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San Bernardino Valley College
Course Outline for ENVT 103
Hazardous Substances and Environmental Consequences

I. CATALOG DESCRIPTION:
ENVT 103: Hazardous Substances and Environmental Consequences
3 hours/week lecture = 3 units
Catalog Description: Examination of the effects that different types of substances have on the environment. Aquatic chemistry will cover water pollution and water treatment. Atmospheric chemistry will deal with the major threats to the global atmosphere, including greenhouse gases and ozone-depleting chemicals. Soil chemistry will examine macronutrients and micronutrients and soil erosion. The nature and sources of hazardous waste: reduction, treatment and disposal.
Schedule Description: Examination of the effects that different types of substances have on the environment, the nature and sources of hazardous waste, and how to reduce, treat and dispose of the wastes.
Prerequisite/corequisite: CHEM 101 or equivalent

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES FOR STUDENTS:
Upon completion of the course, the student will be able to:
A. Identify the routes of entry of hazardous substances and how they effect the body.
B. Explain dose–effect and time–effect relationships.
C. Determine exposure limits and personal protective equipment required.
D. Identify occupational and health hazards in the working environment.

IV. CONTENTS:
A. Chemistry and Environmental Chemistry
1. Environmental chemistry and environmental biochemistry
2. Chemistry and chemical reactions
3. Organic chemistry
4. Organic formulas, structures and names
5. Aromatic organic compounds
6. Organic acids, alcohol's and esters
7. Synthetic polymers
B. Properties of Water and Bodies of Water
1. Water: quality, quantity and chemistry
2. Properties of water
3. Characteristics of bodies of water
4. Aquatic chemistry
5. Gases in water
6. Alkalinity
7. Acidity

C. Fundamentals of Aquatic Chemistry
   1. Water acidity and carbon dioxide in water
   2. Calcium and other metals in water
   3. Complexation and chelation
   4. Polyphosphates in water

D. Oxidation-Reduction
   1. Oxidation-reduction phenomena
   2. Electron and redox reactions
   3. Limits of PE in water

E. Phase Interactions
   1. Chemical interactions involving solids, gases and water
   2. Formation of sediments
   3. Solubility's of solids
   4. Colloidal properties of clay
   5. Aggregation of particles
   6. Surface sorption by solids
   7. Ion exchange with bottom sediments
   8. Organic compounds on sediments and suspended matter

F. Water Pollution
   1. Nature and types of water pollution
   2. Elemental pollutants
   3. Heavy metals
   4. Metalloids
   5. Inorganic species
   6. Organic pollutants

G. Water Treatment
   1. Water treatment and use
   2. Municipal water treatment
   3. Treatment of water for industrial use
   4. Sewage treatment
   5. Industrial waste water treatment
   6. Removal of dissolved organics
   7. Removal of dissolved inorganics
   8. Sludge
   9. Water disinfection
   10. Natural water purification process

H. Atmosphere and Atmospheric Chemistry
   1. Importance of the atmosphere
   2. Physical characteristics of the atmosphere
   3. Energy and mass transfer in the atmosphere
   4. Energy transfer
   5. Chemical and photochemical reactions in the atmosphere
   6. Reactions of atmospheric oxygen
   7. Reactions of atmospheric nitrogen

I. Particles in the Atmosphere
   1. Physical behavior of particles

2. Composition of inorganic particles
3. Toxic metals
4. Radioactive particles
5. Composition of organic particles
6. Effects of particles

J. Organic Air Pollutants
1. Organic compounds in the atmosphere
2. Aromatic hydrocarbons
3. Aldehydes and ketones
4. Alcohols
5. Organohalide compounds
6. Organosulfur compounds
7. Organonitrogen compounds

K. Photochemical Smog
1. Smog-forming automotive emissions
2. Photochemical reactions of methane
3. Smog formation
4. Reactivity of hydrocarbons
5. Inorganic products of smog
6. Effects of smog

L. Soil Chemistry
1. Acid-base and ion exchange reactions in soils
2. Macronutrients in soil
3. Nitrogen, phosphorus and potassium in soil
4. Micronutrients in soil
5. Soil erosion

M. Nature and Sources of Hazardous Waste
1. Classification of hazardous substances and wastes
2. Origin and amounts of wastes
3. Flammable and combustible substances
4. Reactive substances
5. Toxic substances
6. Corrosive substances
7. Generation, treatment and disposal

N. Environmental Chemistry of Hazardous Waste
1. Origin of hazardous wastes
2. Transportation of hazardous wastes
3. Effects of hazardous wastes
4. Fates of hazardous wastes
5. Hazardous wastes in the hydrosphere
6. Hazardous wastes in the atmosphere
7. Hazardous wastes in the biosphere

O. Reduction, Treatment and Disposal of Hazardous Wastes
1. Waste reduction and minimization
2. Recycling
3. Physical methods of waste treatment

4. Thermal treatment methods
5. Biodegradation of wastes
6. Preparation of waste disposal
7. Ultimate disposal of wastes
8. Leachate and gas emissions

V. METHODS OF INSTRUCTION:
A. Lecture
B. Readings

VI. TYPICAL ASSIGNMENTS:
A. Read lessons and complete weekly homework assignments.
Typical Questions:
1. Under what circumstances does a contaminant become a pollutant?
2. What do mercury and arsenic have in common in regard to their interactions with bacteria in sediments?
B. Term Paper –Research and analysis of an environmentally hazardous substance, explaining the effects of this material on the environment.

VII. EVALUATION:
A. Methods of Evaluation:
1. Graded assignments
2. Midterm/final exam/term project
Typical Questions:
a. What is the basic structure of clay?
b. How does the structure of clay enable the removal of both organic and inorganic compounds from gaseous solutions?
B. Frequency of Evaluation:
1. Eight (8) exercises
2. One (1) midterm
3. One (1) final and term project

VIII. TYPICAL TEXTS:
Manahan, Stanley E. Environmental Chemistry, Fifth Edition. Lewis Publishers, 1991.
Hawkins, Darryl W. Basic Concepts of Environmental Chemistry. Lewis Publishers, 1997.

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:
None