Environmental Systems Management
Subject Code: 010725
Course & Unit Descriptions

Course Description:

Learners will analyze and interpret biological, chemical and physical properties of soil, water and air. They will determine the source and type of environmental contamination, evaluate pollution control measures and be prepared to respond accordingly. Learners will be able to monitor treatment processes for potable water, waste water and solid waste. Learners will develop and implement environmental plans using principles governing ecosystems in relation to resource development and industrial processes.

Unit: Safety and Equipment Operation

Students will demonstrate their knowledge of safety rules and regulations. Students will learn the procedures of first aid and contacting emergency personnel when necessary. Students will inspect and provide basic maintenance to basic machinery and equipment in a facility or worksite.

Benchmark: 4.1 Safety Procedures
Level 1: Follow safety procedures in general situations with basic tools and equipment, evaluate work environment and seek assistance to rectify the problem
Level 2: Follow safety procedures in specific situations with specialized tools and equipment, evaluate situation and take corrective action

Indicators
4.1.01 Demonstrate knowledge of safety rules and regulations
4.1.02 Interpret safety signs and symbols
4.1.03 Model safe attitudes and behaviors (e.g., lifting, climbing)
4.1.04 Identify safety hazards and take corrective measures
4.1.05 Use safety equipment in accordance with established procedures
4.1.06 Follow established procedures for the administration of first aid and contact emergency medical personnel when necessary

Academic Standards
English: Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)

Benchmark: 4.2 Stationary and Mobile Equipment Maintenance
Level 1: Inspect and provide basic maintenance to basic machinery, instruments, stationary and mobile equipment and facility
Level 2: Inspect and maintain specialized machinery and equipment according to schedule

Indicators
4.2.01 Perform a machine condition inspection
4.2.03 Ensure presence and function of safety systems and hardware
4.2.08 Maintain machinery, equipment, instruments and facility cleanliness, appearance, and safety
4.2.10 Conduct preventative maintenance and identify causes of malfunctions and failures

Academic Standards
English: Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)

Math: Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Mathematical Processes B, 8-10)

Benchmark: 4.3 Equipment Operation
Level 1: Inspect and safely operate precalibrated equipment
Level 2: Inspect and safely operate specialized equipment with some limitations to adjustments and functions

Indicators
4.3.01 Follow manufacturer's recommended operating procedures and adjustment specifications
4.3.02 Describe function, limitations, and proper use of equipment, equipment controls and instrumentation
4.3.03 Perform pre-operation inspection and adjustments
4.3.04 Perform appropriate start-up, operating and shut-down procedures
4.3.05 Identify, select and exhibit the desired application of hand and power tools
4.3.06 Perform post-operating inspection and adjustments

Academic Standards
English: Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)
Math: Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Mathematical Processes B, 8-10)

Unit: Ecosystems

Students will learn the components of an ecosystem and along with inventorying and evaluating the habitats of a specific ecosystem.

Benchmark: 5.3 Ecosystems
Level 1: Identify ecosystems and compare components of ecosystems
Level 2: Inventory and evaluate habitats of specific ecosystems

Indicators
5.3.01 Explain and illustrate basic ecological principles and cycles (e.g., nitrogen cycle, food web, energy pyramid)
5.3.02 Explain biotic (plant and animal) interactions with the abiotic (non-living) environment
5.3.03 Differentiate between renewable and nonrenewable components of ecosystems
5.3.04 Model positive environmental practices for sustainability of resources
5.3.05 Inventory and evaluate characteristics of different ecosystems (e.g., pond, stream, crop lands, open land, brush lands, grasslands, woodlands, wetlands)
5.3.06 Discuss restoration ecology and its role in repairing damaged landscapes
5.3.07 Identify and contrast biomes globally
5.3.08 Determine the factors that affect ecological succession
5.3.09 Determine the impact that native and non-native invasive species have on ecosystems

Academic Standards
Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Explain that many processes occur in patterns within the Earth's systems. (Earth and Space Sciences B, 9-10)
Social Studies: Evaluate the consequences of geographic and environmental changes resulting from governmental policies and human modifications to the physical environment. (Geography B, 11-12)

Unit: Soil

Students will determine and analyze the physical, biological and chemical properties of soils and other plant growing media. Students will utilize their knowledge of soil characteristics to overcome soil use limitations.

