COURSE TITLE: ENVIRONMENTAL CHEMISTRY AND TOXICOLOGY  
COURSE NUMBER: CHEM 3114  
CREDIT HOURS: 3  
CONTACT HOURS: 3 LEC. HR/WEEK  
PREREQUISITE: CHEM 1022  
**Course Description**

Major chemical cycles and effects of environmental pollution in these systems; basics of atmospheric chemistry; aquatic chemistry; soil chemistry; pollution of air, water and soil; chemical toxicology: toxicants and their metabolism; energy production and its impact on the environment; analytical methods in environmental studies; Introduction to green chemistry.

**Learning Outcomes**

By the end of this course students should be able to:

* Familiarize with the concept of environmental chemistry
* Identify the common causes of environmental pollution
* Describe about aquatic chemistry and water pollution
* Explain about atmospheric chemistry and air pollution;
* Familiarize with the concept of green chemistry;
* Study some toxic organic chemicals and their effects; and
* Device methods to decrease pollution.

Course outline:

1. Introduction to Environmental Chemistry  
   1.1. Basic concepts in Environmental chemistry  
   1.2. Properties of chemicals in the environment  
   1.3. Environnemental transformation and degradation  
    1.3.1. Abiotic transformation and degradation  
    1.3.2. Biotransformation and degradation  
   1.4. Matter and cycles of matter
2. Aquatic chemistry and Water pollution  
   2.1. Introduction to the Fundamentals of aquatic chemistry  
   2.2. The Properties of water, a unique substance  
   2.3. Water Quality  
   2.4. Water quality requirements  
   2.5. Nature and types of Water pollutants
3. Atmospheric chemistry and Air pollution  
   3.1. Importance and physical characteristics of the atmosphere  
   3.2. Atmospheric chemical reactions  
   3.3. Air quality  
   3.4. Nature and classification of air pollutants  
    3.4.1. Gaseous inorganic air pollutants  
    3.4.2. Organic air pollutants  
    3.4.3. Photochemical smog  
    3.4.4. Chlorofluro compounds and ozone layer depletion  
    3.4.5. Green House Gases and Global warming
4. Soil Chemistry  
   4.1. Soil and agriculture  
   4.2. Nature and composition of soil  
   4.3. Nutrients in soil  
   4.4. Reactions in soil  
   4.5. Wastes and pollutants in soil
5. Environmental Toxicity and toxicology  
   5.1. Introduction  
   5.2. Organic and inorganic pollutants  
   5.3. Agricultural and pharmaceutical contaminants  
   5.4. Pesticides  
   5.5. PCB’s(polychlorinated biphenyls)  
   5.6. Nitrogen and phosphorous compounds  
   5.7. Toxic heavy metals and organo-metallic compounds  
    5.7.1. mercury  
    5.7.2. lead  
    5.7.3. arsenic  
    5.7.4. Chromium
6. Green chemistry  
   6.1. Introduction  
   6.2. The concept of Atom Economy  
   6.3. Design and application of surfactants for carbon dioxide  
   6.4. Designing an environmentally safe marine synthetic antifoulant

* Field study, report and defense

Reference materials:

* Manahan, Environmental Chemistry, 7th edition, ©2000 by CRC Press, Lewis Publishers
* S.C. BHATIA, Environmental Chemistry ©2007, Satish Kumar Jain for CBS Publishers and Distributors
* P.S.SINDHU, Environmental Chemistry ©2002, New Age International Publishers
* Ming-Ho Yu (2005),Environmental Toxicology, Second edition, CRC Press
* A.K.DE, Environmental Chemistry, 6th edition, ©2002, New Age International Publishers
* Reeve, Environmental Analysis, ©1994, Wiley and Sons Publishers
* Renep.Schwarzenbach, Philip M. Gschwend& Dieter M.Imboden, Environmental Organic Chemistry 2nd edition ,©2003, Wiley and Sons, Inc., Hoboken, New Jersey Publishers
* Clark J, Macquarrie D, Handbook of Green Chemistry and Technology.Blackwell Science Ltd, 2002