



**Department of: Environmental Sciences and Health**

**College of: Science**

**University of: Salahaddin**

**Subject: Environmental Toxicity Theory**

**Course Book: Third Stage**

**Lecturer's name: Dr. Nashmeel Saeed Khudhur  
(Assistant Professor) (Ph.D.) Theory**

**Lecturer's name: Lanja Omer Tahir (Assistant  
Lecturer) (MSc) Practical**

**Academic Year: 2023/2024**

# Course Book

1. Course name	Environmental Toxicity
2. Lecturer in charge	Dr. Nashmeel Saeed Khudhur (Ph.D.) Lanja Omer Tahir (MSc)
3. Department/ College	Department of Environmental Sciences and Health/ College of Science
4. Contact	e-mail: <a href="mailto:nashmeel.khudhur@su.edu.krd">nashmeel.khudhur@su.edu.krd</a> e-mail: <a href="mailto:lanja.tahir@su.edu.krd">lanja.tahir@su.edu.krd</a>
5. Time (in hours) per week	Theory: 2, Practical: 2
6. Office hours	
7. Course code	
8. Teacher's academic profile	<p><b>Assist. Prof. Dr. Nashmeel Saeed Khudhur</b></p> <p>* Graduated in Biology Department-Microbiology (Ranked 3<sup>rd</sup> in the department and 6th in the collage) in Salahaddin University/ College of Science (2001-2002). Worked as assistant biology for 2 years at different subjects.</p> <p>* Got M.Sc. in Biology at Salahaddin University in (2006) under the thesis title of “<b>Wastewater Treatment Using <i>Typha angustifolia</i> L. as a Biological Purifier for Irrigation Purposes</b>”.</p> <p>Then got Assistant Lecturer title.</p> <p>* Got Ph.D. in in Biology Salahaddin University in (2013). The Dissertation title was “<b>Effect of Some Pesticides on Soil Microorganisms in Hawler Governorate</b>”.</p> <p>During the academic life, I thought different subjects in both Biology and Environmental Science and Health Departments including Ecology and Pollution, Sewage and Soil Microbiology, Virology, Eco-physiology, Mycology and Plant Pathology, General Biology, Microbiology, Toxicology and Quality Control, Public Health and Environmental Awareness, Toxicity and Pesticides, Climate Change, Advanced Environmental Analysis, Advanced Soil Pollution, Trace Element Pollution, ...etc.</p> <p>Worked at different committees including Scientific and Higher Education, Higher Education Examination Committee, Quality Assurance and Curriculum Development, Seminar Presentation, Research Project Evaluation, Department Council, Students Affair, Objection committees and many others. I have 24 scientific articles and 14 social articles.</p> <p>I am now an academic staff in Environmental Sciences and Health Department in the College of Science, Department Head of Quality Assurance and Curriculum Development Program, and teaching courses for Bachelor, Master's students and PhD students.</p>

	<p><b>Lanja Omer Tahir</b>          Has MSc. degree in Biology/ Water Quality. She got it in 2011 in the Biology Department / College of Science-Salahaddin University. In addition, she got Bachelor's in 2002-2003 in the biology department. She is teaching different subjects in the Environmental Sciences &amp; Health and Biology Department including; Environmental Toxicity; Limnology; Water Pollution, Algae and Archegoniate.</p>
<p><b>9. Keywords</b></p>	<p><b>Environment, Toxicity, Toxicants, ...</b></p>
<p><b>10. Course overview:</b>          This course will cover the most important topics of environmental toxicity, which focus on the definition of toxicants and their introduction into the ecosystems and their metabolism. This course also covers the principal aspects of toxicology, exposure to toxicants, toxicokinetics and toxicodynamics. The student will take knowledge about toxicity and mode of action of different toxicants like heavy metals, radioactive substances, hydrocarbons, plastics and dioxin, etc.</p>	
<p><b>11. Course objective:</b>          The aim of this course is to understand the basic principles and applications of toxicology, as well as to identify the different classes of environmental toxic substances that have known effects on individuals or populations. This course will give better understanding for classifying the different routes of toxic exposure, metabolic pathways, mechanisms of distribution within the organism's body, and elimination processes. Moreover, understanding the target effects of different toxicants on the cellular, organ system and whole body levels will be another objective. The course also recognizes different populations at risk based on past history, age, geography, and occupational and environmental exposures. Finally, the course relates to applied toxicology principles and community health practices.</p>	
<p><b>12. Student's obligation</b>          In this course, the students will be evaluated through two exams. The student's obligation during the course is attendance in the class for two hours for studying the theory and two hours practical. During this course the students will prepare a report about one of the environmental toxicants and may consider as an exam. An absence from classes should be excused according to the general regulations (i.e. sick leave) soon after coming back to college otherwise the absence is recorded as an unexcused one. The student should also be ready for a quiz at the end of each lecture.</p>	
<p><b>13. Forms of teaching</b>          For each class, we recommend the students to take the lecture handout before attending the classroom. A student must read the lecture before the class. In the class, the lectures were power-point present at the first hour of the class, inconspicuous points are clear on whiteboard, difficult idioms and tough words are also clear for the students, and then medium talk with teacher will make to discuss the theoretical aspects of the subjects. At the end of the class a short review of the lectures will make by the students while the data-show projector is switch-off in order to remind them the critical points from the lectures each week. Finally a slide of question mark is present in order the students to ask the teacher about inconspicuous points from each lecture.          Social media considered as another method for teaching using different platforms including Moodle, Google Meet, Zoom, Free Call Conference...etc.</p>	

