### SSL 3110 SOIL AND WATER POLLUTION

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**Course Type**: **CORE (B.Sc. ALUM III)**

**1. COURSE DESCRIPTION**

**Course Credits (CU)**: **3 CU i.e. 45 Contact Hours per semester**

**Course Duration**: **15 weeks (45 hours) i.e. 30 LH, 30 PH**

Background to pollution. Definition and concepts related to soil and water pollution. Types of pollutants and their sources; sediments, acids, heavy metals, nuclear wastes, organic, petroleum products, agro-chemicals, poly aromatic hydrocarbons. Cycles of pollutants and their effects on the environment, human health (blue baby syndrome, abortion), soil and water quality. Assessment of pollution. Rehabilitation of polluted soil and water, and associated costs. Ground water contamination. Management of soil and water pollution (chemical degradation, biodegradation, phytoremediation etc). Mitigation of pollution, Legal aspects of toxicants in the environment e.g WHO recommendations)

**2. COURSE OBJECTIVES**

**The overall objective**

Students will be able to appreciate the dangers associated with misuse by humans of agricultural soil and water resources and to equip them with model interventions needed to abate the risks.

**Thespecific objectives**

By the end of this course, the students will be able to:

1. Define relevant concepts related to the pollution of soil and water resources;
2. Gain thorough insights into how pollution of soil and water resources arises;
3. Identify and classify the various types of soil and water pollutants, and their fate in the environment;
4. Appreciate the effects and costs of pollutants on the environment, including human health, animal and plant health, and the functioning and stability of agroecosystems;
5. Acquire modern technologies for controlling soil and water pollution; and
6. Get exposure to local and international legal aspects of soil and water pollution, including internationally acceptable levels of certain chemicals in soil and water resources, established safety standards and penalties for noncompliance, established policies and by-laws for pollution control, etc.

**3. RECOMMENDED REFERENCES FOR READING**

1. State of Environment Report for Uganda, NEMA 1994.

2. State of Environment Report for Uganda, NEMA 1996.

3. Biogeochemical Cycles of Nutrients…

4. Brady, N. C. and Ray .R. Weil. The Nature and Properties and Soils. 14th edition. Pearson

 Education Ltd. Prentice Hall. 975 pages.

5. Troech F.R.., Arthur-Hobbs, J. and Donahue, L. 2004. Soil and Water conservation for

 Productivity and Environmental Protection. 4th edition. Pearson Education Ltd. Prentice Hall.

 656 pages.

6. Calabrese, J. Kostecki., P.T. and Dragun. J. 2006. Contaminated Soils, Sediments and Water.

 Volume 10: Successes and Challenges. Springer. 508 pages

7. Pollution Control and Waste Management in Developing Countries. 2000. [G E Ekosse](http://publications.thecommonwealth.org/g-e--ekosse-38-a.aspx), [Gotlop Y Bogatsu,](http://publications.thecommonwealth.org/gotlop-y--bogatsu--39-a.aspx) [M B Darkoh](http://publications.thecommonwealth.org/m-b--darkoh-40-a.aspx), [O Totolo](http://publications.thecommonwealth.org/o--totolo-41-a.aspx) and [Rogers W'O Okot-Uma](http://publications.thecommonwealth.org/rogers-w-o-okot-uma-33-a.aspx) (Authors). I**SBN No:** 978-0-85092-557-9. 462 pages.

**4. COURSE CONTENT, METHODS OF INSTRUCTION, TOOLS AND EQUIPMENT REQUIRED**

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| **TOPIC** | **CONTENT** | **METHOD OF INSTRUCTION / Time allocated** | **TOOLS / EQUIPMENT NEEDED** |
| **1. INTRODUCTION** | * Background to the rise of pollution
* Definition of concepts
* General effects of soil and water pollution
 | Interactive lectures (3 hrs) | Chalk/BB or Markers/ Flip charts/LCD Projector |
| **2. MAJOR SOIL AND WATER POLLUTANTS** | * People related sources
* Industrial sources
 | Interactive lectures (4 hrs) | Chalk/BB or Markers/Flip charts |
| **3. MAJOR SOIL AND WATER POLLUTANTS** | * Agricultural sources
 | Interactive lectures (2 hrs) | Chalk/BB or Markers/Flip charts |
| **4. SOIL AND WATER POLLUTION** | * Sediments as pollutants
* Soil and water acidification
* Toxic elements in soil and water: heavy metals, pesticides
* Organic pollutants - Sewage/Waste water

