

Department  
**UNIVERSITY OF CALGARY**  
**FACULTY OF SCIENCE**  
**DEPARTMENT OF CHEMISTRY**  
**COURSE SYLLABUS**  
**SPRING 2018**

**1. Course:** Environmental Chemistry, CHEM 321.

LEC	DAYS	TIME	ROOM	INSTRUCTOR	OFFICE	EMAIL	OFFICE HOURS
L01	Tu/Th	12:00-2:45 pm	ST 141	Dr. Izadifard	SA 246	<a href="mailto:izadifam@ucalgary.ca">izadifam@ucalgary.ca</a>	Tu/Th, 3:00-4:00pm

Course website or Desire 2 Learn (D2L) course name: <https://d2l.ucalgary.ca/d2l/home/225994>

**2. Course Description:** A survey course of major aspects of environmental chemistry including the natural chemical cycles in the biosphere, geosphere, hydrosphere and atmosphere and the consequences of anthropogenic disturbances to these cycles. Topics discussed will include: Aquatic Chemistry and Water Pollution; Atmospheric Chemistry and its Alteration; Soil Chemistry and the Fate of Pollutants; Toxicological Chemistry.

**3. Recommended Textbook(s):**

"Fundamentals of Environmental and Toxicological Chemistry: Sustainable Science". Fourth Edition, by Stanley Manahan. CRC Press (2013).

"Environmental Chemistry". 4<sup>th</sup> or 5<sup>th</sup> Edition, by Colin Baird and Michael Cann, W. H. Freeman, NY.

"Elements of Environmental Chemistry". 2<sup>nd</sup> Edition, by Ronald Hites and Jonathan Raff. Wiley.

"Environmental Chemistry: A global perspective". 3<sup>rd</sup> Edition, by G. W. vanLoon and S. J. Duffy. Oxford University Press.

"Environmental Organic Chemistry". 2<sup>nd</sup> Edition, Rene P. Schwarzenbach, Philip M. Gschwend and Dieter M. Imboden A John Wiley & Sons Publication.

**4. Topics Covered:**

**1. General Concepts:**

**A. Essential chemical concepts**

- Fundamentals (atoms, elements, radicals, states of matter, elemental and chemical bonding, kinetics, gas law, chemical reactions, stoichiometry, units)
- Organic chemistry (definition, importance of carbon, functional groups and classification of organic compounds by focusing on toxic organic compounds and their environmental impacts)

**B. Biological and Ecological concepts**

- Microbiological processes
- Nutrient cycles (Global biogeochemical cycles)
- Limnological concepts and eutrophication

**2. Toxicological Chemistry**

- Fundamentals (toxin modes of entry, bioaccumulation, bioconcentration, biomagnification,  $K_{ow}$ , BCF, fugacity, toxin mode-of-entries, toxic responses, dose-response relationship,  $LD_{50}$ ,  $TD_{50}$ ,  $ED_{50}$ , NOAEL)
- Survey of toxic compounds in the anthrosphere: pesticides, persistent organic pollutants, (Dioxins, Furans and PCBs), contaminants of emerging concern and Endocrine disruptors

**3. Aquatic Chemistry**

- The chemistry of natural waters
- The pollution and purification of water (drinking water and municipal waste water)

#### **4. Soil Chemistry**

- Introduction to soil chemistry
- Environmental issues associated with soils

#### **5. Atmospheric Chemistry**

- Stratospheric chemistry
- Catalytic stratospheric ozone depletion
- Atmospheric chemistry
- Ground level air pollution; acid rain, aerosols, greenhouse gas effect

#### **6. Energy**

**A.** Energy and climate change

**B.** Energy and water pollution

Department Approval: Approved by Department Head Date: May 2, 2018