

# Irrigation & Drainage Engineering Design

ABE 4231C Section 0490

**Class Periods:** Monday, Wednesday, Friday, Period 6 (12:50 PM - 1:40 PM);  
Tuesday, Period 5 - 7 (11:45 AM - 2:45 PM)

**Location:** Rogers 106

**Academic Term:** Fall 2023

## Instructor:

Richard V. Scholtz, III

Rogers 107

[rscholtz@ufl.edu](mailto:rscholtz@ufl.edu)

352-294-6704 and 352-339-1751

Office Hours: Wednesday, and Friday - Period 3 and 5 (9:35 am – 12:35 pm), or by appointment. Contact via email to setup a Zoom or Teams Connection.

## Course Description

4 credits. Irrigation & drainage systems design including pump sizing & specification, water distribution systems, plant water requirement, drainage systems, & flood control. (Offered Fall).

## Course Pre-Requisites / Co-Requisites

Pre-Requisites: ABE 3212C: Land and Water Resources Engineering; Co-requisites: CWR 3201: Hydrodynamics or EGN 3353C: Fluid Mechanics

## Course Objectives

- Understand the hydrologic cycle, principles and processes necessary to effectively manage water resources through well designed drainage and irrigation systems.
- Apply appropriate techniques and analyses to the effective design of both irrigation and drainage systems.
- Design, test, and analyze agricultural irrigation and drainage systems and their components.
- Enhance communication skills, and impart a sense of professional, ethical and societal responsibility gained through knowledge and discussion of contemporary issues.

## Materials and Supply Fees

\$30.

## Relation to Program Outcomes (ABET):

This course contributes four (4) credit hours toward meeting the minimum 48 credit hours of Engineering Topics in the basic-level curriculum for the Bachelor of Science Degree in Agricultural and Biological Engineering.

| Outcome   | Coverage* |
|---|-----------|
| 1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics  | Medium    |
| 2. 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                   | Medium    |
| 3. An ability to communicate effectively with a range of audiences  | Medium    |
| 4. 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 | Medium    |

|   |      |
|---|------|
| 5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives | Low  |
| 6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions  | High |
| 7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies   | High |

\*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

### **Recommended Materials**

- Butler, D. and J.W. Davies. 2004. Urban Drainage. Taylor & Francis, Inc. New York. 568 pages.
- Fangmeier, D.D., W.J. Elliot, S.R. Workman, R.L. Huffman, and G.O. Schwab. 2006. Soil and Water Conservation Engineering, Fifth Edition. Thomson Delmar Learning. Clifton Park, NY. 552 pages.
- James, L.G. 1988. Principles of Farm Irrigation System Design. John Wiley and Sons. New York. 480 pages.
- Jensen, M.E., Editor. 1980. Design and Operation of Farm Irrigation Systems. ASAE Monograph No. 3. Amer. Soc. Agric. Engr. St. Joseph, MI. 829 pages
- Hoffman, G.J., T.A. Howell and K.H. Soloman. 1990. Management of Farm Irrigation Systems. Amer. Soc. Agric. Engr. St. Joseph, MI. 1040 pages.
- Keller, J. and R.D. Bliesner. 1990. Sprinkle and Trickle Irrigation. Van Nostrand Reinhold. New York. 652 pages.
- Nakayama, F.S. and D.A. Bucks. 1986. Trickle Irrigation for Crop Production: Design, Operation and Management. Developments in Agric. Engr. 9. Elsevier Press. New York. 383 pages.
- Pair, C.H., Editor-in-Chief. 1983. Irrigation. 5th Edition. The Irrigation Assoc. Silver Springs, MD. 686 pages..
- S. Bureau of Reclamation. 2005. Drainage Manual: A Guide to Integrating Plant, Soil, and Water Relationships for Drainage of Irrigated Lands. University Press of the Pacific. Honolulu, HI. 308 pages.

### **Course Format**

Formal lectures develop the theory and methods used in analysis and design. Example problems are presented in class. The laboratory section will be used to reinforce lecture and study materials through problem discussion, lab assignments, field trips, and guest speakers.

### **Course Outline**

#### Lecture Topics:

- Introduction and Mathematics
  - Common mathematical tools
  - Economy
- Soil-Plant-Water Relationships
  - Consumptive use and evapotranspiration
  - Nutrient and water requirements and use efficiencies
  - Water Management (scheduling)
- Natural Resources
  - Sources of water
  - Aquifers and wells
  - Water quality
  - Water quantity
  - Water law
- Hydrologic Cycle
- Determining evapotranspiration
- Determining rainfall
- Determining infiltration
- Hydraulics
  - Water measurement
  - Friction loss
  - Pipe sizing
  - Pumps
  - Pump performance
  - Pump selection
- Irrigation
  - Types of irrigation systems
  - Performance of irrigation systems
  - Uniformity of water application
  - Efficiency
  - Design standards