Benchmark: 5.1 Soils
Level 1: Determine and analyze the physical, biological and chemical properties of soils and other plant growing media
Level 2: Utilize knowledge of soil characteristics and soil information resources to overcome any existing soil use limitations

Indicators
5.1.01 Classify soil types based on composition (e.g., aggregate size, organic matter, texture)
5.1.02 Inventory soils and determine land use capabilities
5.1.03 Interpret soil survey data to implement conservation practices
5.1.04 Select techniques that reduce soil erosion and compaction based on soil and land properties (e.g., no till, subsurface and watershed drainage)
5.1.05 Evaluate soil limitations (e.g., wildlife/wetlands habitats, septic systems, drainage, agriculture and socio-economic considerations, preservation easements)
5.1.06 Explain current and historical interactions between human activities and soils (e.g., wetlands use, urbanization, desertification, finite resources, habitat change, climate change)
5.1.07 Identify soil forming factors and explain how they produce variability in soils

Academic Standards
English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
Math: Describe and interpret rates of change from graphical and numerical data. (Algebra J, 8-10)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)
Social Studies: Use appropriate data sources and geographic tools to analyze and evaluate public policies. (Geography C, 11-12)

Unit: Water

Students will assess water quality using basic indicators provided. Students will analyze and interpret the properties of water as well as water sources. Students will be able to create and implement water management plans.

Benchmark: 5.2 Water
Level 1: Assess water quality using basic indicators
Level 2: Analyze and interpret the biological, chemical and physical properties of water quality

Indicators
5.2.01 Measure pH, dissolved oxygen (DO), biological oxygen demand (BOD), temperature and macroinvertebrate populations to determine water quality
5.2.02 Measure hardness, nitrogen, phosphorus, vegetation and physical characteristics of lentic and lotic waters to determine water quality
5.2.03 Explain the hydrological cycle (e.g., condensation, evaporation, transpiration) and how human activity impacts the cycle
5.2.04 Explain the biotic and abiotic factors affecting water quality
5.2.05 Monitor and analyze water quality and quantity
5.2.06 Explain the interactions between human activities and the earth's hydrosphere (e.g., septic systems, desalinization, point and nonpoint sources of pollution)

5.2.07 Implement practices to maintain or improve water quality

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Apply various measurement scales to describe phenomena and solve problems. (Measurement B, 11-12)

Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Benchmark: 5.8 Water Use and Management (Hydrology)

Level 1: Identify sources of water (e.g., surface water, soil water, bedrock water, aquifer)
Level 2: Collect and interpret data for a localized water use and management plan

Indicators

5.8.01 Explain hydrology
5.8.02 Explain geological and meteorological principles affecting groundwater supply
5.8.03 Conduct channel flow analysis
5.8.04 Identify basic criteria for water well design
5.8.05 Identify differences in groundwater potential
5.8.06 Assess the potential for water contamination at a specific site
5.8.07 Measure volumes of water (e.g., wells, ponds, run-off, waterways)
5.8.08 Control water (e.g., pumps, dams, retention ponds, drainage)
5.8.09 Control water (e.g., pumps, dams, retention ponds, drainage)

Academic Standards

English: Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)

Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)

Science: Describe how human activities can impact the status of natural systems. (Life Sciences G, 9 -10)

Social Studies: Evaluate the consequences of geographic and environmental changes resulting from governmental policies and human modifications to the physical environment. (Geography B, 11-12)

Unit: Air

Students will measure levels of oxygen, carbon dioxide and particulate matter while assessing the air quality and determining its impact on the environment.

