

Secondary Education Curriculum, 2082

Environment Science

Grade: 11 and 12



Government of Nepal
Ministry of Education, Science and Technology
Curriculum Development Centre
Sanothimi, Bhaktapur

Secondary Education Curriculum, 2082

Environment Science

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Subject Code: (Grade 11: 4131), (Grade 12 : 4141)

Credit Hour: 5

Annual Working Hours: 160

1. Introduction

Environment Science is an interdisciplinary subject that deals with the interrelationship and interdependence between living beings and their surrounding environment. Growing population, increased urbanization and development, and unsustainable use of resources are the major causes of environmental degradation. In Nepal, where the national economy and people's livelihood are intricately linked to natural resources, the sustainable utilization and management of these resources has become a pressing challenge. In this connection, educating and raising environmental awareness is the key option for sustainable resource utilization. Environment Science course provides essential base for the study of complex inter-relationship between various natural and anthropogenic phenomena. Therefore, the relevancy of the subject has been greatly realized over the period of time.

This curriculum presumes that the students opting Environment Science in Grade 11 and 12 come with diverse aspirations; some of them may continue higher level studies in Environment Science, others may join technical and vocational areas or even other streams. The curriculum is designed to provide students with general understanding of the fundamental laws and principles governing environmental sustainability paradigms. It focuses to develop basic scientific understanding, skills, competencies and attitude required at secondary level (Grade 11-12). The curriculum expects developing environmental understanding based on scientific grounds and applications in daily life as well as obtaining new knowledge through integrated approach.

The curriculum has been structured for two years in such a way that it builds the knowledge, understanding and basic principles of Environment Science with intrinsic linkages between life, livelihood and environment. It also tries to develop an understanding on local impacts of global phenomena and vice-versa. It incorporates the level-wise competencies, grade-wise leaning outcomes and scope and sequence of contents. It also includes the suggested practical/project works, learning facilitation process and assessment strategies to meet the intended learning outcomes of the subject. The curriculum for grade 11 and 12 includes 120 hours of theoretical

learning and 40 hours of practical and project work to develop a comprehensive understanding of the environmental concepts, issues and solutions.

2. Level-wise Competencies

On completion of this course, students are expected to demonstrate the following competencies:

1. Understand and analyze the various spheres of the Earth and their interconnections.
2. Determine and evaluate the factors contributing to environmental degradation.
3. Apply strategies and techniques to prevent and mitigate environmental degradation, pollution, and hazards.
4. Employ appropriate tools, techniques, and methodologies to address environmental challenges and communicate evidence-based solutions to the local community.
5. Classify and assess the services and values provided by terrestrial and aquatic ecosystems.
6. Demonstrate proficiency in the sustainable management of environmental resources.
7. Articulate the significance of biodiversity for environmental stability and prioritize actions that promote biodiversity conservation.
8. Utilize environmental knowledge and technologies to support national development and environmental sustainability.

3. Grade-wise Learning Outcomes

3.1 Grade 11

SN	Content Area	Learning Outcomes
1	Fundamentals of Environment and Environment Science	<ul style="list-style-type: none">1.1 Demonstrate a comprehensive understanding of the concepts related to the environment and Environment Science.1.2 Articulate the scope and significance of Environment Science.1.3 Analyze the environmental changes resulting from societal development.1.4 Illustrate the interdependence between human beings and the environment.1.5 Explain the principles and practices of environmental stewardship.

