


<b>College of Engineering</b> <b>Department of Civil Engineering</b>		
<b>CE 503 Drainage Engineering</b>		
<b>Credit and Contact hours</b>	3 / 3 (Lectures), 0 (Tutorials), 0 (Laboratory)	
<b>Required, or Elective</b>	Elective	
<b>Course Description</b>	Introduction to land drainage, Water logging problem, quality of irrigation water, reclamation of salt and alkali soils, different layout of surface drainage system, sub-surface drainage, unsteady flow to drains, design of pipe/ tile drainage system, and materials for pipe drainage system.	
<b>Prerequisites or Co-requisites</b>	None	
<b>Course Learning Outcomes</b>	Students completing this course successfully will be able to:	
	<b>Course Learning Outcomes (CLOs)</b>	<b>Related Student Outcomes (SO)</b>
	<b>CLO1.</b> Recognize the principles of drainage engineering to assess the need for drainage systems in agricultural fields. K1	<b>SO1</b>
	<b>CLO2.</b> Identify and explain different types of drainage systems for agricultural land. K1	<b>SO1</b>
	<b>CLO3.</b> Implement problem-solving skills to diagnose and address issues related to drainage systems, considering crop productivity, waterlogging, and soil salinity. S1	<b>SO2</b>
	<b>CLO4.</b> Perform and demonstrate different types of drainage systems commonly used and apply the effective one as a case study. V2	<b>SO7</b>
<b>Student Outcomes related to this Course</b>	SO 1 Recognize advanced engineering knowledge, concepts, and techniques to identify, interpret, and analyze complex and real-life engineering problems. SO 2 Provide solutions for complex and real-life engineering problems through critical thinking and the use of modern engineering tools, and identify their impact on social, global, cultural, environmental, safety, and economic factors. SO 7 Effectively manage, individually or in groups, specialized tasks and activities in coursework, projects, assignments, and research work with a high level of autonomy and responsibility.	

<b>Topics Covered</b>	<b>List of Topics</b>	<b>Related CLOs</b>
	1. Introduction to land drainage, Water logging problem, causes of water logging	<b>CLO1, CLO2, CLO3</b>
	2. Water and salt stress coefficient, Salt balance of irrigated land	<b>CLO3</b>
	3. Quality of Irrigation water, Reclamation of salt and alkali soils	<b>CLO2, CLO3</b>
	4. Introduction to surface drainage system, Different layout of surface drainage system, Drainage coefficient	<b>CLO1, CLO2, CLO4</b>
	5. Introduction to sub-surface drainage	<b>CLO2</b>
	6. Design of subsurface drainage systems: Dupuit's assumptions, Hooghoudt's Equation, and Earnst's equation	<b>CLO1, CLO3</b>
	7. Unsteady flow to drains	<b>CLO1, CLO3, CLO4</b>
	8. Design of pipe/ tile drainage system	<b>CLO4</b>
	9. Materials for pipe drainage system	<b>CLO2, CLO4</b>
<b>Textbook(s) and Other Required Material</b>	<ul style="list-style-type: none"> <li>• Bhattacharya AK and Michael AM. 2013. Land Drainage, Principles, Methods and Applications. Vikas Publication House, Noida (UP)</li> <li>• Ritzema H.P.1994 Drainage Principles and Applications, ILRI Publication</li> </ul>	
<b>Grading System</b>	Quizzes	5%
	Lecture Attendance	5%
	Project work	30%
	Mid-term exam	20 %
	Final Exam	40 %
<b>Instructors</b>	Dr. Saleh Alhazloul	
<b>Date of Review</b>	March, 2025	