



THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE & LIFE SCIENCES
COLLEGE OF ENGINEERING

Biosystems Engineering

BE CE 455 555: Soil and Water Resources Engineering

Shantz Bldg. # 38, Room 440; Wednesdays from 3:00PM to 5:30PM

Description of Course

Introduction to soil and water relationships, water resources, irrigation systems, irrigation water supply, irrigation management, irrigation system designs, and utilizing data analytics for optimization.

Course Prerequisites or Co-requisites

Math 124, CE 218: Mechanics of Fluids.

Instructor and Contact Information

Dr. Akrum H. Tamimi, Professor of Practice; Forbes Bldg. #36, room 140;

520-621-9663; akrumt@arizona.edu

Office Hours: by appointment. Please send me an email with your availability.

D2L: <https://d2l.arizona.edu/d2l/home/1069213>

Course Format and Teaching Methods

This is a flipped class. Class will be taught in a collaborative interactive way. More details about this teaching model will be presented during first day. Most of the homework and activities will be completed in groups during class time and hence to get credit for this work you have to be present in class. Class will use Zoom in the Cloud Meetings. Activities, presentations, homework in class solutions and discussions will be recorded and posted to D2L.

Reviewing, presenting, and discussing peer reviewed papers will be expected by students. Homework that involves design and computer programming will be assigned. Programming to solve Soil-Plant-Water relationships and irrigation Engineering problems and conduct predictions using artificial intelligence tools will be learned & practiced.

Course Objectives

The course will cover

1. Basic soil physical characteristics
2. Basic water resources engineering
3. Plant-soil-water relationships
4. Infiltration
5. Transpiration and evapotranspiration
6. Irrigation scheduling and management
7. Water and irrigation water quality
8. Water distribution systems analysis
9. Surface irrigation system design
10. Pressurized irrigation system design
11. Introduce students to new ways to solving and analyzing problems using programming tools such as the R Language and Python programming tools to conduct predictions and artificial intelligence.

12. Apply data science and big data analytics to predict soil-water-plant systems and irrigation systems behavior.

Expected Learning Outcomes

At the conclusion of the course, students will be able to

1. Collect, determine, and interpret information and data related to soil, water, and environmental factors
2. Use programming and prediction tools such artificial intelligence in determining soil, water, and environmental factors
3. Utilize the engineering design process to design, analyze and provide management tools for different types of irrigation systems under different environmental conditions
4. Use programming and prediction tools such artificial intelligence to optimize irrigation system analysis and designs
5. Students registered for BE CE 556 will have the skills to design an extensive professional project or research a specific problem or theme extensively. A professional technical report will be generated out of this task.

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at:

<http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable,

<http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See:

<https://deanofstudents.arizona.edu/absences>

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Absences may affect a student's final course grade. If you anticipate being absent, are unexpectedly absent, or are unable to participate in class online activities, please contact me as soon as possible. To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu. If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057.

Makeup Policy for Students Who Register Late

If you register after the first class meeting, you can make up missed assignments/quizzes and the deadline for doing so will be determined case-by-case. Please talk to the instructor to determine those due dates.

Course Communications

Official UA e-mail address and this course D2L

Required Texts or Readings

No text is required for this class. Presentations will be posted to D2L course site on weekly basis which will cover the topics as well as the supplemental references. You are required to review and study materials

posted to D2L before coming to class. Handouts in the form of PDF files for specific topics will be provided by the instructor via D2L.

Required or Special Materials

You are expected to bring your laptop to every class meeting. Your laptop will be used for taking quizzes including a daily attendance quiz and to work on and submit your individual and group in class assignments. Laptops with Windows 10 operating systems are preferred.

Other Supplemental Materials

1. Jensen, M.E. (Ed). 1980. Design and Operation of Farm Irrigation Systems. ASAE Monograph #3. American Society of Agricultural Engineers. St. Joseph, MI. 829p
2. FAO Irrigation and Drainage Paper No. 56. Crop Water Requirements. UN-FAO, Rome, Italy. 1995.
<http://www.fao.org/docrep/X0490E/X0490E00.htm>
3. FAO Irrigation and Drainage Paper No. 66. Crop Yield Response to Water. UN-FAO, Rome, Italy, 2012,
<http://www.fao.org/docrep/016/i2800e/i2800e.pdf>
4. Technical Papers, Reports and Journal Papers will be provided throughout the semester

Assignments and Examinations: Schedule/Due Dates

1. Attendance of class in person or using Zoom Class will be through a short quiz at the beginning of each class.
2. In class group and individual homework and quizzes will be practiced daily. You are supposed to read the presentations posted on D2L for the specific day, come to class, ask questions for clarifications and then solve homework problems. There will be out of class quizzes and homework too on occasions.
3. Design Project/Literature Review:
 - a. Students registered for BE CE 456 must select a topic to perform a design, artificial intelligence, or data analytics project. Your project must be approved by Dr. Tamimi by March 11, 2021 through a proposal you submit to D2L. This must be an individual project. Groups of no more than 3 students can be approved if the project is a major one and involves multi-disciplines.
 - b. Students registered for BE CE 556 are expected to develop extensive literature review or design project. This must be approved by Dr. Tamimi and must reflect graduate status. The project has to be innovative and has to bring something new to share with the class when presented.
4. There will be a paper review on regular basis. The paper selected will be based on the week's topic. Every student is expected to review and submit a written review to D2L assignment folder. The write up should not exceed 2 pages, typed in New Times Roman Font Size 12 and 1.5-line spacing, 1-inch margin around with a footer indicating student's name, paper title and date. You should include figures and tables presented in the paper you are reviewing. The review will be submitted as a MS Word Document. A rubric is posted in D2L.
5. Each student is expected to do an in-class presentation of at least one (1) paper for at least 15 minutes. Please review at least two of the references to make sure that the author is using the conclusions of other authors correctly. Dates and papers are assigned by Dr. Tamimi for each student and a schedule is posted in D2L and is shown below.

