

**Oakland University
School of Health Sciences
Environmental Health and Safety Program**

**Course Syllabus:
ENV4460/EHS 4460-Industrial and Environmental Toxicology (3 credits)**

Instructor and Class Meeting Information:

Instructor: Patrick. Frazee.
Office: 3172 Human Health Building
e-Office Hours: Tuesdays 5:00 to 6:00 PM
Phone: 248-364-8652
E-mail: frazee@oakland.edu
Class Sessions: Online – Tuesday at 6:30 PM
Class Location: Online

Catalog Description:

Introduction to the basic concepts and techniques of toxicology, with special attention given to the industrial environment. Evaluation of the toxic effects of substances and toxic responses to various substances. This class satisfies the General Education requirements in the Intensive Writing Area. Cross listed with ENV 484 Environmental Toxicology
Prerequisites: BIO 1002, CHM 2010, EHS 3380.

Required Text:

Casarett & Doull's Toxicology, Essentials of Toxicology, Klaassen & Watkins, Second Edition, 2010.

General Education Learning Outcomes:

Upon completion of this course, the student should be able to demonstrate:

1. Appropriate uses of a variety of methods of inquiry and a recognition of ethical considerations that arise in an industrial environment.
2. The ability to integrate the knowledge learned in general education and its relevance to the student's life and career as a safety and health professional.
3. Knowledge of the elements, writing processes, and organizing strategies for creating analytical and expository prose.

Course Objectives:

Upon completion of this course, students should be able to:

1. Define commonly used terms related to toxicology including, toxicokinetics, toxicodynamics, toxicology, dose-response relationships, toxicity, and lethality of chemicals and drugs.
2. Describe nomenclature commonly used in toxicology and explain the process of identifying toxicological agents in the United States.
3. Examine and use the decision making process in evaluating the toxicity of chemicals on humans.
4. Differentiate and detect adverse chemical reactions, appraise toxicovigilance, and compare the effects of disease created by chemical exposure.
5. Construct models of biological variability, integrate toxic chemical dosage versus toxic chemical effect, formulate margins of safety in toxic chemical exposure.
6. Appraise toxic chemical regulations on exposure, compare risk versus benefit in different age groups, evaluate the impact of exposure detection mechanisms and assess adverse reactions on humans after exposure.
7. Develop a hypothesis as to chemical interactions, analyze data, and prove conclusion from accumulated material sampled.

Cross-Cutting Capacities:

Upon completion of this course, the student should be able to demonstrate:

1. Effective communications in both written and verbal form which are essential to successful completion of this course.
2. Critical thinking skills required to apply general education and OSH major course to site-specific applications of toxicology in today's industrial environment.
3. Information literacy skills necessary to apply classroom learning and research skills necessary to address toxic chemical interactions in the workplace.

Class Schedule:

Week 1 - Introduction: Historical review and role of Industrial Toxicology, Basic Concepts in Toxicology; Dose/Response curves and data and Risk Assessment (Text, chapters 1, 2, and 4)

Week 2 – Chemical Reactivity and Mechanisms of Toxicants (Text, chapter 3)

Week 3 - Absorption, Distribution and Excretion of Toxicants, Toxicokinetics (Text, chapters 5, 7)

Week 4 - Biotransformation of Toxicants (Text, chapter 6)

Week 5 – Carcinogenesis (Text, chapter 8);

Week 6 – Toxicology of the Pulmonary System – asbestos, fibers, particles (Text, chapter 15)

Week 7 - Mid-term Exam

Week 8 – Winter Recess

Week 9 – Nervous System Toxicology (Text, chapter 16); Toxic Effects of Solvents and Vapors (Text, chapter 24)

Week 10 - Toxic Responses of the Eye _ Caustics and Acids (Text, chapter 17), Toxicology of the Skin (Text, chapter 19),

Week 11 - SDS Exercise – finding toxicology information online Occupational Toxicology (Text, chapter 33)

Week 12 – Practical Applications of Toxicology in Industry/Environment

Week 13 – Toxic Responses of the Blood (Text, Chapter 11)

Week 14 - Toxicity of Metals (Text, chapter 23)

Week 15 - Toxic Effects of Radiation and Radioactive Materials (Text, chapter 25);

Week - Final Exam

Course Procedures:

This class is an online course with weekly opportunity for group discussion by the students to support an active learning environment. Two traditional exams are given throughout the course and a major portion of the student grade is determined by an independent toxicological research project resulting in a major term paper.