SN	Content Area	Learning Outcomes
2	Ecology and Ecosystem	<p>2.1 Define ecology and its significance in environmental studies.</p> <p>2.2 Articulate the fundamental principles of ecology.</p> <p>2.3 Identify and describe the components that make up ecosystems.</p> <p>2.4 Explain the various types of ecosystems and their distinguished features.</p> <p>2.5 Demonstrate a thorough understanding of the concepts of food chain, food web, and trophic level.</p>
3	Environmental Resources	<p>3.1 Define environmental resources and their role in sustaining ecosystems.</p> <p>3.2 Classify environmental resources into perpetual, renewable, and non-renewable categories.</p> <p>3.3 Explain the significance of biological resources, including plants, animals, and microorganisms in environmental systems.</p> <p>3.4 Analyze forest resources, with a focus on major forest types in Nepal, fragmentation, degradation, and the causes and consequences of forest degradation.</p> <p>3.5 Evaluate water resources, emphasizing spatial and temporal variability, water stress, and hydropower development.</p> <p>3.6 Define and analyze minerals and soils in the environment, focusing on their potential, uses, and the environmental implications of mining.</p> <p>3.7 Describe energy resources, including renewable and non-renewable sources, and analyze demand-supply trends of these resources.</p>
4	Environmental Pollution and Degradation	<p>4.1 Define environmental pollution and its significance in environmental studies.</p> <p>4.2 Describe the various types of pollution, including air, water, land, noise, and radiation.</p> <p>4.3 Analyze the causes and sources of environmental pollutants.</p> <p>4.4 Evaluate the impacts of environmental pollution on human health, agriculture, ecosystems, biodiversity, water, and land resources.</p> <p>4.5 Analyze the different types of environmental pollution prevalent in Nepal.</p> <p>4.6 Assess the environmental degradation of sensitive areas, with a focus on the Chure area of Nepal.</p>

SN	Content Area	Learning Outcomes
5	Climate Science	<p>5.1 Define weather and climate, and distinguish between them.</p> <p>5.2 Explain the concepts of insolation and the Earth's heat budget.</p> <p>5.3 Define the greenhouse effect and global warming.</p> <p>5.4 Analyze the impacts of climate change on agriculture and food security, human health, biodiversity, water resources, tourism, and infrastructure.</p> <p>5.5 Evaluate the evidence of climate change occurring in the Nepal Himalaya.</p>
6	Environmental Hazards	<p>6.1 Define the concepts of hazard, exposure, vulnerability, risk, and disaster.</p> <p>6.2 Distinguish between the concepts of hazard and disaster.</p> <p>6.3 Explain the different types of hazards, including natural and anthropogenic hazards.</p> <p>6.4 Differentiate and analyze climatic and non-climatic hazards.</p> <p>6.5 Evaluate the prevalence of environmental hazards in the Nepali context.</p>
7	Solid Waste Management	<p>7.1 Identify and describe effective solid waste management practices.</p> <p>7.2 Analyze the types, sources, and characteristics of solid waste.</p> <p>7.3 Evaluate the environmental impacts of solid waste.</p> <p>7.4 Explain solid waste management approaches, including the 5-R principles, collection, segregation, storage, and transportation.</p> <p>7.5 Discuss various solid waste management techniques, including open dumping, sanitary landfilling, aerobic and anaerobic composting, vermicomposting, incineration, and pyrolysis.</p>
8	Environmental Policies	<p>8.1 Analyze the concepts of environmental policies and laws, including policies, acts, rules, and standards.</p> <p>8.2 Trace the historical development and evolution of environmental policies.</p> <p>8.3 Evaluate the significance of environmental policies and laws in effective environmental management.</p> <p>8.4 Discuss the sectoral environmental policies implemented in Nepal.</p> <p>8.5 Explain the concept of environmental and social safeguards and their role in environmental protection.</p>

SN	Content Area	Learning Outcomes
9	Ecosystem Services	<p>9.1 Define the concept of ecosystem services and their role in environmental sustainability.</p> <p>9.2 Classify the different types of ecosystem services.</p> <p>9.3 Evaluate the importance and values of ecosystem services.</p> <p>9.4 Analyze the concept of payment for ecosystem services and its applications.</p> <p>9.5 Describe the ecosystem services provided by various ecosystems in Nepal.</p>
10	Technology and Environment	<p>10.1 Analyze the relationship between technology and the environment.</p> <p>10.2 Evaluate the impacts of technology on the environment.</p> <p>10.3 Identify various energy technologies and assess their environmental impacts.</p> <p>10.4 Define and explain the concept of technological hazards.</p> <p>10.5 Demonstrate an understanding of the application of technology, specifically Remote Sensing (RS) and Geographic Information Systems (GIS), in environmental management.</p>

