

**Department of Civil Engineering  
Hydraulic Engineering CE 3456  
TR 10:30 am-11:50 am CCSB 1.0202  
CRN 13254  
Laboratory  
T 1:30 pm-4:20 pm and R 1:30 pm-4:20 pm**

**Teaching Assistant**

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**Instructor Contact Information and Biography**

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**Note:** You can reach me by phone but the best way is by email. I will repond to your emails within 24 business hours. I will send you updates and class announcements through **Blackboard**.

I grew up in Guayanilla ([http://en.wikipedia.org/wiki/Guayanilla,\\_Puerto\\_Rico](http://en.wikipedia.org/wiki/Guayanilla,_Puerto_Rico)), a municipality of Puerto Rico, located on the southern coast of the island, bordering the Caribbean Sea, south of Adjuntas, east of Yauco; and west of Peñuelas and about 12 miles (20 km) west of Ponce, the 2nd largest city of Puerto



Rico. ([http://en.wikipedia.org/wiki/Ponce,\\_Puerto\\_Rico](http://en.wikipedia.org/wiki/Ponce,_Puerto_Rico)) (population <200,000).

I have a Bachelor's degree in Civil Engineering from the University of Puerto Rico at Mayaguez (UPRM), a Master's degree in Environmental Systems Engineering from Clemson University, and a Ph.D. in Civil Engineering, Specialized in Environmental Engineering, from New Mexico State University. In Puerto Rico, I was a professor in Civil Engineering at UPRM and worked in research (EPA, DOD, NSF) dealing with removal of contaminants from water using natural adsorbents, remote telemetry systems for monitoring of a small community drinking water treatment plant, physical modeling of transport of explosive related chemicals in sub-surface environments, and odor problems of combined sewer-overflows. I worked as consultant to the Comptroller of Puerto Rico as an auditor of the 10 largest water and wastewater treatment plants in Puerto Rico. I was part of the Puerto Rico Environmental Quality Board (PREQB) and Director of the Water Quality Area in the PREQB.

There is not enough space in this syllabus to explain why I left "paradise" for El Paso, but my family ended up here in 2006. Since August 2009, I have been at UTEP. I have taught courses in Environmental Engineering, Engineering Economy, Engineering Statics, Water and Wastewater Engineering, Capstone Senior Design Courses (I and II), Thermo-fluids, and Experimental Design. I can say I really have come to love UTEP and our students. I have found hard-working students that truly want to build a better future for themselves and their families.

### Course Description

Hydraulics is a broad area with many sub disciplines. This class will focus on fundamental hydraulic principles as illustrated through laboratory experiments. Rather than attempting to cover the entire field, we will focus in detail surface water hydrology, groundwater hydrology, open channel flow, and flow in pipes. Hydraulics is very much a laboratory oriented course and cannot be properly learned in the absence of a laboratory. Laboratory exercises are featured prominently in the class and grading.

Mastery of fundamental concepts will facilitate the student in learning more detailed hydraulics applications throughout his/her career. Although computer codes are frequently used in engineering practice to perform many of the calculations we will cover, the computer codes change with time whereas the fundamental principles upon which the codes are based do not change. The class will focus on fundamentals rather than cook book solutions.

Students are responsible for familiarity with all assigned reading. Quantitative problems on tests will be limited to problems similar to homework problems and problems solved in class. Conceptual and fact questions will be drawn from reading, presentations, and online assignments.

Class format will consist of a combination of brief lectures, presentation of auxiliary materials (e.g., subject matter videos), class exercises, and solution of homework problems. It is assumed that the student has read the textbook chapter and attempted all homework prior to the class period where it is assigned. Unless specifically requested homework does not have to be turned in but may be the subject of quizzes.

### A few things I want to share about this class

#### Have you ever wondered?

- How a toilet works?
- How to select a pump?
- How to select the material and diameter of a pipe?
- What is a hydraulic jump?
- How to design a retention pond?
- How to design a culvert?

These are some of the questions that this course will help you answer!

#### Why is this course so Important that it is required for all Civil Engineering Students?

This course will provide an understanding of fundamental aspects of hydraulic systems, a fundamental task for Civil Engineers. You will need to understand how transport, store, and regulate water on surface and subsurface environments..Can you think of any other reasons why this is such an important course?

### Learning Goals

Keep in mind these Learning Goals as you prepare to study for the class exams!