**14. Assessment scheme**

There will be 15 classes to be completed. Student's answer will be graded according to the following scale:

Pass = 50-100, Failed = 0-49.

Grades are break down as follow:

First exam = 15 points

Second exam = 15 points

Report and seminar (if done)= 15 points

The mean of all will take as 15%. The final grade at the end of the year would be 50% with 35% of practical subject. The final examination takes 50% for theory subject only. So the final grade would be passed upon the following criteria:

Total of the examinations = 15%

Practical = 35%

Final examination = 50% (all for theory).

**15. Student learning outcome:**

At the end of the semester, students should get enough information about the:

- ✓ Toxicology and environmental toxicity and its importance in different fields of life.
- ✓ What are toxicants and their introduction into the ecosystems and how they are metabolize?
- ✓ Toxicokinetics and toxicodynamics, and factors affecting xenobiotic action.
- ✓ Toxicity and mode of action of different toxicants like heavy metals, radioactive substances, hydrocarbons, plastics and dioxin, etc.
- ✓ What are pesticides? Their pathway in the environment and living organisms. Pesticide poisoning and symptoms of poisoning and first-aid procedures.

**16. Course Reading List and References:**

Required books:

- 1- Wright, D. A. and Welbourn, P. A. 2002. Environmental Toxicology. Cambridge University Press.
- 2- Pandey, K; Shukla, J.P. and Trivedi, S.P. 2005. Fundamentals of Toxicology. New Central Book Agency (P) Ltd. India.
- 3- Hodgson, E. 2004. A Textbook of Modern Toxicology. 3<sup>rd</sup> edition. John Wiley & Sons, Inc.
- 4- Yu, M. H. 2005. Environmental toxicology: Biological and Health Effects of Pollutants. 2<sup>nd</sup> edition. CRC Press LLC.
- 5- Duffus, J.H. and Worth, H.G. 2006. Fundamental Toxicology. Biddles Ltd, King's Lynn, Norfolk, UK.
- 6- Williams, P.L.; James, R.C. and Roberts, S.M. 2000. Principles of Toxicology: Environmental and Industrial Applications. 2<sup>nd</sup> edition. John Wiley & Sons, Inc.

**17. The Topics:**

**Lecturer's name**

**A: Theory**

Dr. Nashmeel Saeed Khudhur  
2 hour per week for theoretical lecture

**Introduction to toxicity, toxicology and historical preview.** Introduction. Definitions of toxicology. Relation of toxicology with other science. History

of toxicology. Branches of toxicology. Applied branches of toxicology. Principal aspects of toxicology. Importance of toxicology.

**Toxicant and their classification.** Definition of toxicants or poisons. Classification. Introduction of toxicants into the ecosystems.

**Toxicants metabolism and biotransformation.** Introduction. Absorption, Distribution, Metabolism, and Excretion of toxicants (ADME). Biotransformation. Toxicant metabolizing enzymes. Biotransformation pathways. Individual susceptibility. Exposure. Duration of exposure. Frequency of exposure.

**Exposure and toxicokinetics.** Basic principles of toxicokinetics. A/ Definition. B/ Several basic parameters. C/ Classical toxicokinetics.