Expectations of Student:

Active participation in Webex sessions and Forums; student learning. Articles on pertinent toxicological issues will be presented and discussed by students. Out of class research is required to complete a major term paper. The student is expected to prepare a professional paper based on the toxicological research topic assigned by the instructor.

Grading Determination:

Class grade points are determined by the following performance measures. The percentages are estimates and may vary during the semester.

| <u>Test Instrument</u> | <u>Percentage</u> |
|------------------------|-------------------|
| Assignments/Quizzes | 20 |
| Mid-Term Exam | 30 |
| Term Paper | 15 |
| Final examination | 30 |
| Participation | 5 |

(See page 11 for grading scale)

Proctoring of Exams:

All examinations in this class will be proctored by ProctorU. Please make adequate accommodations for the examination proctoring fees. ProctorU is a live online proctoring service that allows you to take your exam from the comfort of your home. ProctorU is available 24/7, however you will need to schedule your proctoring session at least 72 hours in advance to avoid any on demand scheduling fees. Creating a ProctorU account is very simple. All you will need to do is visit <http://proctoru.com/portal/oakland>.

ProctorU also provides free technical support to ensure you have the best testing situation possible. That is available at www.proctoru.com/testitout. On this page you will also be able to test your equipment, learn about what to expect during your proctoring session, and ask any questions you may have about the proctoring process with a ProctorU representative.

In order to use ProctorU you will need to have a high-speed internet connection, a webcam (internal or external), a windows or apple Operating System, and a government issued photo id. ProctorU recommends that you visit proctoru.com/testitout prior to your proctoring session to test your equipment. For additional technical services needed before your exam, you can click on the button that says "connect to a live person."

Oakland University Portal Page

url: <http://proctoru.com/portal/oakland>

Test Taker Walk Through Video

url: <https://vimeo.com/107066503>

Academic Conduct Policy:

Plagiarism, falsifying records or reports, and unauthorized collaboration, access, or modifying of computer programs are considered serious breaches of academic conduct. The Oakland University policy on academic conduct will be strictly followed with no exceptions. See the OU catalog under Academic Policies and Procedures in this regard. The mid-term and final exams cannot be taken in the OU library or any other public place without permission from the instructor.

Add/Drops:

The University add/drop policy will be explicitly followed. It is the student's responsibility to be aware of the University deadline dates for dropping the course.

Important dates:

Jan. 17 – last day for: 100% refund, add a class, declare audit, “no grade” drop.

Jan 26 – Last day to file application for degree/certificates for winter 2017

March 14 – last day to withdraw

Special Considerations:

Students with disabilities who may require special considerations should make an appointment with campus Disability Support Services. Students should also bring their needs to the attention of the instructor as soon as possible.

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General Requirements for Written Term Papers

1. Each student will be assigned an industrial or environmental chemical.
2. The term paper must include the following headings.

Introduction - An introduction section which describes the general category and information pertaining to the assigned chemical. This section should include how the chemical is used in industry and how its use may result in exposure to persons. It should also include physical and chemical characteristics and properties, CAS number, chemical structure, and formula.

Toxicokinetics - A discussion on the toxicokinetics of the chemical must cover the following areas:

- a. Absorption – How easily the chemical is absorbed into the body through ingestion, inhalation and skin contact.
- b. Distribution – Once absorbed, where does the chemical go? What percent reaches the various systems. Identify how the chemical is distributed to various parts of the body.
- c. Storage – Where the chemical is stored.
- d. Metabolism – Where and how the chemical is metabolized. Include the enzymes involved, the metabolites, and the location in the body where metabolism occurs. In many cases there are several steps or metabolic pathways.
- e. Excretion – How is the chemical or its metabolites excreted? Include the biological half-life of the chemical and its metabolites.