3.2 Grade 12

SN	Content Area	Learning Outcomes
1	Environmental Spheres	<p>1.1 Analyze the concept of environmental spheres and evaluate the Earth as a closed system.</p> <p>1.2 Describe the composition and vertical zonation of the atmosphere, and identify the meteorological parameters influencing air mass movement.</p> <p>1.3 Explain the hydrological cycle and the global distribution of water, differentiate between lentic and lotic environments and their characteristics, and analyze lake stratification and zonation.</p> <p>1.4 Characterize the physical, chemical, and biological properties of soil, illustrate the soil profile, and describe pedogenic processes.</p> <p>1.5 Define the biosphere and evaluate the concept, components, and interactions of environmental spheres.</p>

SN	Content Area	Learning Outcomes
2	Ecosystem Dynamics	<p>2.1 Demonstrate an understanding of the concept of ecosystem dynamics.</p> <p>2.2 Analyze population dynamics, explain environmental factors, describe population and community characteristics, evaluate species interactions, and discuss ecological succession.</p> <p>2.3 Differentiate between R and K reproduction strategies.</p> <p>2.4 Outline the flow of energy within ecosystems.</p> <p>2.5 Explain nutrient cycling and biogeochemical cycles, and illustrate the hydrological cycle.</p>
3	Biodiversity Conservation	<p>3.1 Explain the concept of biodiversity conservation.</p> <p>3.2 Evaluate the importance and values of biodiversity.</p> <p>3.3 Assess the status of biodiversity and identify threats to biodiversity in Nepal.</p> <p>3.4 Analyze initiatives for biodiversity conservation, differentiate between in-situ and ex-situ conservation methods in Nepal, and discuss policy provisions for biodiversity conservation, such as the Convention on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).</p> <p>3.5 Evaluate how biodiversity conservation contributes to achieving environmental sustainability.</p>
4	Environmental Pollution Control and Management	<p>4.1 Identify and describe air pollution control technologies for particulate matter.</p> <p>4.2 Analyze water pollution control technologies, including primary, secondary, and tertiary wastewater treatment methods.</p> <p>4.3 Evaluate measures for controlling soil and land pollution.</p> <p>4.4 Explain measures for noise pollution control.</p> <p>4.5 Define ecosystem restoration and assess its significance in pollution control.</p>

SN	Content Area	Learning Outcomes
5	Climate Change Resilience	<p>5.1 Explain the concept of climate change resilience.</p> <p>5.2 Define climate change vulnerability.</p> <p>5.3 Identify adaptation and mitigation strategies to address climate change.</p> <p>5.4 Analyze the impacts of climate change in the Himalayas.</p> <p>5.5 Describe national and international initiatives to combat climate change, including Nepal's climate change policy, LAPA, NAPA, NAP, BUR, UNFCCC, and the Paris Agreement.</p>
6	Disaster Risk Reduction and Management	<p>6.1 Demonstrate an understanding of the Disaster Risk Management (DRM) cycle.</p> <p>6.2 Explain the concept of loss and damage.</p> <p>6.3 Identify Disaster Risk Reduction (DRR) approaches.</p> <p>6.4 Define the Early Warning System (EWS).</p> <p>6.5 Describe community-based initiatives in Disaster Risk Management (DRM) in Nepal.</p>
7	Environmental Assessment	<p>7.1 Define environmental assessment and explain its significance.</p> <p>7.2 Differentiate between Baseline Environmental Study (BES), Initial Environmental Examination (IEE), and Environmental Impact Assessment (EIA).</p> <p>7.3 Describe the steps in environmental assessment, including screening, scoping, preparation of terms of reference, and baseline information collection.</p> <p>7.4 Identify and explain environmental standards related to drinking water, ambient air, and noise.</p> <p>7.5 Demonstrate an understanding of environmental management systems.</p>

