course learning Objectives:

- a. This course equips students with hands-on skills in water quality analysis and wastewater treatment processes.
- b. Develop expertise in biochemical assessments such as BOD, suspended solids, and sludge volume index (SVI) through practical experiments and microscopic examination of biological samples.
- c. Gain proficiency in advanced techniques like lime-soda softening, breakpoint chlorination, desalination demonstrations, and coagulant optimization for real-world water purification applications.
- d. Apply knowledge through field visits to water treatment plants and effluent facilities, preparing detailed reports on treatment processes, efficiency evaluations, and pollution control measures.

Course Outcome

Upon completion, students will be able to:

- a. Execute standard water quality tests (H₂S strip, turbidity, hardness, ions via flame photometry) and calculate optimum chemical dosages for treatment.
- b. Analyze wastewater parameters (BOD, solids fractionation, residual chlorine) and interpret results for compliance with environmental standards.
- c. Assess treatment plant operations during field visits, documenting processes like coagulation, sedimentation, and disinfection with efficiency calculations.
- d. Prepare comprehensive lab reports and project submissions on water treatment techniques, including data analysis, process optimization, and recommendations for sustainable practices.

Core Practical Components

1. Water quality testing by H₂S strip test.
2. Calibration and standardization of nephelometer; determination of turbidity in water samples.
3. Determination of optimum lime-soda dose for hardness removal.
4. Determination of sodium and potassium by flame photometer.
5. Determination of optimum coagulant dosage in wastewater sample.
6. Determination of residual chlorine and available chlorine in bleaching powder.
7. Determination of suspended, settleable, volatile, and fixed solids in wastewater.
8. Determination of BOD for given sample.
9. Determination of chlorine demand, residual chlorine, and breakpoint chlorination.
10. Demonstration of desalination of saltwater.
11. Study of water treatment plant operations (coagulation, flocculation, sedimentation, filtration).
12. Analysis of influent/effluent quality in a local treatment facility.
13. Calculation of treatment efficiency (removal percentages for turbidity, hardness, BOD).
14. Jar test for coagulant optimization and flocculation studies.
15. Microscopic examination of treated water and sludge samples.
16. Field visit to water treatment plant/effluent treatment facility for process observation.

Field Visit Report Format

Students are often required to document their findings in a structured report. Key sections typically include:

1. **Title Page:** Location and purpose of the visit.
2. **Introduction:** Background on the site and objectives.
3. **Methodology:** Tools used for data collection or observation.
4. **Observations:** Detailed accounts of what was seen (e.g., specific species or industrial processes).
5. **Findings & Analysis:** Interpretation of the data collected.
6. **Conclusion:** Summary of the visit's impact on environmental awareness and responsibility.

***Note:** *Minimum 10 Practicals + 1 Field Visit*

References

1. Standard Methods for the Examination of Water and Wastewater (2012). APHA-WEF.
2. Rao, M.N. & Datta, A.K. (1987). Wastewater Treatment. Oxford & IBH.
3. Pepper, I.L. et al. (2011). Environmental and Pollution Science. Academic Press.
4. CPCB (2022). Guidelines for Water Quality Monitoring.
5. NEERI Manual on Water and Wastewater Analysis (1986). NEERI Publications.

Kuvempu University
Scheme for BSc, IV Semester
Practical Knowledge and Skill Development Course
Practical Examination

(MAX MARKS: 50 (C1:05 (Assignment) + C2:05 (Class Seminar) + C3:40)

Time: **3hours**

Max Marks: 40

I. Preparation, Identification/ Estimation/Quantification/ Calculation/Report	20 Marks
II. Writing Comments/Project Report Submission and Presentation	10 Marks
III. Record / Project write up	05 Marks
IV. Viva-voce examination	05 Marks

SEMESTER-VI

Practical Knowledge and Skill Development Course (Compulsory)

UGES-PS-III: Solid waste and Bio medical waste Treatment

Course Learning Objectives

- a. This course equips students with practical skills in solid waste characterization.
- b. Develop expertise in sustainable waste processing techniques such as vermicomposting, urban composting, and e-waste recycling using hands-on composting setups and material separation protocols.
- c. Gain proficiency in biomedical waste management practices, including segregation, autoclaving, incineration studies, and safe handling as per CPCB/BMW Rules for hazardous waste streams.
- d. Apply knowledge through field visits to dump yards, composting facilities, and biomedical waste treatment plants, preparing reports on waste minimization and circular economy strategies.

