PLEN-PLANT,ENVRMTL SCIENCES

PLEN 5401. Introduction to AI in Agriculture
3 Credits (3)
This course introduces the fundamental concepts, tools, and techniques used to develop and deploy AI systems relevant to agriculture, food production, natural resources, and the environment. Students will gain experience and familiarity with how AI technologies, such as machine learning, computer vision, and IoT, are applied to real-world problems such as precision farming and ranching, crop disease detection, crop breeding, environmental monitoring, natural resource management, and food systems. The course will incorporate concepts of responsible and ethical use of AI in agriculture and natural resource management.
Learning Outcomes
1. Describe the structure of modern agricultural systems through short essays.
2. Classify agricultural challenges by their impact on productivity using case study analysis.
3. Compare traditional and technology-aided approaches to solving farm-level problems in a written critique.
4. Explain how predictive analytics improve yield estimates by interpreting model outputs from sample datasets.
5. Demonstrate the use of a simple AI tool with agricultural data.
6. Evaluate the effectiveness of AI solutions in published case studies using a structured rubric.
7. Design a prototype AI solution and justify its feasibility.
8. Troubleshoot limitations of AI applications through scenario-based discussions.
9. Identify biases in agricultural datasets through hands-on data audits. 1
10. Discuss ethical dilemmas of deploying AI in agriculture. 1
11. Develop guidelines for responsible AI deployment in agriculture.

PLEN 5403. AI Applications in Agriculture, Plant & Environmental Sciences
3 Credits (3)
Practical application of AI concepts, tools, and techniques to agriculture production systems, crop and livestock management, natural resource management, wildlife, and plant and environmental sciences. The course will consider how AI can be used to inform management of agricultural and environmental systems where temporal and spatial variability, feedbacks, and human decision-making create complex, non-linear systems. Data forms, sources, privacy, and security, will also be considered.
Learning Outcomes
1. Develop understanding of various agricultural science fields including agronomy, horticulture, soils, and environmental science.
2. Work with and analyze various agricultural monitoring and measurement data types.
3. Identify major problems and issues facing current and future agricultural production that can be assisted by Artificial Intelligence and Machine Learning.
4. Understand the evolution of agriculture and how machine learning is shaping the future of farming.
5. Explain how and apply clustering and dimensionality reduction techniques help with soil zoning, crop segmentation, and large-scale data analysis.
6. Explain how and apply machine learning can enhance crop price forecasting, logistics, and reduce post-harvest loss.
7. Examine data privacy, algorithmic bias, and the ethical considerations of AI in agriculture (ethics).
8. Discuss future directions including autonomous systems, AI for climate-smart farming, and next-gen opportunities in Agri-AI.

PLEN 6110. Arid Land Water Resources
3 Credits (2+2P)
The course will cover various issues of relevance to water resources and water supply management within the Southwest US and other semiarid and arid regions. Discussions may include development and sustainability, climate change and drought, socioeconomic and cultural, and transboundary issues. Students will develop literature reviews, draft proposals, and conduct presentations. May be repeated up to 3 credits.
Learning Outcomes
1. Write an original research paper based on a literature review that is conceptualized, researched, and orally presented in class.
2. Conduct literature review research and develop a research proposal.
3. Communicate effectively (both oral and written) including engaging in discussion and debate.
4. Describe contemporary issues in water resources in the Southwest US and other arid lands.

PLEN 6120. Instrumentation in Agronomy
3 Credits (3)
Use of instruments used in research in all areas of agronomy including gas chromatography, high performance liquid chromatography, neutron soil moisture probe, and other instruments. May be repeated up to 3 credits.

PLEN 6130. Introduction to Scientific Writing
3 Credits (3)
Students will learn how to communicate, through written format, to both the scientific community and diverse audiences. Students will be introduced to new technologies and new genres of scientific writing. Students will also learn basic reviewing and writing skills that underlie efficient preparation of literature reviews, scientific manuscripts, project reports, blog-posts, opinion or perspective pieces for more popular venues, advocacy articles for legislators, and descriptive pieces for popular venues such as newspapers, magazines, and broadcast media. Emphasis will be on the communication of experimental findings in peer-reviewed scientific journals.
Learning Outcomes
1. Students will review the basics of rhetoric and the technology of language.
2. Students will learn how to overcome writing barriers and gain confidence in their writing skills.
3. Students will improve their writing skills so that manuscript preparation becomes more efficient and productive.
4. Students will learn professional standards for the conduct of ethical reporting of scientific results.
5. Students will learn to recognize structural and stylistic elements in scientific articles that help researchers achieve certain communication goals.
6. Students will learn the basics of table, figure, diagram, and image presentation in manuscripts.

7. Literature reviews, framed so that they answer an important question in the field, and lead to peer-reviewed publication, may also be prepared. (With permission of the instructor.)

PLEN 6210. Advanced Scientific Writing
3 Credits (3)
Students will learn to improve their writing skills so that their manuscript preparation process is more efficient and productive. Students will also gain experience in peer-review. Students are required to have analyzed data ready for incorporation into a finished manuscript. Students will learn professional standards for the conduct of ethical reporting of scientific results. At the end of the course, a manuscript ready for submission to a peer-reviewed journal will have been completed.
Prerequisites: EPWS/AGRO/HORT/SOIL 5213.
Learning Outcomes
1. Students will review the basics of rhetoric and the technology of language.
2. Students will learn how to overcome writing barriers and gain confidence in their writing skills.
3. Students will improve their writing skills so that manuscript preparation becomes more efficient and productive.
4. Students will learn professional standards for the conduct of ethical reporting of scientific results.
5. Students will learn to recognize structural and stylistic elements in scientific articles that help researchers achieve certain communication goals.
6. Students will learn the basics of table, figure, diagram, and image presentation in manuscripts.
7. Literature reviews, framed so that they answer an important question in the field, and lead to peer-reviewed publication, may also be prepared. (With permission of the instructor.)

