**Contaminants in Agricultural Systems**

**ABE 4932/6933**

***In Person & Online***

***Class Periods:*** T 10:40–11:30 AM (Period 4), R 10:40 AM – 12:35 PM (Periods 4-5)

***Location:*** 283 Frazier-Rogers Hall

***Academic Term:*** Fall 2025

***Instructor:***

Dr. Dengjun Wang

Department of Agricultural and Biological Engineering

University of Florida

1741 Museum Road, Gainesville, FL 32603

Faculty Profile: https://abe.ufl.edu/people/faculty/dengjun-wang/

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Phone: (352) 294-7969

Office Location: 255 Frazier-Rogers Hall

Office Hours: Immediately after class and by appointment, in person or via ZOOM

***Teaching Assistant/Peer Mentor/Supervised Teaching Student:***

TBA. Teaching Assistant (TA) will announce office hours (office location and ZOOM link) at the beginning of the course. Please contact TA in Canvas on office hours.

***Course Description: 3 Credits.***

This course studies sources, environmental behaviors, and plant uptake of contaminants, and remediation strategies to mitigate their adverse effects in agricultural systems, including microplastics and per- and polyfluoroalkyl substances. This course is a combination of lectures, readings, group discussions, and hands-on experiential activities (e.g., field trips & sampling, water treatment plant tour, laboratory experiments, analytical instrument operation, and data analysis).

***Course Pre-Requisites / Co-Requisites:***

None.

***Course Objectives:***

* Gain fundamental knowledge of the nature and sources of contaminants (from agrochemicals, biosolids, manures, water irrigation, runoff, etc.) in agricultural systems.
* Characterize the fate, transport, and uptake of contaminants in agricultural and biological systems.
* Equip analytical skills to identify and quantify contaminants in agricultural and biological systems.
* Analyze adverse effects of contaminants on agricultural productivity, food safety, and human health.
* Engineer agricultural and biological system practices, as well as remediation strategies to mitigate adverse effects of contaminants in agriculture.

***Materials and Supply Fees:***

None.

***Related to Program Outcomes (ABET):***

This course addresses the following ABET outcomes.

|  |  |
| --- | --- |
| **Outcome** | **Coverage** |
| 1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
 | Medium |
| 1. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
 | High |
| 1. An ability to communicate effectively with a range of audiences.
 | Medium |
| 1. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
 |  |
| 1. An ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives.
 | Medium |
| 1. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
 | High |
| 1. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
 | Medium |

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not a part of the course outcomes that are addressed.*

***Recommended Textbooks:***

* **Agriculture, Hydrology and Water Quality**

By: P. M. Haygarth and S. C. Jarvis.

Published on October 15, 2002, First Edition, CABI Publishing, 502 pages.

ISBN: 0-85199-545-4.

Link: https://www.cabidigitallibrary.org/doi/book/10.1079/9780851995458.0000.

* **Global Assessment of Soil Pollution: Summary for Policymakers**

By: Food and Agriculture Organization (FAO) and United Nations Environment Programme (UNEP).

Published in 2021, First Edition, FAO and UNEP, 84 pages.

ISBN: 978-92-5-134448-4.

DOI: https://doi.org/10.4060/cb4827en.

Link: https://openknowledge.fao.org/items/9f84ec0f-7280-4937-91f5-fa54bdd886a1.

* **Emerging Contaminants: Sustainable Agriculture and the Environment**

By: A. Kumari, V. D. Rajput, S. S. Mandzhieva, T. Minkina, E. D. van Hullebusch.

Published on March 26, 2024, First Edition, Elsevier.

ISBN: 978-0-443-18985-2.

DOI: https://doi.org/10.1016/C2022-0-00910-7.

Link: https://openknowledge.fao.org/items/9f84ec0f-7280-4937-91f5-fa54bdd886a1.