SN	Content Area	Learning Outcomes
8	Environmental Governance	<p>8.1 Demonstrate an understanding of the concept of environmental governance.</p> <p>8.2 Explain the provisions related to the environment in the Constitution of Nepal and other relevant legal frameworks.</p> <p>8.3 Identify and describe the provisions outlined in the Environmental Protection Act (EPA) and Environmental Protection Rules (EPR).</p> <p>8.4 Define the concept of environmental justice.</p> <p>8.5 Analyze the roles and significance of internationally binding legal entities in environmental governance.</p>
9	Environmental Economics and Sustainability	<p>9.1 Demonstrate an understanding of the principles of environmental economics.</p> <p>9.2 Explain the concept of a circular economy.</p> <p>9.3 Classify the Sustainable Development Goals (SDGs) based on social, economic, and environmental perspectives.</p> <p>9.4 Analyze the role and relevance of the SDGs in the context of Nepal.</p> <p>9.5 Describe the application of environmental economics in promoting the sustainable use of environmental resources.</p>
10	Green Entrepreneurship	<p>10.1 Explain the concept of green entrepreneurship.</p> <p>10.2 Analyze the importance of green technologies in sustainable development.</p> <p>10.3 Define green businesses and eco-design principles.</p> <p>10.4 Describe eco-tourism, emphasizing its economic and environmental benefits.</p> <p>10.5 Evaluate the current practices and future prospects of green entrepreneurship in Nepal.</p>

4. Scope and Sequence of Contents

Grade 11

SN	Content Area	Elaboration of Contents	Working Hours (Th.)
1	Fundamentals of Environment and Environment Science	1.1 Concept of environment and Environment Science 1.2. Scope and importance of Environment Science 1.3 Environment and societal development 1.4 Interdependency of human beings on the environment 1.5 Environmental stewardship	10
2	Ecology and Ecosystem	2.1 Concept of ecology 2.2 Principles of ecology 2.3 Components of ecosystem 2.4 Types of ecosystems 2.5 Food chain, food web and trophic level	15
3	Environmental Resources	3.1 Concept of environmental resources 3.2 Types of resources (perpetual, renewable and non-renewable) 3.3 Biological resources: importance of plants, animals and microorganisms 3.4 Forest resources: forest types of Nepal, fragmentation and degradation, cause and consequences 3.5 Water resources (spatial and temporal variability, water stress and hydropower development) 3.6 Mineral and soils (potential and uses, environmental implication of mining) 3.7 Energy resources (renewable and non-renewable energy sources, demand-supply trends)	15

SN	Content Area	Elaboration of Contents	Working Hours (Th.)
4	Environmental Pollution and Degradation	4.1 Concept of environmental pollution 4.2. Types of pollution: air, water, land, noise and radiation 4.3. Causes and sources of pollutants 4.4 Effects of environmental pollution: human health, agriculture, ecosystem, biodiversity, water and land resources 4.5 Environmental pollution in Nepal 4.6 Environmental degradation of sensitive areas (Chure area of Nepal)	15
5	Climate Science	5.1 Concept of weather and climate 5.2 Insolation and heat budget 5.3 Concept of greenhouse effect and global warming 5.4 Climate change impacts (agriculture and food security, human health, biodiversity, water, tourism and infrastructure) 5.5 Climate change in Nepali context	10
6	Environmental Hazards	6.1 Concept of hazard, exposure, vulnerability, risk and disaster 6.2 Difference between hazard and disaster 6.3 Types of hazards (natural and anthropogenic) 6.4 Climatic and non-climatic hazards 6.5 Environmental hazards in Nepali context	10
7	Solid Waste Management	7.1. Concept of solid waste management 7.2 Types, sources and characteristics of solid wastes 7.3. Impacts of solid waste on environment 7.4. Solid waste management approaches (5-R, collection, segregation, storage and transportation) 7.5. Solid waste management techniques: open dumping, sanitary land filling, composting (aerobic and anaerobic), vermi-composting; incineration and pyrolysis	10

SN	Content Area	Elaboration of Contents	Working Hours (Th.)
8	Environmental Policies	8.1 Concept of environmental policies and laws (policies, acts, rules and standards) 8.2 Evolution of environmental policies 8.3 Importance of environmental policies and laws 8.4 Sectoral environmental policies in Nepal 8.5 Environmental and social safeguard	10
9	Ecosystem Services	9.1 Definition of ecosystem services 9.2 Types of ecosystem services 9.3 Values of ecosystem services 9.4 Payment for ecosystem services 9.5 Ecosystem services in Nepal	15
10	Technology and Environment	10.1 Concept of technology and environment 10.2 Impacts of technology on environment 10.3 Assessment of energy technologies 10.4 Technological hazards 10.5 Application of technology in environment (RS and GIS)	10

