Spring 2019

CE 620-852: Open Channel Flow

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Department of Civil and Environmental Engineering
Course Description and Outline

CE 620 – Open Channel Flow **Spring 2019**
Section: 852 **Steven C. Flormann, P.E., CFM**

Prerequisites: Undergraduate courses in fluid mechanics or permission of instructor.

Course Objective: The analysis and design of open channels have significant influence on how engineering projects are planned, permitted, designed, and constructed as well as how emergency services respond to natural disasters. This course examines the theory behind and the practical applications of open channel flow analyses and design calculations. In addition, the course will introduce scour analysis procedures and also discuss the application of the U.S. Army Corps of Engineers HEC-RAS software.

Course Texts:

Required:

Henderson, F.M., Open Channel Flow, Prentice-Hall Inc., Upper Saddle River, 1966 ISBN 0-02-353510-5 **(The NJIT Bookstore does not stock books for Online Classes)**

U.S. Army Corps of Engineers, HEC-RAS Version 5.0.6 Hydraulic Reference and User Manual (Included with free HEC-RAS software download at http://www.hec.usace.army.mil/software/hec-ras/downloads.aspx)

Supplemental:

U.S Department of Transportation Federal Highway Administration, Evaluating Scour at Bridges Hydraulic Engineering Circular No. 18 (HEC-18), Fifth Edition, April 2012 http://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif12003.pdf

U.S Department of Transportation Federal Highway Administration, Urban Drainage Design Manual Hydraulic Engineering Circular No. 22 (HEC-22), Third Edition, Sept. 2009 http://www.fhwa.dot.gov/engineering/hydraulics/pubs/10009/10009.pdf

Course Format: Homework assignments will be given throughout the course. A project utilizing HEC-RAS will be assigned.

***Honor Code:** Students are advised that the NJIT Honor Code will be upheld in this course, and any violations will be brought to the immediate attention of the Dean of Students.

Course Grading Basis: Homework assignments = 15%, Midterm Exam = 30%, Final Exam = 30%, Class Participation = 10%, Project = 15%

Instructor Contact: Phone: (862) 200-9052; scf3@njit.edu. Office Hours: by appointment.

Course Syllabus: *Please see following page.* Students will be consulted on any substantial changes to the course syllabus. Changes will be discussed and announced in advance.

Course Outline: CE 620

Week	*Date*	*Lecture Topic*	*Assigned Reading*	*Assignment*
1	1/22	**Review:** Role of Open Channel Flow in Engineering Introduction Energy: Basics, Transitions, Critical Flow	Chapter 1 Chapter 2	--
2	1/28	Energy: Sub & Super-Critical Flow, Rectangular Channels, Non-Rectangular Channels,	Chapter 2	HW 1
3	2/4	Momentum Principle: Hydraulic Jumps, Rectangular Channel Momentum Function, Momentum vs. Depth (M-y), Non-Rectangular Sections	Chapter 3	--
4	2/11	Flow Resistance: Resistance Equation, Uniform Flow, Non-Uniform Flow, Longitudinal Profiles (Backwater Curves Part 1), Interaction of Local Features and Profiles	Chapter 4	HW 2
5	2/18	Flow Resistance-Non-Uniform Flow: Uniform Channels: Step Method, Direct Integration Method Non-Uniform Channels: Step-, Ezra-, Grimm-, Escoffier Methods	Chapter 5	--
6	2/25	Backwater Curves Part 2 and Channel Controls: Weirs and Spillways, Free Overfalls, Underflow (Sluice) Gates, Critical Depth Meters, Energy Dissipaters		HW 3
7	3/4	Channel Controls Part 2 and Mid Term Review	Chapter 6	--
8	3/11	**Midterm Exam**		--
9	3/18	**Spring Break** (No Class)		--
10	3/25	Transitions: Expansion and Contraction, Direction Changes, Culverts, Bridge Piers, Lateral Flows	Chapter 7	HW 4
11	4/1	HEC-RAS Part 1: File Structure, Basic Data Requirements, Cross Sections, Flow Data, Bridges/Culverts/Weirs	HEC-RAS User Manual Chapters 1, 3, 5, 6	--
12	4/8	HEC-RAS Part 2: Advanced Geometric Options, Computer Lab. Assignment of Project.	HEC-RAS User Manual Chapters 6 & 7	HW 5
13	4/25	Unsteady Flow: Equation of Motion, Method of Characteristics, Positive and Negative Waves, Surge Formation, Dam-Breach, Oscillatory Waves	Chapter 8	--
14	4/22	Sediment Transport: Modes of Motion and Bed Formation, Threshold for Movement, Suspended Loads, Bed-Load Formulas and Entrainment, Stable Channel, Natural River	Chapter 10	--
15	4/29	Bridge Scour and Final Exam Review		--
16	5/6	**Final Exam Period**		--