

Irrigation Systems Management

MSYM 452/852, AGRO 452, WATS 452

Fall 2021 Syllabus

<u>Class Time:</u>	Lecture:	1:00-1:50 MW	112 Chase Hall	(Section 150)
	Lab:	2:00-3:50 M	148 Chase Hall	(Section 151)
	Lab:	2:00-3:50 W	148 Chase Hall	(Section 152)

Instructor:

Dr. Derek Heeren
Room 239 Chase Hall; 402-472-8577
Office Hours: 4:00-5:00 MW; or by appointment
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Textbook:

Eisenhauer, D. E., D. L. Martin, D. M. Heeren, and G. J. Hoffman. 2021. *Irrigation Systems Management*. ASABE: St. Joseph, Mich. Open access, available at: <https://asabe.org/ism>.

Prerequisites:

MSYM 109 Physical Principles in Agriculture (or PHYS 141, PHYS 151, PHYS 211) required;
AGRO/SOIL 153 Soil Resources recommended

Course Description:

The purpose of the course is to develop a working understanding of irrigation systems and how they are managed. The course will stress the fundamentals as well as application of current irrigation technology. The effects of irrigation on water quality and water supplies will be discussed. Improved water management for minimizing impacts on water resources and the environment will be emphasized.

Objectives: following the course, students should be able to:

1. Measure soil water content and use the information for irrigation management.
2. Measure water flow rates, calculate water application amounts, and apply data in irrigation management.
3. Calculate plant water use rates and use the information in irrigation design and management.
4. Apply various irrigation scheduling techniques.
5. Match irrigation pumps to the irrigation system and determine the appropriate size of electric motors.
6. Select, describe, and evaluate sprinkler, microirrigation, and surface irrigation systems.
7. Analyze the costs of operating an irrigation system.
8. Describe the legal and regulatory constraints to water use for irrigation.
9. Prevent backflow of contaminants from irrigation systems to the water source.
10. Define the impacts of irrigation on water resources and the environment.
11. Describe how irrigation wells operate.

Schedule:

Date	Lecture Topic	Lecture Reading	Monday Lab Topic	Wednesday Lab Topic	Comments
8-23	Introduction to Irrigation; Impact on Water Resources	Chapter 1	Lab Introduction and Team Organization		
8-25	Fundamentals: Soil Water	Chapter 2		Lab Introduction and Team Organization	Readiness Test 1 Chapter 1
8-30	Infiltration	Chapter 2	Soil Water Properties		
9-1	Measuring Water Applications	Chapter 3		Soil Water Properties	Readiness Test 2 Chapters 2 & 3
9-6	Labor Day – No Class		No Lab		
9-8	Plant Water Use	Chapter 4		Water Flow Measurement	
9-13	ET Calculations	Chapter 4	Water Flow Measurement		Readiness Test 3 Chapter 4
9-15	Managing the Soil Water Reservoir: Irrigation System Performance	Chapter 5		Computation of Crop ET	
9-20	System Evaluations	Chapter 5	Computation of Crop ET		Readiness Test 4 Chapter 5
9-22	Irrigation Efficiency and Water Resources Sustainability	Chapter 5		Irrigation System Evaluation and Tour, ENREC	Outdoor Lab Return to Lincoln around 6:00-6:30
9-27	Irrigation Scheduling	Chapter 6	Irrigation System Evaluation and Tour, ENREC		Outdoor Lab Return to Lincoln around 6:00-6:30
9-29	Exam 1			No Lab	Exam 1 Chapters 1-5
10-4	Irrigation Scheduling	Chapter 6	Irrigation Scheduling		
10-6	Salinity Management	Chapter 7		Irrigation Scheduling	Readiness Test 5 Chapters 6 & 7
10-11	Irrigation Systems: Pipeline Hydraulics	Chapter 8	Pipeline Hydraulics		
10-13	Pipeline Hydraulics	Chapter 8		Pipeline Hydraulics	Readiness Test 6 Chapter 8
10-18	Fall Break		No Lab		

Date	Lecture Topic	Lecture Reading	Monday Lab Topic	Wednesday Lab Topic	Comments
10-20	Pump Hydraulics	Chapter 8		Pumps	
10-25	Water Supply Systems; Aquifers and Wells	Chapter 9	Pumps		
10-27	Surface Irrigation	Chapter 10		Furrow Irrigation	Readiness Test 7 Chapters 9 & 10
11-1	Microirrigation	Chapter 14	Furrow Irrigation		
11-3	Sprinklers; Solid Set Irrigation	Chapter 11		Drip and Sprinkler Evaluation	
11-8	Exam 2		Drip and Sprinkler Evaluation		Exam 2 Chapters 6-10
11-10	Moved-Lateral Sprinkler Systems	Chapter 12		Side Roll and Solid Set Irrigation	
11-15	Center Pivots and Lateral Moves	Chapter 13	Side Roll and Solid Set Irrigation		Readiness Test 8 Chapters 11 & 12
11-17	Center Pivots and Lateral Moves	Chapter 13		Center Pivot Sprinkler Systems	
11-22	Canopy Thresholds for Irrigation Scheduling	Chapter 6	Center Pivot Sprinkler Systems		Readiness Test 9 Chapter 13
11-24	Thanksgiving Break			No Lab	
11-29	Variable Rate Irrigation	Chapters 6 and 13	Variable Rate Irrigation		
12-1	Water Policy	Chapter 9		Variable Rate Irrigation	
12-6	Chemigation	Chapter 15	Chemigation and Backflow Prevention		Readiness Test 10 Chapter 15
12-8	Environmental and Resource Management Considerations			Chemigation and Backflow Prevention	
12-13 (Mon)	Exam 3 1:00-2:50 p.m., CHA 112	Exam 3: Chapters 11-15			

Teams:

We will apply a team-based learning approach in this course. Students will be expected to make a significant contribution to the success of their team, and this will be included in the course grade calculation. Your participation is important.