Grade 12

SN	Content Area	Elaboration of Contents	Working Hours (Th.)
1	Environmental Spheres	1.1 Concept of environmental spheres; Earth as a closed system 1.2 Atmosphere: composition and vertical zonation of atmosphere; meteorological parameters 1.3 Hydrosphere: hydrological cycles and global distribution of water; Lentic and lotic environment and their characteristics, lake stratification and zonation 1.4 Lithosphere: Properties of soil (physical, chemical and biological); Soil profile and pedogenic processes 1.5 Biosphere: concept, components and interaction with other spheres	15

SN	Content Area	Elaboration of Contents	Working Hours (Th.)
2	Ecosystem Dynamics	2.1 Concept of ecosystem dynamics 2.2 Population dynamics; Environmental factors, population and community characteristics, species interaction and succession 2.3 Reproduction strategy (R and K Selection) 2.4 Energy flow in ecosystem 2.5 Nutrient cycling; biogeochemical and hydrological cycle	15
3	Biodiversity Conservation	3.1 Concept of biodiversity conservation 3.2 Importance and values of biodiversity 3.3 Status and threats of biodiversity in Nepal 3.4 Initiatives for biodiversity conservation; In-situ/ ex-situ conservation in Nepal, Policy provisions for biodiversity conservation (e.g., CBD and CITES) 3.5 Biodiversity conservation and environmental sustainability	10
4	Environmental Pollution Control and Management	4.1 Air pollution control technologies (particulate matter) 4.2 Water pollution control technologies (wastewater treatment-primary, secondary and tertiary methods) 4.3 Soil/land pollution control 4.4 Sound pollution control 4.5 Concept of ecosystem restoration	15
5	Climate Change Resilience	5.1 Concept of climate change resilience 5.2 Climate change vulnerability 5.3 Adaptation and mitigation to climate change 5.4 Climate change impacts in Himalayas 5.5 National and international initiatives (climate change policy Nepal, LAPA, NAPA, NAP, BUR; UNFCCC and Paris Agreement)	10

SN	Content Area	Elaboration of Contents	Working Hours (Th.)
6	Disaster Risk Reduction and Management	6.1 Disaster Risk Management (DRM) cycle 6.2 Loss and damage 6.3 Disaster risk reduction (DRR) approaches 6.4 Early Warning Systems (EWS) 6.5 Community based initiatives in DRM in Nepal	10
7	Environmental Assessment	7.1 Concept of environment assessment 7.2 Environmental assessment (BES, IEE and EIA) 7.3 Steps in environmental assessment (screening, scoping, preparation of terms of reference, baseline information collection, etc.) 7.4 Environmental standards (drinking water, ambient air and noise) 7.5 Environmental management systems	15
8	Environmental Governance	8.1 Concept of environmental governance 8.2 Constitution of Nepal; provision related to environment 8.3 Environmental Protection Act (EPA) and Environmental Protection Rules (EDR) 8.4 Environmental justice 8.5 Internationally binding legal entities	10
9	Environmental Economics and Sustainability	9.1 Concept of environmental economics 9.2 Circular economy 9.3 Sustainable Development Goals (SDGs) 9.4 SDGs in Nepali context 9.5 Environmental economics and sustainable use of environmental resources	10
10	Green Entrepreneurship	10.1 Concept of green entrepreneurship 10.2 Importance of green technologies 10.3 Green businesses and eco-design 10.4 Eco-tourism 10.5 Green entrepreneurship in Nepali context	10

5. Suggested Practical and Project Activities

This curriculum provides students with the opportunity to explore a range of topics of Environment Science, and foster the skills to analyze the real field situations, including contemporary environmental challenges, the impact of the pollution on ecosystem health, waste management, etc. Students will also increase their scientific understanding and examine the interrelationships between science, environment and society. Project work outlined in the curriculum consists of activities designed to demonstrate the understanding and ideas through collecting, processing, analyzing and communicating the information. Forty working hours have been designated to practical and project activities in each grade. The practical/project works will enable the students to do the following.

- Identify and apply tools used in environmental sampling and analyze environmental data.
- Investigate a range of perspectives that have contributed to scientific knowledge about the environment, and apply these knowledge and procedures addressing environmental problems and issues.
- Recognize the major contemporary environmental challenges, acquire knowledge and demonstrate capability to report such situations.