 - Manure, agropesticides | Interactive lectures (5 hrs) | Chalk/BB or Markers/Flip charts |
| **5. CLASSIFICATION OF SOIL AND WATER POLLUTANTS** | * By source: Point and non-point source pollutants
* By physical state: solid, liquid, gaseous
* By chemical composition: inorganic, organic
* By degradability: degradable and recalcitrant
* By toxicity: non-toxic, toxic and hazardous
 | Interactive lectures (3 hrs) | Chalk/BB or Markers/Flip charts/LCD Projector |
| **6. TEST ONE** |  | ( 2 hrs) |  |
| **7. ENVIRONMENTAL EFFECTS OF SOIL AND WATER POLLUTION** | Pollution effects and management options:* Effects on soil and water quality
* Effects on human health
* Effects on animal health
* Effects on ecosystem functioning and stability
 | Interactive lectures (2 hrs)Practical (2 hrs)Field excursion (3 hrs) | Chalk/BB or Markers/Flip charts/LCD Projector/Demonstration kits |
| **8. ENVIRONMENTAL EFFECTS OF SOIL AND WATER POLLUTION** | * Global warming (reactive nitrogen loss to atm)
* Loss of aquatic and terrestrial life
* Eutrophication and drying of water bodies
* Soil erosion (where vegetation has died)
* Soil acidification
 | Interactive lectures (3 hrs)Practical (3 hrs) | Chalk/BB or Markers/Flip charts |
| **9. FATE OF POLLUTANTS IN THE ENVIRONMENT** | * Overland flow and seepage into surface water
* Leaching to groundwater resources
* Volatilization and transportation as dust to atm
* Uptake by plants and animals, entering the food chains to humans
* Sequestration in organic and inorganic soil colloids
* Biodegradation by microorganisms and subsequent transformation into simple harmless products or more polymeric and stable secondary metabolites e.g. the case of trifluralin
* Chemodegradation in the soil and water
* etc
 | Interactive lectures (2 hrs) | Chalk/BB or Markers/Flip charts/LCD Projector (for demonstration) |
| **10. GROUND WATER CONTAMINATION: MAJOR CONTAMINANTS** | * Faecal matter (leaching, drilling of bore holes)
* Chlorides and Fluorides (leaching and seepage)
* Nitrates – methaemoglobinemia (leaching/seepage from contaminated sites)
* Iodides (Leaching and seepage from contaminated sites)
 | Interactive lectures (3 hrs), field excursions (3 hrs) | Chalk/BB or Markers/Flip charts |
| **11. TEST TWO** |  | ( 2 hrs) |  |
| **12. MANAGEMENT OF SOIL AND WATER POLLUTANTS** | * Chemical Methods: Chemodegradation, precipitation, etc.
* Biological methods: Microbial biodegradation, Phytoremediation
* Physical methods: Photodegradation, deep burial in consolidated subsurface horizons, excavation for safe disposal, etc.
 | Interactive lectures (3 hrs), field excursions (3 hrs) | Chalk/BB or Markers/Flip charts |
| **13. LEGAL ASPECTS OF TOXICANTS IN THE ENVIRONMENT GENETICS RESOURCES** | * As spelt in the Mining Act (year?), the Water Act (year?), Guidelines for EIA for Uganda (1997), Environment Statute for Uganda (1995)
* Critical levels of Major pollutants in soil and water resources considered safe. Refer to: WHO standards, EPA guidelines (USA)
* Who pays for polluting: the poor who are victims or the industry? Etc.
 | Tutorials, seminars, workshops (invite experts as guest speakers) | Chalk/BB or Markers/Flip charts |

**5. SUMMARY OF TIME NEEDED**

Interactive lectures covering theory 30 hrs

Class and station-based practicals 5 hrs

Field visits 9 hrs

Seminars 2 hrs

Evaluation 4 hrs

**6. OVERALL COURSE EVALUATION**

Continuous Assessment Tests 20%

Class practicals, Field work, Write-ups 20%

Final examination 60%