Benchmark: 5.5 Air

Level 1: Measure levels of oxygen, carbon dioxide and particulate matter
Level 2: Assess air quality and determine its impact on the environment

Indicators

5.5.01 Determine chemical and physical properties of air (e.g., composition, density, pressure)
5.5.02 Explain chemical cycles and how they relate to the biosphere, geosphere and atmosphere (e.g., nitrogen cycle, oxygen cycle, sulfur cycle)
5.5.03 Explain human and natural factors affecting air quality (e.g., volcanic eruptions, forest fires, greenhouse gases, dust, farming practices)
5.5.04 Monitor and evaluate air quantity and quality
5.5.05 Assess the potential for air contamination at a specific site

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)

Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Unit: Pollution and Contaminants

Students will test for the presence of contaminants and the follow the proper reporting procedures. Students will be able to assess affected areas and determine the sources and types of contaminants while responding appropriately.

Benchmark: 5.4 Contaminants

Level 1: Determine the presence of contaminants and follow reporting procedures

Level 2: Assess affected area, determine the source and type of contaminant, and respond appropriately

Indicators

5.4.01 Determine types, sources and impact of natural and man-made contaminants (e.g., manure; wastewater; soil; agricultural, residential and industrial chemicals)

5.4.02 Explain and implement programs and policies related to contaminants

5.4.03 Identify, comply with and implement contaminant control, remediation and prevention practices (e.g., biological, radiological, sanitation, buffer strips for run-off)

5.4.04 Monitor, analyze and evaluate levels of contaminants from point source and non-point source

Academic Standards

English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)

Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)

Science: Describe how human activities can impact the status of natural systems. (Life Sciences G, 9 -10)

Social Studies: Evaluate the consequences of geographic and environmental changes resulting from governmental policies and human modifications to the physical environment. (Geography B, 11-12)

Benchmark: 5.9 Pollution Control

Level 1: Comply with pollution control measures

Level 2: Evaluate pollution control measures

Indicators

5.9.01 Identify presence of pollution and pollutants

5.9.02 Perform environmental sampling and chart and analyze the results

5.9.03 Describe environmental impact from industrial and non-industrial processes

5.9.04 Quantify extent of pollution

5.9.05 Locate sources of pollution (e.g., point source and non-point source)

5.9.08 Monitor noise and light pollution and implement abatement measures

Academic Standards

Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)

Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Unit: Solid Waste

Using best available technology, students will collect and dispose of solid wastes while identifying all associated risks.

Benchmark: 5.10 Solid Waste and Renewable Resource Management
Level 1: Collect and dispose of solid waste using best available technology
Level 2: Control and process solid waste using available and alternative technology

Indicators
5.10.02 Identify the risks associated with solid waste accumulation, utilization and disposal
5.10.03 Determine acceptable site for disposal of solid waste
5.10.04 Describe the process of aerobic and anaerobic waste decomposition (biotic and abiotic influences)
5.10.05 Describe and monitor solid waste disposal procedures (e.g., landfills, lagoon, run-off)
5.10.06 Describe and implement waste management methods (e.g., composting facility, waste incineration, recycling)
5.10.07 Explain control processes and potential use for waste byproducts (e.g., landfill gas, sludge, manure, methane)
5.10.08 Describe standard operational techniques and identify design requirements for specific purposes (e.g., landfill, lagoon, leachate treatment)
5.10.09 Describe site closure methods and post-closure monitoring
5.10.10 Determine solid waste volume generated by an operation or facility

Academic Standards
English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Unit: Water Treatment

Students will select and monitor water treatment processes for potable water and wastewater at a specific site.