The table below shows the suggested practical activities and project works for both grades.

Practical and Project Work for Grade 11 (Any Eight) (5 hrs. each)
<ol style="list-style-type: none">1. Document the cultural practices associated with environment and natural resources.2. Considering forest nearby your settlement or school area, prepare a checklist of the plant species with their uses; enumerate the local names and scientific names for the species identified. Did you find the diversity in the plant species in the forest?3. Make a field visit of one of the ecosystems. Illustrate pyramid of biomass and number using the data collected from the field.4. Depict the energy consumption scenario in different sectors of Nepal.5. Visit the nearby aquatic ecosystem. Characterize the point and non-point sources of pollutants in the ecosystem.6. Analyze the temperature and precipitation trend of nearby meteorological station.7. Measure the pH, temperature and total suspended solids content in water samples collected from aquatic ecosystem.8. Determine pH and electrical conductivity of soils found in agriculture land, grassland and/or forestlands. Interpret the results with respect to soil quality.

9. Determine moisture content of soils found in agriculture land, grassland and/or forestlands.
10. Visit the nearby aquatic ecosystem. List the biotic and abiotic components of the ecosystem you noticed. Identify the different ecosystem services provided by the system (quantify the amount of provisioning services as appropriate).
11. Visit nearby wastewater treatment plant. After returning from the field, develop a model of wastewater treatment plant.
12. Collect solid waste from your house. Analyze its composition and characterize its type.
13. Document the existing environmental policies of your local level.
14. Analyze the existing use of energy related technologies in Nepal.
15. Prepare natural resource map of your locality and develop a management plan for its sustainable utilization.

Practical and Project Work for Grade 12 (Any Eight) (5 hrs. each)

1. Analyze the population trend of your local level. Assess how population has been changing over time. How has this change impacted the local environment?
2. Prepare a report on local initiatives to reduce the impacts of pollution on the environment (e.g., community cleanup and indigenous practices like *Sithi Nakha*).
3. Collect and analyze the data of ambient air quality monitoring (primary or secondary data). Compare the results obtained with national and international air quality standards.
4. With the help of a topographic map, sketch different features of a selected catchment area. Categorize different land use practices.
5. Determine the change in physical (color, turbidity, temperature, total solids) and chemical (pH, EC, dissolved oxygen) parameters of streams/river along the stretches. Compare the water quality across the stretches.
6. Visit to any developmental project site. Make a flowchart of EA process for development project in Nepal. Use the available EA reports (online or in hard copy) for making a flow chart.
7. Visit to any protected area and make a report on conservation status of biodiversity.
8. Document loss and damage status of a disaster event prevalent at your community. List the activities carried out by the community in response to the disaster.

9. Document the existing disaster preparedness plans of your local government.
10. Make a report about impacts of anthropogenic activities on soil environment (consider the site polluted due to chemical fertilizer/pesticide or pollution or excavated or mine site).
11. Visit the nearby landfill site/dumping site and prepare a report describing the features, storage capacity, ongoing activities, opportunities and challenges of the landfill site.
12. Conduct a field study to any ex-situ conservation areas (e.g., Zoo or Botanical Garden), list the ongoing practices, and prepare a report including opportunities/challenges of the ex-situ conservation practice.
13. Visit any industry nearby your locality, list the energy used, raw materials consumed, processing, product, pollutants emitted from the industry and the pollution control technologies (and their working principles) installed by the industries.
14. Visit your community (ward) and make the list of environmental problems and prepare a report about it.
15. Study the remarkable environmental initiatives at local community and develop a video and share among your peers and teachers.

6. Learning Facilitation Process and Methods

Students will be facilitated to learn rather than just accumulation of information. Teacher plays vital role for delivering subject matters. Student centered teaching-learning process is highly emphasized. Students are encouraged to adopt multiple pathways of learning, such as online search, field visit, library visit, literature review, laboratory work, individual and group work, research work, etc. with the support of teacher. Self-study by students is highly encouraged and learning will not be confined merely within the scope of curriculum. Teacher should keep in mind intra and inter-disciplinary approach to teaching and learning, as opposed to compartmentalization of knowledge. Supportive role of parents/guardians in creating conducive environment for promoting the spirit of inquiry and creativity in students' learning is anticipated.