***Recommended Reading Materials:***

1. Clarke, B.O.; Smith, S. R. 2011. Review of ‘emerging’ organic contaminants in biosolids and assessment of international research priorities for the agricultural use of biosolids. ***Environment International,*** 37 (1): 226-247. <https://doi.org/10.1016/j.envint.2010.06.004>.
2. Pullagurala, V.L.R.; Rawat, S.; Adisa, I.O.; Hernandez-Viezcas, J.A.; Peralta-Videa, J.R.; Gardea-Torresdey, J.L. 2018. Plant uptake and translocation of contaminants of emerging concern in soil. ***Science of The Total Environment,*** 636: 1585-1596. <https://doi.org/10.1016/j.scitotenv.2018.04.375>.
3. Li, Z. 2025. Plant uptake models of pesticides: Advancing integrated pest management, food safety, and health risk assessment. ***Reviews of Environmental Contamination and Toxicology,*** 263: 3. <https://doi.org/10.1007/s44169-024-00076-y>.
4. Wang, W.; Ge, J.; Yu, X.; Li, H. 2020. Environmental fate and impacts of microplastics in soil ecosystems: Progress and perspective. ***Science of The Total Environment,*** 708: 134841. <https://doi.org/10.1016/j.scitotenv.2019.134841>.
5. Fu, Q.; Malchi, T.; Carter, L.J.; Li, H.; Gan, J.; Chefetz, B. 2019. Pharmaceutical and personal care products: From wastewater treatment into agro-food systems. ***Environmental Science & Technology,*** 53(24): 14083-14090. <https://pubs.acs.org/doi/full/10.1021/acs.est.9b06206>.
6. Li, X.; Shen, X.; Jiang, W.; Xi, Y.; Li, S. 2024. Comprehensive review of emerging contaminants: Detection technologies, environmental impact, and management strategies. ***Ecotoxicology and Environmental Safety,*** 278: 116420. <https://doi.org/10.1016/j.ecoenv.2024.116420>.
7. Saidon, N.B.; Szabo, R.; Budai, P.; Lehel, J. 2024. Trophic transfer and biomagnification potential of environmental contaminants (heavy metals) in aquatic ecosystems. ***Environmental Pollution,*** 340: 122815. <https://doi.org/10.1016/j.envpol.2023.122815>.
8. Chen, J.; Zhao, L.; Wang, B.; Blaney, L.; Huang, J.; He, X.; Wu, F.; Yu, G. 2025. Mitigating pesticide mixture hazard in global surface waters through agricultural management. ***One Earth,*** 8 (1): 101163. [https://www.cell.com/one-earth/abstract/S2590-3322(24)00593-1](https://www.cell.com/one-earth/abstract/S2590-3322%2824%2900593-1).
9. Hou, D.; O’Connor, D.; Igalavithana, A.D.; Alessi, D.S.; Luo, J.; Tsang, D.C.W.; Sparks, D.L.; Yamauchi, Y.; Rinklebe, J.; Ok, Y.S. 2020. Metal contamination and bioremediation of agricultural soils for food safety and sustainability. ***Nature Reviews Earth & Environment,*** 1: 366-381. <https://www.nature.com/articles/s43017-020-0061-y>.
10. Puri, M.; Gandhi, K.; Kumar, M.S. 2023. Emerging environmental contaminants: A global perspective on policies and regulations. ***Journal of Environmental Management,*** 332: 117344. <https://doi.org/10.1016/j.jenvman.2023.117344>.

***Required Computer:***

UF student computing requirement:<https://news.it.ufl.edu/education/student-computing-requirements-for-uf/>.