Benchmark: 5.11 Potable Water Treatment Operations
Level 1: Select the potable water treatment method for a specific purpose
Level 2: Monitor the water treatment processes for potable water at a specific site

Indicators
5.11.01 Identify characteristics of potable water treatment and sources of water
5.11.02 Collect potable water samples
5.11.03 Identify components of water entering water-treatment facility
5.11.04 Perform an analysis of the components of potable water
5.11.07 Describe taste and odor control in water treatment
5.11.08 Identify methods for backflow prevention

Academic Standards
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Benchmark: 5.12 Wastewater Treatment Operations
Level 1: Select a wastewater treatment method for a specific purpose
Level 2: Monitor the wastewater treatment methods for a specific site

Indicators
5.12.02 Collect wastewater samples
5.12.03 Describe wastewater collection systems
5.12.04 Identify, analyze and reconcile the components of wastewater with state and local standards
5.12.05 Troubleshoot wastewater collection systems
5.12.06 Describe the processes in wastewater treatment (e.g., mixing, coagulation and flocculation; disinfection; treatment system; effluent disposal; solids management)
5.12.08 Identify methods for cross-connection and backflow prevention
5.12.09 Identify industrial pretreatment programs

Academic Standards
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Unit: Law, Regulations and Hazardous Materials

Students will identify and describe government regulations and societal issues as related to specific business enterprises or environmental projects. Students will follow the proper handling, storage, and recording of hazardous materials.

Benchmark: 3.10 Business Regulation, Law and Related Issues
Level 1: Identify and describe government regulations and societal issues related to a specific business enterprise or environmental project
Level 2: Determine the impact of government regulations and societal issues on an environmental project or the performance of a business enterprise

Indicators
3.10.02 Explain the purpose and impact of government regulations
3.10.03 Identify local, state and federal regulations relative to compliance
3.10.06 Identify governmental agencies and non-governmental organizations that impact agricultural/environmental issues
3.10.07 Research history, politics and policies related to issues
3.10.08 Assess the impact of issues affecting the industry and recommend solutions

Academic Standards
English: Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)
Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)

Social Studies: Evaluate the consequences of geographic and environmental changes resulting from governmental policies and human modifications to the physical environment. (Geography B, 11-12)

Benchmark: 5.13 Hazardous Materials Management
Level 1: Differentiate between restricted and non-restricted hazardous materials
Level 2: Follow handling, storage, and recording procedures for hazardous materials

Indicators
5.13.01 Describe health and safety practices to reduce risks from hazardous materials (i.e., MSDS forms, employer notification forms, personal protective equipment)
5.13.02 Demonstrate appropriate responses for major types of hazardous materials disasters (e.g., chemical, fire and explosion, general safety hazards)
5.13.03 Demonstrate an ability to obtain and use information addressing hazardous substance discharge
5.13.04 Demonstrate safe management, handling, disposal and/or recycling procedures for hazardous and regulated materials and hazardous waste
5.13.05 Detect and identify hazardous materials
5.13.06 Perform site evaluation to determine presence and storage of hazardous materials
5.13.09 Maintain hazardous material handling documentation
5.13.10 Identify hazardous materials that can be recycled

Academic Standards
English: Apply reading comprehension strategies to understand grade-appropriate text. (Reading Process A, 8-10; Reading Process A, 11-12)
Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Unit: Pest Management

Students will identify common types of plant pests and apply basic management methods.

Benchmark: 7.3 Pest Management
Level 1: Identify common types of plant pests and apply basic pest management control methods
Level 2: Scout and identify specific plant pests and plant damage and apply specialized pest management control methods

Indicators
7.3.01 Identify and classify plant pests (i.e., insects, pathogens, weeds, diseases, animals)
7.3.02 Examine interrelationships between plants, pests, humans and environment (e.g., non-native species, climate change)
7.3.03 Analyze and calculate economic threshold of pest damage
7.3.04 Determine and implement pest management safety practices (e.g., MSDS, EPA, OSHA, PPE)
7.3.05 Develop an integrated pest management plans based on pest life cycles, available treatments and application methods
7.3.06 Select application methods, implement pest control plan (i.e. organic and non-organic) and evaluate effectiveness and impact on environment

Academic Standards
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data. (Data Analysis D, 8-10)

Science: Explain the structure and function of ecosystems and relate how ecosystems change over time. (Life Sciences F, 9-10)
Social Studies: Evaluate the consequences of geographic and environmental changes resulting from governmental policies and human modifications to the physical environment. (Geography B, 11-12)

Unit: GPS and GIS

Students will use the GIS software to interpret maps and GIS computer applications in producing maps.

