

Course title: Environmental Chemistry and Microbiology				
Course code: NRE 131		No. of credits: 3	L-T-P: 35-10-0	Learning hours: 45
Pre-requisite course code and title (if any): Fundamental knowledge of basic and applied chemistry				
Department: Natural and Applied Sciences				
Course coordinator:			Course instructor: Prof. V. Subramanian/Dr Shashi Bhushan Tripathi/ Dr Chaithanya Madhurantakam	
Contact details: subra42@gmail.com				
Course type: Core			Course offered in: Semester 1	
Course Description The objective of the course is to provide detail understating of various aspects of chemistry, which are particularly valuable to environmental scientific practice and lay a foundation for understanding in specialized areas of environment management and practices. Students will get the training in analytic and conceptual skills required for environmental chemistry research.				
Course objectives 1. To provide understating of various aspects of chemicals and chemistry, which are particularly valuable to environmental scientific practice 2. To lay a foundation for understanding in specialized areas of environment management and practices.				
Course content				
Module	Topic	L	T	P
1.	Atmosphere: Chemical composition of atmosphere- particles, ions and radicals; formation of particulate matter; photochemical and chemical reactions in the atmosphere; chemistry of greenhouse gases and ozone layer depletion; gaseous transformations in the atmosphere and removal mechanisms; photochemical smog; nuclear winter.	8	2	
2.	Lithosphere: Chemical composition of lithosphere; water and air in soil; inorganic and organic components in soil; acid, base and ion-exchange reaction in the soil; soil acidity, salinity and sodocity; effects of ecological factors on the toxicity of soil; Bio-geochemical cycles.	8	2	
3.	Water: Basic concept of colloidal and quantitative chemistry. Oxidation-reduction reactions and equations; gas laws, equilibrium and Lechatelier's principle, activity and coefficients, variations in equilibrium relationships, shifting chemical equilibrium, amphoteric hydroxides, buffers and buffer index; solubility of salts, complex formation	9	3	
4.	Environmental Microbiology: Microorganisms and their association with man, animals and plants; Extremophilic microorganisms, Microbial metabolism; role of micro-organisms in environmental management.	4	1	
5.	Principles of environmental monitoring techniques- Neutron Activation Analysis; calorimetric; Colourimetry; Atomic Absorption Spectroscopy; Gas chromatography, HPLC, Ion exchange Chromatography and Polarography. XRF, XRD.	6	2	
	Total	35	10	
Evaluation criteria <ul style="list-style-type: none">Minor Test 1: 15% (written test based on module 1 and 2)Minor Test 2: 15% (written test based on module 3 and 4)Assignment/Presentation: 20% (assignment on the applications of analytical instruments pertaining to environmental analysis)Major Test: 50% (written test and viva covering entire syllabus)				

Learning outcomes

- The students will learn basic chemical contents in the context of environmental studies (module 1 to 4)
- Students will understand the theory behind the analytical techniques (module 5)
- Students will learn the conceptual skills required for environmental chemistry research (module 1 to 5)
- Students will learn about the roles of microbes in managing environmental problems (module 4)

Pedagogical approach**Materials**

Required text

1. Bailey R.A. (2002) *Chemistry of the Environment*, Academic Press, San Diego.
2. Masters G.M. (2004) *Introduction to Environmental Engineering and Science*, Second Edition, Pearson Education.

Suggested readings

1. Baird C. (1999) *Environmental Chemistry* (2nd edition), WH Freeman and Co.
2. Buell P. and Girard J. (2002) *Chemistry Fundamentals: An Environmental Perspective* (2nd edition), Jones & Bartlett Publishers.
3. Bunce N. (1991) *Environmental Chemistry*, Wuerz Publishing Ltd., Winnipeg, Canada.
4. Cunningham W.P. and Cunningham M.A. (2007) *Principles of Environmental Science: Inquiry and Applications*, Tata McGraw-Hill.
5. Harrison R.M. (1991) *Introductory Chemistry for the Environmental Sciences*, Cambridge University Press.
6. Harrison R.M. (Edited) (1999) *Understanding our Environment: An Introduction to Environmental Chemistry and Pollution*, Royal Society of Chemistry.
7. Miller G.T. (2001) *Environmental Science*, (eighth edition), Brooks/Cole.
8. Pepper I.L., Gerba C.P. and Brusseau M.L. (2006) *Environmental and Pollution Science*, Second edition, Academic Press.

Case studies

Websites

Journals

1. Applied Environmental Microbiology
2. Environmental Chemistry Letters
3. Journal of Environmental Chemistry and Ecotoxicology

Additional information (if any)**Student responsibilities**

Attendance, feedback, discipline, guest faculty etc