***Course Schedule:***

**Topic 1:** Introduction to contaminants

**Topic 2:** Sources of contaminants entering agricultural systems

**Topic 3:** Fate & transport of contaminants in the environment (**Lab Tour**)

**Topic 4:** Case study: Microplastics in agricultural systems (**First Exam**)

**Topic 5:** Plant uptake and food chain transfer of contaminants (**UF Field & Fork Tour**)

**Topic 6:** Analysis of contaminants in soil-water-plant system (**Combined Field-Laboratory Project**)

**Topic 7:** Contaminant residues in agricultural products

**Topic 8:** Effects of contaminants on agricultural productivity (**Mid-term Exam**)

**Topic 9:** Effects of contaminants on human health (**Guest Lecture**)

**Topic 10:** Case study 2: Per- and polyfluoroalkyl substances (PFAS) in agricultural systems

**Topic 11:** Best management practices for sustainable agriculture

**Topic 12:** Engineering strategies for pollution control (**Murphree Water Treatment Plant Tour**)

**Topic 13:** Policy and regulatory perspectives of contaminants (**Final Project Presentation**)

***Important Dates (Tentative):***

**9/16/2025** Exam 1 (10:40 – 11:30 AM, 283 Frazier-Rogers Hall)

**10/7/2025** Exam 2 (10:40 – 11:55 AM, 283 Frazier-Rogers Hall)

**11/4/2025** Exam 2 (10:40 – 11:55 AM, 283 Frazier-Rogers Hall)

**12/2/2025**  Final Project Presentation (10:40 – 11:55 AM, 283 Frazier-Rogers Hall)

***Evaluation of Grades:***

|  |  |  |
| --- | --- | --- |
| **Assignment** | **Total Points** | **Percentage of Final Grade** |
| Homework Sets (6) | 100 each | 20% |
| Video | 100 | 8% |
| Exam 1 | 100 | 14% |
| Exam 2 | 100 | 14% |
| Exam 3 | 100 | 14% |
| Project | 100 | 15% |
| Final Project Presentation | 100 | 15% |
| **Total** |  | **100%** |

**Video:** A 10 min video (PowerPoint presentation) needs to be submitted to Canvas, which is due in two weeks when the course starts. The topic of the video presentation should be related to one or more aspects (e.g., source, fate & transport, plant uptake, see ***Course Schedule*** above) of contaminants in agricultural systems. Students are highly recommended to select your most interested contaminants for the video presentation, so the instructor (Dr. Wang) can pay more attention to these contaminants throughout the course lectures.

**Project:** The main purpose of the project assignment is to provide a unique opportunity for students to gain the hands-on experiences on how to: (1) collect soil, water, and plant samples in the field (e.g., UF Field & Fork); (2) process the field collected samples in the wet laboratory (soil grinding, water filtering, acid digestion, etc.); (3) analyze the concentrations of contaminants in the processed samples using analytical instruments (UV-vis spectrophotometer, ICP-OES, HPLC-MS/MS, etc.); and (4) analyze and interpret the collected data of contaminants in the soil-water-plant system. The project results can be presented as the final project presentation. After the completion of this project, students are expected to gain rich experiences on how to analyze and track contaminants in soil-water-plant system, along with basic knowledge to evaluate the healthy vs. contaminated soil-water-plant system.

All deliverables should be submitted electronically in Canvas. Electronic documents must be a single text document (i.e., Word or PDF file) that clearly address the assignments (e.g., homework). Any relevant graphs, tables, and equations that support your assignment should be included (i.e., pasted) in this document and should be numbered, labeled, and captioned appropriately. If you do not sufficiently explain your work, you may will get partial credit. The assignments should be formatted so that they can be printed on standard paper (8.5’’ by 11’’).

***Grading Policy:***

|  |  |  |
| --- | --- | --- |
| **Percent**  | **Grade**  | **Grade Points**  |
| ≥ 90.0 | A  | 4.00  |
| 87.0 – 89.9  | A-  | 3.67  |
| 84.0 – 86.9  | B+  | 3.33  |
| 80.0 – 83.9  | B  | 3.00  |
| 77.0 – 79.9  | B-  | 2.67  |
| 74.0 – 76.9 | C+  | 2.33  |
| 70.0 – 73.9  | C  | 2.00  |
| 67.0 – 69.9  | C-  | 1.67  |
| 60.0 – 66.9  | D  |  |
| 0.00 – 59.9  | E  | 0.00  |

More information on UF grading policy may be found at:

[UF Graduate Catalog](https://catalog.ufl.edu/graduate/?catoid=10&navoid=2020#grades)

[Grades and Grading Policies](https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/)

***Attendance Policy and Resources:***

Academic policies for this course are consistent with university policies. See <https://syllabus.ufl.edu/syllabus-policy/uf-syllabus-policy-links/>

***Campus Health and Wellness Resources:***

Visit <https://one.uf.edu/whole-gator/topics> for resources that are designed to help you thrive physically, mentally, and emotionally at UF.

Please contact [UMatterWeCare](https://umatter.ufl.edu/) for additional and immediate support.

***Software Use:***

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

***Student Privacy:***

* Instructure (Canvas)
	+ [Instructure Privacy Policy](https://www.instructure.com/policies/privacy)
	+ [Instructure Accessibility](https://www.instructure.com/canvas/accessibility)
* Zoom
	+ [Zoom Privacy Policy](https://zoom.us/privacy)
	+ [Zoom Accessibility](https://zoom.us/accessibility)