PLEN 6225. Advanced Scientific Writing
3 Credits (3)
Students will learn to improve their writing skills so that their manuscript preparation process is more efficient and productive. Students will also gain experience in peer-review. Students are required to have analyzed data ready for incorporation into a finished manuscript. Students will learn professional standards for the conduct of ethical reporting of scientific results. At the end of the course, a manuscript ready for submission to a peer-reviewed journal will have been completed.
Prerequisite: AGRO/HORT/SOIL/EPWS 513, or EPWS 613, or PLEN 6130.
Learning Outcomes
1. Students will learn how to overcome writing barriers and develop a writing schedule.
2. Students will learn how to better organize the results of their experiments into effective tables and figures.
3. Students will improve their writing skills so that manuscript preparation becomes more efficient and productive.
4. Students will learn how to successfully navigate a manuscript through the entire manuscript preparation, revision, review, and publishing process.
5. Students will learn professional standards for the conduct of ethical reporting of scientific results.
6. Students will learn professional standards for conducting objective, rigorous reviews of scientific manuscripts.
7. Students will successfully communicate their research findings to the scientific community through publication in peer-reviewed, scientific journals.

PLEN 6320. Advanced Soil Physics
3 Credits (3)
Advanced treatment of soil physics, modeling, includes working on an existing/new research project, modeling existing or new data, step by step guide on the use of some 1-D and 2-D models. Specific areas of specialization will be field scale variability of soil properties, water flow, solute transport, and plant water relations. May be repeated up to 3 credits.

PLEN 6410. Moisture Heat Contaminant Transport Modeling
3 Credits (3)
Provides clear coverage of the basic principles of heat, moisture and contaminant transport through porous media, and a step-by-step guidance and hands on application on the use of some spreadsheet based and physically based one-and two-dimensional transport models. A similar course does not exist in the college for students that can encourage them to pursue modeling as a means of solving vadose zone and groundwater contamination and remediation problems. Consent of instructor required. May be repeated up to 3 credits.

PLEN 6415. Breeding for Plant Disease Resistance
3 Credits (3)
A practically-oriented course of lectures and discussion on concepts and principles of breeding for disease and pest resistance. Labs familiarize students with preparation, quantification, and application of inoculum to hosts. May be repeated up to 3 credits.

PLEN 6420. Advanced Crop Breeding
4 Credits (3+3P)
Applications of breeding principles to crop improvement. Emphasis on breeding methodologies using modern techniques, including biotechnology. May be repeated up to 4 credits.
Learning Outcomes
1. Apply advanced breeding principles and methodologies (conventional and molecular) to the genetic improvement of crops, including self- and cross-pollinated species.
2. Analyze and interpret scientific literature related to plant breeding, with emphasis on critical evaluation of experimental design, data analysis, and breeding outcomes.
3. Utilize genomics tools such as marker-assisted selection, genome-wide association studies (GWAS), and genomic selection in developing breeding strategies for crop improvement.
4. Demonstrate proficiency in quantitative genetics concepts by estimating genetic parameters (heritability, combining ability, genetic gain) and conducting DNA marker-trait association analyses.
5. Integrate plant breeding theories and practices to effectively communicate solutions in professional settings, including job presentations simulating real-world plant breeding positions.

PLEN 6425. Biometrical Genetics and Plant Breeding
3 Credits (3)
A statistical approach to gene action and population parameters as applied to plant improvement. May be repeated up to 3 credits.

PLEN 6610. Introduction to Environmental and Ecological Modeling
4 Credits (4)
The course introduces approaches to modeling environmental and ecological processes. Provides students with valuable tools for mathematical and simulation modeling of environmental systems.
Learning Outcomes
1. Familiarity with diverse modeling approaches used in ecology and environmental sciences.

2. The skills and confidence to use simulation approaches for problem-solving.
3. Familiarity in using 'R' as a tool for data analysis and simulation modeling.
4. An improved understanding and appreciation of complex environmental and ecological issues.

PLEN 6810. University Teaching Experience
1-3 Credits (1-3)
Certain graduate students will be permitted to teach up to one-third of one AGRO/HORT/SOIL/ENVS course. The student will prepare and deliver lectures and will prepare, administer, and grade at least one examination. The professor in charge of the course will attend and evaluate the student's lectures. Consent of instructor required. May be repeated up to 3 credits.

Learning Outcomes

1. Incorporate a variety of teaching and learning strategies.
2. Coach and encourage students to answer questions and solve problems.
3. Engage students in active and collaborative learning.
4. Implement appropriate assessment strategies.
5. Use technology in teaching and learning.

PLEN 6910. Doctoral Seminar
1 Credit (1)
Current research discussions presented by doctoral level graduate students. Not more than 2 credits toward the degree. May be repeated up to 2 credits.

PLEN 6920. Doctoral Proposal
1 Credit (1)
Current research proposal written by doctoral level graduate students. Not more than 1 credits toward the degree. May be repeated up to 1 credit.

PLEN 6991. Doctoral Research
1-15 Credits (1-15)
Research. May be repeated up to 88 credits.

Learning Outcomes

1. Varies

PLEN 6996. Advanced Topics
1-6 Credits (1-6)
Topics of current interest, designated by title and credit. Maximum of 6 credits per semester. No more than 9 credits toward a degree. May be repeated up to 9 credits.

PLEN 7000. Doctoral Dissertation
1-15 Credits (1-15)
Dissertation. May be repeated up to 88 credits.

Learning Outcomes

1. Varies