Toxicodynamics - A discussion on the toxicodynamics of the chemical must cover the following areas;

- a. Interaction at the tissue, affected organ or body system – describe how the chemical or its metabolites interact with a specific target organ or body system. This includes the mechanism of action that results in toxicity. Include a discussion for both acute exposure and chronic exposure. (Note: The target tissue or organ may be different for acute vs chronic exposure.)
- b. Toxic effects – Describe the toxic effects resulting from interaction of the chemical or its metabolites with the target organ, tissue or system. Include both acute and chronic effects.
- c. Dose needed to produce both acute and chronic effects. Include results of animal tests, human experience, regulatory exposure limits and guides.
- d. Other toxic effects of the chemical or its metabolites on other organs or system.

Chemical Interaction - Identify at least one other chemical (industrial, environmental, or pharmaceutical) known to interact with the assigned chemical at the same body tissue, organs, system or physiological functions. Gather data to determine whether the interaction might be classified as:

- a. Additive
- b. Antagonistic
- c. Synergistic
- d. Potentiation

Conclusion - This section must include a statement of whether the two chemicals together produce toxic effects which are either additive, antagonistic, synergistic or potentiation. Support your conclusion with reasons based on the information gathered and previously shown in your paper. Describe the harmfulness if both chemicals are present in the human body at the same time.

7. Term papers will be submitted on Moodle using an MS Word type document file and will include a bibliography with at least 10 **scientific** references. You must follow the example for citing references shown below. **If you quote (paste) any material from another source without the proper reference citation, it will be considered plagiarism.**

Recommended Readings for peer-reviewed studies:

The OU Library has numerous online scientific toxicology journals.

Journal of Occupational and Environmental Medicine (JOEM): OU Library Call # RC963.A3J86

British Journal of Industrial Medicine: OU Library Call # RC963.A23

Medical Toxicology; Diagnosis and Treatment of Human Poisonings

Principles and Methods of Toxicology; Hayes

Industrial Hygiene and Toxicology; Patty

Example Method for Citing References

Scientific studies have examined the relationship between coffee consumption and an array of medical conditions. Findings are contradictory as to whether coffee has any specific health benefits, and results are similarly conflicting regarding negative effects of coffee consumption.^[1]

Coffee appears to reduce the risk of Alzheimer's disease, Parkinson's disease, heart disease, diabetes mellitus type 2, cirrhosis of the liver,^[2] and gout. Some health effects are due to the caffeine content of coffee, as the benefits are only observed in those who drink caffeinated coffee, while others appear to be due to other components.^[3] For example, the antioxidants in coffee prevent free radicals from causing cell damage.^[4]

Although caffeine has not been linked to any life-threatening disease, doctors and nurses routinely advise some patients to watch their caffeine intake or to eliminate it altogether.^[5] Research suggests that drinking caffeinated coffee can cause a temporary increase in the stiffening of arterial walls.^[6] Excess coffee consumption may lead to a magnesium deficiency or hypomagnesaemia,^[7] and may be a risk factor for coronary heart disease. Some studies suggest that it may have a mixed effect on short-term memory, by improving it when the information to be recalled is related to the current train of thought, but making it more difficult to recall unrelated information.^[8] About 10% of people with a moderate daily intake (235 mg per day) reported increased depression and anxiety when caffeine was withdrawn,^[9] and about 15% of the general population report having stopped caffeine use completely, citing concern about health and unpleasant side effects.^[10] Nevertheless, the mainstream view of medical experts is that drinking three 8-ounce (236 ml) cups of coffee per day (considered average or moderate consumption) does not have significant health risks for adults.^[11]

