

COURSE OUTLINE

CIVE 516: Water Control and Measurement

Credits: 3

Term(s) to be offered: Spring

Prerequisite: None

Course description: Flow regulation and measurement in gravity flow irrigation systems for efficient and equitable water distribution among users.

Instructor: Ramchand Oad, 202 Glover: 491-7682

Text: Course Handouts available on the class website
Channel Systems. American Society of Agricultural Engineers.

- Reference Texts:**
1. Henderson, F.M (1966). Open Channel Flow.
 2. Hanif Chaudhry (1993). Open-Channel Flow.
 3. Bos, Replogle and Clemmens (1991). Flow Measuring Flumes for Open Channel Systems: American Society of Agricultural Engineers

Course Objectives: The main objective is to learn engineering fundamentals of water control and its application in flow regulation and measurement, in gravity flow open-channel systems. Specifically, students will learn how water is controlled in irrigation systems, for the purpose of enhancing farmers' capacity to satisfy crop water requirements. For fair and equitable water distribution among users, we need institutional rules and appropriate technology. The primary focus of this course is the use of appropriate technology; that is, proper selection, design and operation of hydraulic control structures that are used to monitor and regulate water in gravity flow systems.

Upon completion of this course, the student should be able to:

- Describe the approaches for regulation and measurement of flow in irrigation systems
- Describe the process for selecting the most appropriate technology for flow regulation and control
- Describe the types of institutional rules required for effective irrigation water management.

Course Topics/Weekly Schedule:

Week Topic

Unit I: Water control in Irrigation Systems

1. Introduction, background and context, Define water control in irrigated agriculture, Social and physical aspects of water control, Physical infrastructure, planning and selection of control structures.
2. Hydraulics of water control, Concept of hydraulic control in open channel flow, How to obtain the condition of hydraulic control, Location of hydraulic control,
3. Physical forms for establishing hydraulic control condition, Hydraulic control relationships.
4. Applications of hydraulic control, Flow regulation: controlling flow discharge and water levels, Measurement of flow discharge.

Unit II: Flow Regulation in Irrigation Systems

5. Types of hydraulic control for flow regulation, Weir flow: upstream control,
6. Orifice flow: free flowing orifice (upstream control), submerged orifice (both upstream and downstream control)
7. Regulation of flow discharge, Intake and turnout structures
8. Water distribution structures,
9. Regulation of flow level, Check structures, Drop structures

Unit III: Flow Measurement in Irrigation Systems

10. Types of hydraulic control for flow measurement, planning and selection
11. Weirs for discharge measurement, Sharp-crested and broad-crested weirs,
12. Control relationships, Design and installation, Management implications
13. Orifices for discharge measurement, Basic orifice: free flow and submerged flow operation, Gated orifice or the sluice gate,
14. Control relationships, design and installation, Management implications.
15. Flumes for discharge measurement, Types: long-throated, zero-throated and Parshall, Control relationships, design and installation, management implications.

Instructional Methodology: Three lectures per week.

Mode of Delivery: Traditional lectures in class and via the course website for distance students.

Methods of Evaluation: The course grade will be based on the following distribution:

Homework	25%
Two Exams	50%
<u>Final Exam</u>	<u>25%</u>
Total	100%