- General system components
- Protecting municipal water supplies
- Design criteria
- Types of sprinkler systems
- Sprinkler system components
- Sprinkler system design
- Microirrigation benefits and problems
- Micro system components and aspects
- Clogging control
- Micro system design
- Subirrigation (seepage) systems
- Seepage methods
- Seepage irrigation process
- Design of seepage irrigation systems
- Land Forming
  - Surveying and spatial data
  - Maps and GIS
  - Watersheds
  - Land grading
  - Ditch and channel cuts
  - Impoundments
- Drainage
  - Surface field ditches
  - Steady state design
  - Nonsteady state design
  - Drain tubing aspects
  - Loads on underground conduits

### **Course Schedule**

See Canvas for Scheduled Lectures, Laboratory Exercises, Discussions, and Deliverable Deadlines

### **Attendance Policy, Class Expectations, and Make-Up Policy**

Attendance is expected – Lectures will cover material from various references, so it is imperative that students make every effort to attend classes and take good notes. Students are especially encouraged to ask questions during lectures.

All deliverables will comply with the published deliverable requirements and due date specified at the time of assignment (no deliverable will be due earlier than 3 business days after assignment). **No late deliverable will be accepted**, it is incumbent of each student to make proper arrangements regarding any time-conflict (see make-up policy below).

The student is expected to manage their time efficiently and should anticipate spending three times the length of lectures studying and preparing deliverables outside the classroom. The student should focus on the following: assignments, preparing both design and laboratory reports, review of notes and lecture materials, and assigned readings.

The arrangements for make-up assignments should be made before the date in question unless there is an emergency situation. In which, reviews will be on a case by case basis. Excused absences must be consistent with university policies. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

### **Evaluation of Grades**

| Assignment   | Total Points | Percentage of Final Grade |
|--|--------------|---------------------------|
| Laboratory Reports, Design Tools and Partial Designs Projects (11) | 100-200 each | 75%                       |
| Design Project and Presentation                                    | 400          | 25%                       |
|  |              | 100%                      |

There will be between eleven total assignments. Full experimental reports are required for certain designated lab assignment (see Laboratory Report Guidelines). Design tools and partial design projects will require specific sections of the lab report. Weight of each assignment will be variable, depending on complexity and time requirement.

There will be one design project due by the end of the semester. Each student will identify a problem and design (or redesign) a tool or device that would be useful to an Engineer or operator of a water management, irrigation or

drainage system. Full design report will be required (see Design Report Guidelines). Students will supply necessary design specifications and calculations. Students will present their final projects at the end of the semester.

### **Grading Policy**

The following is given as an example only.

| <b>Percent</b> | <b>Grade</b> | <b>Grade Points</b> |
|----------------|--------------|---------------------|
| 91.0- 100      | A            | 4.00                |
| 89.0 – 90.9    | A-           | 3.67                |
| 87.0- 88.9     | B+           | 3.33                |
| 81.0 - 86.9    | B            | 3.00                |
| 79.0 – 80.9    | B-           | 2.67                |
| 77.0 - 78.9    | C+           | 2.33                |
| 71.0 – 76.9    | C            | 2.00                |
| 69.0 - 70.9    | C-           | 1.67                |
| 67.0 - 68.9    | D+           | 1.33                |
| 61.0 - 66.9    | D            | 1.00                |
| 59.0 - 60.9    | D-           | 0.67                |
| 0 - 58.9       | E            | 0.00                |

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

### **Students Requiring Accommodations**

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

### **Course Evaluation**

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

### **In-Class Recording**

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons),

including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

### ***University Honesty Policy***

Students should also strive to think and act as professionals, an idea that is embodied by the Engineering Code of Ethics. Students should extend all guests both professional and common courtesy. The instructor reserves the right to assess penalty points toward the class, or toward individuals who have chosen to disregard these guidelines.

Students will be strictly held to the University of Florida's policy on Academic Honesty. Suspected violations will result in no points awarded (failure) for the deliverable, and the offending student will be referred to the Dean of Students Office and Office of Student Judicial Affairs. Dropping or replacing the lowest grade will not be an option in these cases. All disputes regarding the suspected infraction will be handled by the Student Judicial Affairs according to Regulations of the University of Florida.

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- HWCOE Human Resources, 352-392-0904, [student-support-hr@eng.ufl.edu](mailto:student-support-hr@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***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. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

## **Campus Resources:**

### Health and Wellness

#### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

#### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

#### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

### Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Connections Center**, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

The Agricultural & Biological Engineering Department has a designated librarian to support your research needs. Amy Buhler is our liaison librarian for all things related to our profession. You are welcome to reach out and schedule an appointment [abuhler@ufl.edu](mailto:abuhler@ufl.edu). Here is a link to the library's subject guide to Agricultural & Biological Engineering: <https://guides.uflib.ufl.edu/abe>

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

**On-Line Students Complaints:** <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.