

Spring 2015

## **CIVE 516: Water Control and Measurement**

CRN: 12150; Online/Distance Learning 801-CRN 24187

### **Instructor**

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Office hours: MW 9-11am.

**Class Meeting Time: MWF: 11.00-11.50 am in Room B2 Engineering Bldg.**

### **Brief Description**

The main objective is to learn fundamentals of hydraulic control concept in open channels, and its application to regulate and measure flow in open-channel water delivery systems. Specifically, students will learn how flow discharge and water level is controlled in open channel systems, starting from a certain source (storage reservoir or diversion from a river) to its point of use (e.g: farm lands in case of irrigation systems). For fair and equitable water distribution among users, we need institutional rules and appropriate hydraulic control structures. Primary focus of this course is the hydraulic design of water control structures that can be used to support a given set of institutional policies and rules. The hydraulic principles are applicable to all canal systems, but the emphasis of this course is on canal systems used for irrigation water delivery and distribution.

**Textbook:** Notes prepared by the instructor. The class text, comprising chapter 1-4, can be accessed through the Canvas webpage.

### **Reference Books**

1. A.J.Clemmens, et.al. Water Measurements with Flumes and Weirs. ILRI Publication 58. Any standard text book on open channel flow, including:
2. Jain, Subhash (2001). Open-Channel Flow
3. Hanif Chaudhry (1993). Open-Channel Flow
4. Henderson, F.M (1966). Open Channel Flow

### **Student Performance and Grading**

Homework assignments, participation in class and field trips: 40%

Midterm and final exams: 60 %

## **CIVE 516: COURSE CONTENT**

### **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, selection and use 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
  - Physical forms for establishing hydraulic control condition
  - Hydraulic control relationships.
3. Applications of hydraulic control
  - Flow regulation: controlling flow discharge and water levels
  - Measurement of flow discharge.

### **Unit II: Flow Regulation in Irrigation Systems**

1. Types of hydraulic control for flow regulation
  - Weir flow: upstream control
  - Orifice flow: free flowing orifice (upstream control), submerged orifice (both upstream and downstream control)
2. Regulation of flow discharge
  - Intake and turnout structures
  - Water distribution structures
3. Regulation of flow level
  - Check structures
  - Drop structures
4. Irrigation System Modernizations
  - Remote control and automation
  - Telemetry
  - Contemporary control gates: Rubicon and Langeman Gates

### **Unit III: Flow Measurement in Irrigation Systems**

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