Benchmark: 5.15 Geographic Information Systems (GIS)
Level 1: Use GIS software to interpret maps
Level 2: Use GIS computer applications to produce maps

Indicators
5.15.01 Interpret and evaluate accuracy of digital imagery and aerial photography
5.15.02 Explain map projections and the use of scales
5.15.04 Explain digital elevation methods (e.g., DEM, GPS)
5.15.08 Determine position on the earth
5.15.10 Integrate GPS data into GIS applications

Academic Standards
English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Social Studies: Use appropriate data sources and geographic tools to analyze and evaluate public policies. (Geography C, 11-12)

Unit: Business Management

Students will learn how to use technology to compile research and analyze information to draw conclusions. Students will use the available technology to create reports and using communication skills, present their findings to small groups.

Benchmark: 3.11 Research and Analysis
Level 1: Conduct a study or survey, select descriptive statistics, create graphical displays and draw conclusions
Level 2: Conduct a problem-based study applying scientific methodology and using descriptive statistics to communicate and support predictions and conclusions

Indicators
3.11.01 Identify research problems and structure a statistical experiment, simulation or study related to the problem
3.11.02 Create a hypothesis and set the probability of acceptance based on review of valid literature
3.11.03 Establish and implement procedures for systematic collection, organization, and use of data
3.11.04 Select and apply sampling methods that appropriately represent the population to be studied
3.11.05 Create, interpret and use tabular and graphical displays and descriptive statistics to describe data
3.11.06 Compute measures of central tendency and dispersion to interpret results and draw conclusions
3.11.07 Describe the relationships among variables using correlations and draw conclusions
3.11.08 Draw conclusions based on observations and/or data analysis and disseminate information to interested parties

Academic Standards

English: Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted. (Research A, 8-10; Research A, 11-12)

Math: Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)

Science: Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (Scientific Inquiry A, 9-10)

Benchmark: 3.6 Information Management

Level 1: Select and use a computer and computer application for a specific purpose

Level 2: Integrate software applications and use multiple software options to create a product, document or presentation

Indicators

3.6.01 Utilize technology to maintain and monitor business records

3.6.02 Conduct research using the Internet

3.6.03 Create and utilize documents using word processors, spreadsheets, databases and electronic mail

3.6.04 Conduct oral/visual presentation using presentation software

3.6.08 Adhere to common security guidelines for technology

Academic Standards

English: Prepare writing for publication that follows an appropriate format and uses a variety of techniques to enhance the final product. (Writing Process F, 11-12)

Math: Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)

Benchmark: 3.7 Communication Skills

Level 1: Integrate a variety of communication techniques to gather and convey information to an individual or small group

Level 2: Conduct a business meeting using decision-making techniques

Indicators

3.7.01 Apply techniques to participate in/facilitate a group discussion

3.7.02 Apply active listening strategies

3.7.03 Develop and deliver formal and informal presentations

3.7.04 Articulate ideas and impact audience through verbal and nonverbal communication

3.7.05 Communicate directions in an organized manner appropriate to the audience

3.7.07 Extract relevant, valid information from materials and cite sources of information

3.7.08 Develop reports and documents that organize information accurately and use formatting techniques for user friendliness

3.7.09 Select and use appropriate channel for workplace communication

3.7.10 Practice etiquette when using communication techniques

Academic Standards

English: Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)

Math: Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)

Social Studies: Evaluate the reliability and credibility of sources. (Social Studies Skills and Methods A, 9 - 10)