Course Outcome

Upon completion, students will be able to:

- a. Quantify solid waste parameters (organic content, SVI, compost quality via pH/moisture) and assess landfill suitability through physical/chemical characterization.
- b. Implement vermicomposting and urban composting systems, analyzing earthworm activity and compost maturity for agricultural applications.
- c. Execute biomedical waste segregation, treatment validation (autoclave efficacy), and disposal planning compliant with BMW Management Rules 2016.
- d. Prepare detailed field reports on waste management hierarchies, recycling efficiencies, and recommendations for zero-waste campus initiatives.

Core Practical Components

1. Study of solid waste management practices in local area (survey and characterization).
2. Determination of SVI of biological sludge and microscopic examination.
3. Estimation of organic matter in refuse by ignition method.
4. Study of vermicomposting methods and earthworm species identification.
5. Analysis of organic compost: total organic content, moisture content, pH determination.
6. Urban composting using organic/domestic waste (setup and monitoring).
7. E-waste management and recycling methods (component separation, material recovery).
8. Biomedical waste segregation categories (color coding, quantity estimation).
9. Study of biomedical waste treatment: autoclaving, shredding, and incineration demonstration.
10. Evaluation of compost maturity (C:N ratio, nutrient analysis).
11. Waste stream auditing in campus/institutional settings.
12. Landfill leachate characterization and liner efficiency assessment.
13. Plastic waste sorting, density separation, and recycling potential study.
14. Hazardous waste identification in biomedical streams (sharps, cytotoxic drugs).
15. Vermicompost vs. traditional compost comparison (nutrient profile, plant growth trial).

16. Field visit to dump yard, composting plant, biomedical waste facility (TSDF), and report submission.

Field Visit Report Format

Students are often required to document their findings in a structured report. Key sections typically include:

1. **Title Page:** Location and purpose of the visit.
2. **Introduction:** Background on the site and objectives.
3. **Methodology:** Tools used for data collection or observation.
4. **Observations:** Detailed accounts of what was seen (e.g., specific species or industrial processes).
5. **Findings & Analysis:** Interpretation of the data collected.
6. **Conclusion:** Summary of the visit's impact on environmental awareness and responsibility.

*Note: **Minimum 10 Practicals + 1 Field Visit**

References

1. CPCB (2016). Biomedical Waste Management Rules. Central Pollution Control Board.
2. Rao, M.N. & Datta, A.K. (1987). Wastewater Treatment (Solid Waste Chapters). Oxford & IBH.
3. MoEFCC (2022). Solid Waste Management Rules 2016 Guidelines.
4. Tchobanoglous, G. et al. (1993). Integrated Solid Waste Management. McGraw-Hill.
5. CPCB (2022). Guidelines for Vermicomposting and Waste Processing.
6. NEERI (2007). Manual on Municipal Solid Waste Management. NEERI Publications.

Kuvempu University
Scheme for BSc, IV Semester
Practical Knowledge and Skill Development Course
Practical Examination

(MAX MARKS: 50 (C1:05 (Assignment) + C2:05 (Class Seminar) + C3:40)

Time: **3hours**

Max Marks: 40

I. Preparation, Identification/ Estimation/Quantification/ Calculation/Report	20 Marks
II. Writing Comments/Project Report Submission and Presentation	10 Marks
III. Record / Project write up	05 Marks
IV. Viva-voce examination	05 Marks

Chairman

(Prof. Yogendra K)
BOS in Environmental Science (UG)