**Toxicodynamics.** Definition. Categories of toxic effects. Toxicodynamics. Application of Toxicodynamics.

**Factors affecting xenobiotic action.** 1. Physicochemical properties. 2. Dose or concentration. 3. Duration and mode of exposure. 4. Environmental factors. 5. Interaction. 6. Biological factors. 7. Nutritional factors.

**Toxicity of heavy metals and radioactive substances.** Introduction to heavy metals. Important toxic metals. Common toxic mechanisms and sites of action of heavy metals. Introduction to radioactive substances. Toxic effects of radiation.

**Toxicity of hydrocarbon compounds.** 1. Volatile organic compounds (VOCs). 2. Solvents. 3. Petroleum hydrocarbons. 4. Polycyclic aromatic hydrocarbons (PAHs).

**Toxicity of plastics and dioxin.** Introduction. Categories of plastics. Properties of plastics. Toxicity of plastics. Toxicity associated with burning of plastics. What is dioxin? Health effects associated with dioxin exposure.

**Toxicity of pesticides.** Introduction. A brief history on pesticide uses. Classification of hazardous pesticides. Mode of action of pesticides. Hazards of pesticides. Pesticide poisoning. First-aid procedures.

**Toxic effects of food additives and drugs.** Introduction. List of food additives. Therapeutic drugs. Toxic effects of drugs. Drugs of Abuse. Hypersensitivity responses to drugs.

**Natural toxins and toxicity.** Introduction. A. Microbial Toxins. B. Mycotoxins. C. Algal Toxins. D. Plant Toxins. E. Animal Toxins.

**Environmental carcinogens.** Introduction. What are environmental carcinogens? What is cancer? Metastasis. Tumour progression. Properties of cancer and cancer cell. Types of cancer. Causes of cancer.

**Environmental Mutagens.** Introduction. Environmental mutagens. Mutations. Effects of mutations. Types of mutations. Causes of mutations. Mutagenesis.

**B: Practical**

Lab 1: Terminology.

Lab 2: Introduction to toxicology and toxicity testing procedures.

A. In terrestrial systems.

B. In aquatic systems.

Lab 3: Toxic metal detection in: plants, water, soil and sediment and animal tissues.

Lab 4-7: Uses of toxicity tests in aquatic systems:

A. Tests on algae:

1. Cytotoxicity testing of  $\text{CuSO}_4$  on *Chara* sp.

2. Determination of LD50 of  $\text{CuSO}_4$  on *Euglena* sp.

3. Determination of  $\text{CuSO}_4$  bioaccumulation in *Chara* sp.

B. Tests on protozoa:

1. Cytotoxicity testing of  $\text{HgCl}_2$  on *Paramecium* sp.

2. Determination of LD50 of  $\text{HgCl}_2$  on *Amoeba* sp.

3. Determination of  $\text{HgCl}_2$  bioaccumulation in *Paramecium* sp.

Lab 8: A. Effect of UV radiation on bacterial growth (eg. *Bacillus* sp.).

B. Effect of UV radiation on fungal growth (eg. *Aspergillus* sp.).

Lab 9: Determination of polycyclic aromatic hydrocarbons (PAHs) in environmental samples (water, soil, sediments, foods, etc).

Lab 10: Toxicity of hydrocarbons in the environment. Testing chloroform, petroleum oil, naphthalene, benzene and ethanol on *E. coli* growth.

Lab 11: A. Detection of food preservatives.

B. Effect of food preservatives on microorganisms.

Lab 12: Determination of aflatoxin and ochratoxin in foods.

Lab 13: Testing of the expired drugs on laboratory animals (mice or rat).

Lab 14: Determination of toxicity of Xenobiotic on higher organisms (animals).

Lab 15: Effect of pesticides on non-target organisms:

Lab 16: Uses of toxicity tests in terrestrial systems (soil):

<p>A. Tests on invertebrates: Toxicity testing of Glyphosate on earth worms.</p> <p>B. Tests on plants (Weeds and Grasses): Toxicity testing of Glyphosate (Herbicide) on seed germination.</p>	
<p><b>20. Extra notes:</b> The course book lacks to the problems which affect the educational process. The absence of appropriate rooms for lecturers to develop themselves.</p>	
<p><b>21. Peer review</b> Assistant Professor Dr. Nashmeel Saeed Khudhur</p>	