During the delivery process of this course in grade 11 and 12, basically the following three approaches will be adopted:

6.1 Conceptual/Theoretical Approach

The conceptual approach may include the following methods and techniques:

- a. Lecture
- b. Discussion and interaction

- c. Question answer
- d. Demonstration
- e. ICT/online based instructions
- f. Cooperative learning
- g. Debate
- h. Group discussions (satellite learning group, peer group, small and large group)
- i. Seminar presentation
- j. Daily assignment
- k. Project-based learning
- l. Innovation/discovery
- m. Field survey
- n. Participating national and international environmental events

6.2 Practical/Experimental

Practical work is the integral part of the learning Environment Science. The process of practical work comprises:

- a. Familiarity with objective of practical work.
- b. Familiarity with materials, chemicals, apparatus and field requirements.
- c. Familiarity with lab process (safety, working modality, etc.).
- d. Conduction of practical work (systematically following the given instruction).
- e. Analysis, interpretation and drawing conclusion.

6.3 Project Work Approach

Project work is an integral part of the learning in Environment Science. Students should be involved in project work to foster self-learning of students in both theoretical and practical contents. Students will complete project work to have practical idea through learning by doing approach and able to connect the theory into the real-world context. It is regarded as method/process of learning rather than content itself. So, use of project work method to facilitate any appropriate contents of this curriculum is highly encouraged.

In this approach, student will conduct at least one research work, or an innovative work under the guidance of teacher, using their knowledge and skills. It could include any of the followings:

- a. Mini research
- b. Survey
- c. Model construction
- d. Paper based work
- e. Study of ethno-science

General process of research work includes the following steps:

- a. Understanding the objective of the research
- b. Planning and designing
- c. Collecting information
- d. Analysis and interpretation
- e. Reporting/communicating (presentation, via visual aids, written report, graphical etc.)

General process of innovative work includes the following steps:

- a. Identification of innovative task (either assigned by teacher or proposed by student)
- b. Planning
- c. Performing the task
- d. Presentation of the work
- e. Record keeping of the work

Students are free to choose any topic listed in this curriculum or a topic suggested by teacher provided that it is within the theoretical contents of the curriculum. However, repetition of topic should be discouraged.

7. **Student Assessment**

Evaluation is an integral part of learning process. Both formative and summative modes of evaluation are emphasized. Formative evaluation will be conducted so as to provide regular feedback for students. Class test, unit test, trimester test, oral question-answer, home assignment, etc., are some ways of formative evaluation.

There will be separate evaluation of theoretical and practical learning. Summative evaluation embraces both internal and external evaluation.

a. **Internal Evaluation**

Student's knowledge, skills and competencies will be measured through internal evaluation in both the Grades 11 and 12. The internal evaluation carries 25 percent of weightage for final evaluation of student achievement. The following table shows the criteria for the internal evaluation:

S.N.	Criteria	Marks
1.	Classroom participation (daily attendance, home assignment and classwork, participation in learning, participation in other activities)	3
2.	Trimester exam (3 marks from each trimester exam)	6
3.	Practical and project work (activities, report preparation and presentation) (reports should have background, objective, materials and methods, results, conclusion)	16
Total		25

The criteria for evaluating practical work and project work is in the table below:

S.N.	Criteria for evaluation of practical and project work	Elaboration of criteria	Marks	Total marks
1.	Laboratory experiment/field activities	Planning/apparatus setup/preparation/field activity	2	8
		Observation/experimentation	2	
		Tabulation, data processing and analysis	2	
		Result interpretation and conclusion	2	
2.	Presentation	Understanding of practical and project activities	2	4
		Presentation skills (clarity, confident, eye contact, logical structure, use of visuals, deep understanding) and logistic arrangement	2	
3.	Practical work and project work reports	Records (number, complete, quality and timely submission)	4	4
Total				16

b. External Evaluation

External evaluation will be based on written examination which carries 75 marks. All the contents delivered from the beginning of the session need to be covered in each of the periodic tests. The types and number of questions will be as per the specification chart developed by the Curriculum Development Centre. Appropriate tools of evaluation need to be adopted as per the requirement and learning level of the students.



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