Final Examination or Project

The date and time of the final exam are as per UA Academic calendar and is shown on the schedule shown below. Due dates for project presentation, evaluation, and report submission are per schedule shown below. Please see Final Exam Regulations, <https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information> , and Final Exam Schedule, <http://www.registrar.arizona.edu/schedules/finals.htm>

Grading Scale and Policies

Grade distribution for the course are shown in the table below. University policy regarding grades and grading systems is available at <http://catalog.arizona.edu/policy/grades-and-grading-system>

Component	% of Final Grade
Homeworks and Quizzes	30%
Selection of Semester Project and Instructor's approval	2%
Semester Project Report: Design or AI or Analytics or Literature	
Review of at least 6 papers for a defined theme	18%
Project Presentation to Class	5%
Paper Reviews - at least 15 Written Reviews & 1 Presentation	20%
Midterm Exam	15%
Final Exam	10%
Total	100%

Letter Grade	% Upper Limit	% Lower Limit
A	100	90
B	89	80
C	79	65
D	64	60
E	59	0

Incomplete (I) or Withdrawal (W):

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal>, respectively.

Dispute of Grade Policy

All grades can be disputed within 2 weeks of posting them on D2L.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations

Please visit Disability Resource Center website: <http://drc.arizona.edu/instructors/syllabus-statement>.

Scheduled Topics/Activities

Schedule of topics, homework and activities is shown below. There will be in class quizzes at the beginning of randomly selected classes that are not listed in the schedule shown below.

Class No.	Date	Topic	Homework	Paper Theme	Presenter
1	25-Aug	Introduction to Course; Water and Its Uses Soils in the Green Plant Environment & Soil-Water Relationships			
2	1-Sep	Soil-Water Relationships Infiltration	Select Paper for review and submit PDF file into D2L assignment folder Available Water and Readily Available Water		
3	8-Sep	Water-Plant-Soil-Plant Anatomy Evaporation and Evapotranspiration	Determining Infiltration Calculation of Evapotranspiration, ET	Matric Potential and soil Water Content Infiltration	Msciola Mattingly
4	15-Sep	Evapotranspiration & Crop Coefficient Data Science and ET Predictions	Determining Crop Coefficient AZMET and ANOVA, Intro to Data Science	Soil Characteristics Matric Potential and soil Water Content	Rehwooldt Truong
5	22-Sep	Irrigation Requirements & Salinity Irrigation Scheduling	Determining Q for Farm	Predicting infiltration using Artificial Intelligence	Boyd
6	29-Sep	Irrigation Scheduling Putting it all together to schedule Irrigation	When to Irrigate Irrigation Scheduling for a specific crop. Deadline for Project Selection	Drop Distribution For Sprinkler Irrigation Systems	Campbell
7	6-Oct	Public Health and Irrigation Water Quality	Determining Q for Farm considering Water Quality	Effects of water quality on irrigated crops	Breen
8	13-Oct	Water Supply & Example of Water Allocation		Relationship between Wet temperature, Relative humidity and air temperature	Moreno
9	20-Oct	Flow Through Pipes Flow Through Pipes and Head Losses	Pipe Design Head Loss Calculations	Modeling flow through pipes	Kaufmann
10	27-Oct	Pumps Pump Selection	Select pump for Irrigation Network	Determining cumulative infiltration using machine learning methods	Scott Spagnuolo
11	3-Nov	Midterm Exam Fundamentals of Irrigation System Design			
12	10-Nov	Pressurized Irrigation Systems-Submain Design Pressurized Irrigation Systems-Sprinkler Network Design	Design Submain - Lateral Design Network Sprinkler System	Modeling Infiltration	Alkhamisi
13	17-Nov	Drip Irrigation CEA Irrigation & Design	CV and Efficiency Calculations Irrigation Scheduling using solar radiation	Determining Evapotranspiration	Northfelt
14	24-Nov	Open Channel Flow; Surface Irrigation Surface Irrigation	Design Open Channel	Determining Manning n values for different surfaces	Picon Hernandez
15	1-Dec	Surface Irrigation Surface Irrigation - Cook Book Approach	Solve the Saint Venant Equation for 1-D Flow Using numerical scheme Design of Furrows	Modeling one dimensional surface Irrigation systems	Schobinger
16	8-Dec	Final Project Presentation Final Project Presentation; Recap			
17	14-Dec	Final Exam - 3:30PM to 5:30PM			

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See:

<http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at

<http://new.library.arizona.edu/research/citing/plagiarism>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.