#### Water forces

1. Momentum changes on pipes
2. Buoyancy
3. Surface tension/ capillary rise
4. Review of viscosity and shear stress

#### Pipe Flow

1. Set up the energy equation and solve it for unknown variables
2. Understand fundamentals of laminar and turbulent flow
3. Estimate friction losses
4. Understand energy and hydraulic grade lines
5. Basic concepts of pump behavior

**Open Channel Flow**

1. Estimate flows using Manning Equation
2. Shear stress limits on channel design
3. Froude number and specific energy relationships
4. Hydraulic jump prediction
5. Flow measurement

**Ground Water**

1. Darcy's Law
2. Energy relationships in groundwater flow
3. Flow patterns in different groundwater systems
4. Finite difference solution of groundwater flow equations
5. Water balance
6. Contaminant transport
7. Qualitative concepts of unsaturated flow
8. Simplified flow and transport analysis

**Surface Water**

1. Hydrologic cycle
2. Methods for estimating peak discharge
3. Return periods and statistics
4. Intensity, Duration, Frequency Curves
5. Hydraulic Design methods

**Course Resources**

**Required text:** Robert J. Houghtalen, A. Osman Akan and Ned H. C. Hwang, Fundamentals of Hydraulic Engineering Systems (4th Edition) ISBN: 9780136016380

**Required software:** Bentley Software (free for CE students)

**Required manual (download from internet):** TxDOT Hydraulic Design Manual

**Blackboard:** Research papers and other materials not covered in the textbook will be posted on the Blackboard course site.

**EDPuzzle:** Please join 'CE3456-Hydraulic Engineering- fall 2015' classroom on <https://EDpuzzle.com> . Sign in to your account and introduce the following code: eEKWp0

**Attendance and quiz tool:** We will use Socrates to keep attendance as well as in-class quick quizzes. So make sure you sign in Socrates at the beginning of each class. Procedure:

- 1) Go to <http://at.utep.socrates2>
- 2) Login with your UTEP credentials
- 3) Scroll down to course titled Hydraulics
- 4) Sign on course by typing password: **Boricua** (it is case sensitive).

**Class YouTube Channel:** For your convenience and in case Blackboard is down, all videos that I upload onto Blackboard will also be available on the Class You Tube. Follow the following: [CE 3456-Fall 2015](https://www.youtube.com/channel/UC7FjEWieSmXqwHfE9gxs5ZA) or <https://www.youtube.com/channel/UC7FjEWieSmXqwHfE9gxs5ZA>

**ABCD card:** Low-tech in class response system for just-in-time teaching. You will be given one copy. If you lose it, you need to reprint it

### Approved calculators:

NCEES has approved the following list of calculators for use in the April and October 2013 exam administrations:

**Casio:** All fx-115 models. Any Casio calculator must contain fx-115 in its model name. Examples of acceptable Casio fx-115 models include but are not limited to the following:

- fx-115 MS
- fx-115 MS Plus
- fx-115 MS SR
- fx-115 ES
- fx-115 ES Plus

**Hewlett Packard:** The HP 33s and HP 35s models, but no others.

**Texas Instruments:** All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name. Examples of acceptable TI-30X and TI-36X models include but are not limited to the following:

- TI-30Xa
- TI-30Xa SOLAR
- TI-30Xa SE
- TI-30XS Multiview
- TI-30X IIB
- TI-30X IIS
- TI-36X II
- TI-36X SOLAR
- TI-36X Pro

### Class format

**Flipped classes:** We will often have flipped classes (especially when I am away on UTEP-related travel). That means that you need to study ahead of time the material and complete the on-line homeworks before the class, so that during the class we will discuss problems of have in-class homeworks. On-line homeworks will be announced on Blackboard and it can be an on-line quiz or a quiz using Edpuzzle.com.

**Team Based Learning:** Team-based learning (TBL) is a structured form of small-group learning that emphasizes student preparation out of class and application of knowledge in class. Students will be organized into diverse teams of 5-7 students that work together throughout the class. Before each unit or module of the course, students prepare by reading prior to class.

### Grade Components

**Ticket to Class (TTC) Homeworks:** TTC homeworks are to be completed before the class. For on-line TTC homeworks they must be completed before the class starts. No make-up or no late homeworks will be accepted. TTC homeworks submitted on paper, need to be turned in at the beginning of the class as soon as you come in. No homeworks will be accepted at the end of the class.

**Regular homeworks:** Most homeworks will be submitted on-line using Blackboard. Some homeworks will be submitted on paper during the scheduled class period to receive full credit. Excluding TTC, homework must be submitted in class on the due date to be considered on-time. If a homework is submitted late on the same day before COB, no points will be taken off except for TTC homeworks. Homeworks turned in on the following class will have 25% of the points taken off. No homeworks will be accepted after that. You need to make sure

that you check Blackboard for homework announcements and deadlines. Generally, you will receive an e-mail with the announcement. If you have a smart phone, make sure you receive your UTEP e-mails on your phone so you have real-time announcements.