Grading and Attendance:

In general, the following grading system will apply:

	<u>Percent of Grade</u>	<u>Letter Grade</u>	<u>Weighted Course Score</u>	<u>UNL Points</u>
Individual Performance		A+	97-100%	4.0
Readiness Tests (10)	15	A	93-97	4.0
Examinations (3)	35	A-	90-93	3.67
		B+	87-90	3.33
		B	83-87	3.0
Team Performance		B-	80-83	2.67
Contribution to Team (evaluated by peers)	10	C+	77-80	2.33
		C	73-77	2.0
		C-	70-73	1.67
Mixed Scores		D+	67-70	1.33
Lab Reports and Homework (approximately ½ team & ½ individual)	40	D	63-67	1.0
		D-	60-63	0.67
		F	<60	0

Three (one-hour) examinations and 10 readiness tests will be given during the course. The lowest individual readiness test score will be dropped for each student; this is primarily designed for excused absences so that a missed readiness test does not need to be made up. Missed examinations and laboratories must be cleared with the instructor ahead of time, and the make-up exam will be administered after the scheduled exam. For the open-book section of the exams, students may use a hard or soft copy of the textbook, notes, Canvas, Excel, etc.; however, the device must not be used to communicate with other people during the exam. Phones should not be used during lectures and only sparingly during labs.

Lab reports (which include the homework problems) will be due at the beginning of class; the grade will be reduced 10 percentage points each school day it is late. No credit will be given on homework that is handed in after the homework set has been graded and returned to the other students. A student will receive a zero for a lab grade if an individual lab report is not submitted. All work should be well organized and neat. Spelling and grammar will be considered in grading reports.

You can access course files and check your current grades on Canvas: <http://my.unl.edu>. Students are responsible for the material presented in lecture or laboratory periods. This course will adhere to UNL's attendance policy (http://stuafs.unl.edu/sa_policies_absences.shtml). It is your responsibility to acquire lecture notes, handouts or exercises for missed class periods.

Academic Dishonesty:

Students are expected to adhere to guidelines concerning academic dishonesty outlined in Section 4.2 of the University's Student Code of Conduct (<http://stuafs.unl.edu/dos/code>). The BSE Department process for grade and academic dishonesty appeals can be found at <http://engineering.unl.edu/bse/bse-academic-resources/>. Students are encouraged to contact the instructor for clarification of these guidelines if they have questions or concerns.

15th Week:

There will be two lab reports due during the 15th week.

Important Dates:

August 30 Last day for registration
September 3 Last day to drop and remove course from student's record
November 12 Last day to drop course. Withdrawals between September 3 and November 12 result in a "W" on the student's record.

Students with Special Needs:

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 232 Canfield Administration, 402-472-3787 voice or TTY, <http://www.unl.edu/ssd/home>.

Emergency Response:

- **Fire Alarm (or other evacuation):** In the event of a fire alarm, gather belongings (purse, keys, cellphone, N-Card, etc.) and use the nearest exit to leave the building. Do not use the elevators. After exiting notify emergency personnel of the location of persons unable to exit the building. Do not return to building unless told to do so by emergency personnel.
- **Tornado Warning:** When sirens sound, move to the lowest interior area of building or designated shelter. Stay away from windows and stay near an inside wall when possible.
- **Active Shooter:**
 - **Evacuate:** if there is a safe escape path, leave belongings behind, keep hands visible and follow police officer instructions.
 - **Hide out:** If evacuation is impossible, secure yourself in your space by turning out lights, closing blinds and barricading doors if possible.
 - **Take action:** As a last resort, and only when your life is in imminent danger, attempt to disrupt and/or incapacitate the active shooter. Fight as if your life depends on it.
- **UNL Alert:** Notifications about serious incidents on campus are sent via text message, email, the unl.edu website, and social media. For more information go to: <https://emergency.unl.edu/unlalert>.
- Additional Emergency Procedures can be found here: <http://emergency.unl.edu/procedure/emergency>

COVID-19:

During class laboratory activities, students in this course must work in close physical proximity to one another for extended periods of time in order to achieve the academic goals of the course. For this reason, the Department of Biological Systems Engineering and the College of Agricultural Sciences and Natural Resources have determined that face coverings will be required during the laboratory activities. If you are unwilling to comply with this requirement, please visit with your advisor about possible alternative courses that you might take in lieu of this one. More information can be found here: <https://covid19.unl.edu/>.