References

1. Kummer, Corby (2003). "Caffeine and Decaf". *The Joy of Coffee*. Houghton Mifflin Cookbooks. pp. 151–170. ISBN 0618302409. Retrieved 2008-02-23.
2. Klatsky, Arthur L.; Morton, C.; Udaltsova, N.; Friedman, D. (2006). "Coffee, Cirrhosis, and Transaminase Enzymes". *Archives of Internal Medicine* **166** (11): 1190–1195. doi:10.1001/archinte.166.11.1190. PMID 16772246. Retrieved 2008-02-23.
3. Pereira, Mark A.; Parker, D.; Folsom, A.R. (2006). "Coffee consumption and risk of type 2 diabetes mellitus: an 11-year prospective study of 28 812 postmenopausal women.". *Archives of Internal Medicine* **166** (12): 1311–1316. PMID 16801515. Retrieved 2008-02-23.
4. Bakalar, Nicholas (2006-08-15). "Coffee as a Health Drink? Studies Find Some Benefits". New York Times. Retrieved 2007-07-28.
5. Op. Cit. Kummer 2003, p. 152
6. Mahmud, A.; Feely, J. (2001). "Acute Effect of Caffeine on Arterial Stiffness and Aortic Pressure Waveform". *Hypertension* **38** (2): 227–231. PMID 11509481. Retrieved 2008-02-23.

7. Johnson, S. (2001). **"The multifaceted and widespread pathology of magnesium deficiency"** (PDF). *Medical Hypotheses* (Harcourt Publishers Ltd) 56 (2): 163–170. **doi:10.1054/mehy.2000.1133**. **PMID 11425281**. Retrieved 2008-02-23.
8. BBC News; Lesk, Valerie (2004-07-20). **"A coffee can make you forgetful"**. BBC News. Retrieved 2008-02-23.
9. Smith, A. (2002). **"Effects of caffeine on human behavior"**. *Food and Chemical Toxicology* 40 (9): 1243–1255. **doi:10.1016/S0278-6915(02)00096-0**. **PMID 12204388**. Retrieved 2008-02-23.
10. Johns Hopkins University School of Medicine (2003). **"Use and Common Sources of Caffeine"**. *Information about Caffeine Dependence*. Retrieved 2008-02-23.
11. Haines, Cynthia Dennison (2007). **"Caffeine in the diet"**. *MedlinePlus Medical Encyclopedia*. The U.S. National Library of Medicine. Retrieved 2008-02-23.

ENV4460/EHS 4460-Industrial and Environmental Toxicology

Successful completion of ENV4460/EHS 4460-Industrial and Environmental Toxicology demonstrates competency in the following outcomes-based ABET accreditation criteria:

1. Ability to apply knowledge of science
2. Ability to analyze and interpret toxicological data
3. Ability to systematically identify and quantitatively evaluate hazardous exposures
4. Knowledge of contemporary health issues as they relate to poisonous chemicals
5. Proficiency in written and oral communications
6. Knowledge of health and safety fundamentals
7. Competency in health and safety program evaluation and management
8. Competency in the toxicological analysis of spills resulting in injuries and accidents
9. Competency in the measurement of safety performance

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**OSH Grading Scale Adopted
1/15/05**

| Assigned Grade: | Percent: | Letter Grade |
|------------------------|--------------------|---------------------|
| 4.0 | 97-100 | |
| 3.9 | 95-96 | |
| 3.8 | 93-94 | |
| 3.7 | 91-92 | |
| 3.6 | 90 | A |
| 3.5 | 89 | |
| 3.4 | 87-88 | |
| 3.3 | 85-86 | |
| 3.2 | 83-84 | |
| 3.1 | 81-82 | |
| 3.0 | 80 | B |
| 2.9 | 79 | |
| 2.8 | 78 | |
| 2.7 | 77 | |
| 2.6 | 76 | |
| 2.5 | 75 | |
| 2.4 | 74 | |
| 2.3 | 73 | |
| 2.2 | 72 | |
| 2.1 | 71 | |
| 2.0 | 70 | C |
| 1.9 | 69 | |
| 1.8 | 68 | |
| 1.7 | 67 | |
| 1.6 | 66 | |
| 1.5 | 65 | |
| 1.4 | 64 | |
| 1.3 | 63 | |
| 1.2 | 62 | |
| 1.1 | 61 | |
| 1.0 | 60 | D |
| 0.0 | 59 or below | F |