**RATs:** A RAT or a Rapid Assessment Test is an individual short-answer or multiple choice quiz given at the beginning of class. Usually a RAT will be followed by an group IF-AT (Immediate Feedback assessment test) or a group assessment quiz.

**Partial exams:** Two partial exams will be given. You must take the exams during the scheduled exam periods. These dates are announced on the first day of class although the dates may be changed according to the progress of the class. Do NOT make other plans on these days. Do NOT schedule airline flights on these days. You will NOT be excused. If you are not present for the exam, you will receive a grade of zero. **No Make-up exam will be given under any circumstance (excused or unexcused).** Final exam grade will count for missing or lowest partial exam grade.

**Final Exam:** The final exam is a **closed book-closed note** comprehensive exam. Every student is required to take the final exam at the end of the semester and pass it with at least a grade of 50%, otherwise you get an F in the course.

**Attendance:** University policy dictates that all students attend all scheduled classes. Attendance can be checked randomly, and not necessarily in every class, by the instructor through sign-up sheets, exams, roll calling, randomly picked names for problem solving in class, or other mechanisms. We will be using a beta version of UTEP's Socrates. **YOU AND ONLY YOU ARE RESPONSIBLE FOR SIGNING ATTENDANCE SHEETS, WHEN PASSED AROUND THE CLASS or SOCRATES.** You need to be present at the moment of the roll call, otherwise it will be considered an absence. Additionally, all exams, and quizzes may be given at the beginning or end of the classes. No additional time nor make up quizzes will be given to late attendees or early leavers.

**Grade Distribution:**

Description	Content	Percent of Final Grade
Homework, quizzes, class, and team participation	Sections covered during the week. You may have either a homework, a quiz, team-work, or all in any given week.	20%
*Attendance	If you have more than 3 unexcused absences, you may get an F in the class.	
2 Partial Exams	Refer to Exam Schedule	40%
Laboratory	Laboratory exercises or attendance to field trips	15%
<b>Final Exam Thursday, Dec 10th 10:00 am–12:45 pm</b>	Comprehensive	<b>25% but need to get 50% to pass the course, otherwise you get an F in the course</b>

**Grading Scheme:** The instructor reserves the right to revise this grading plan. However, students will be informed of any changes. Your final grade will be calculated based on the points you have accumulated as follows:

- A >89.5
- B >79.5 but <89.5
- C >69.5 but <79.5
- D >59.5 but <69.5
- F <59.5

**Note that 89.44 is B, 79.44 is C, 69.44 is D, 59.44 is F. This is where your bonus points come to your rescue!**

**A NOTE ON CLAIMS:** You have **two weeks after the due date to stop by my office in cases of claims in points** for homeworks (TTC, Blackboard Homeworks, IF-ATs, etc.). Also, you only have **two weeks after I return your graded exams** to do this. The end of the semester is too late to come to my office to “fish” for extra points in homeworks or exams.

### **Class Policies**

**Purpose:** These policies serve to help make the learning experience optimally effective and enjoyable for everyone.

**Professional conduct:** During this course, I expect you to deal with your peers and with me in a professional manner. Be courteous and honest and always communicate with each other in a way that shows respect and sensitivity to cultural, religious, sexual, and other individual differences. I expect you to come to class on time and stay focused on the lecture and learning activities.

**Cell Phones ringtones are OFF in Class:** First, professionals turn off their phones in a meeting with other professionals in order to give full attention to the discussion. Second, a ringing phone disrupts because the sound of a phone attracts attention. Disruptions of the learning process are annoying. Your meeting time in class is valuable, chat and text with your friends outside of your team meeting..

**Use of Laptops:** I do not mind you using your laptop in class, except when it disrupts the learning process. If you do not have a smart phone, you will need to bring a laptop to class. I will not accept surfing the internet on topics not related to your class activities, or answering your email, instant messaging, chatting, video viewing, music playing, game playing, etc. These activities show a lack of respect for your classmates and myself, and also shows a disinterest in the course which is un-professional and un-acceptable. If you do, you will no longer be allowed to use your laptop in class. A few suggestions that will help the use of laptops in class:

1. Charge your laptop batteries fully before coming to class.
2. Set your laptop volume control to mute or off before coming to class.
3. Keep your laptop closed during presentations and other specific in-class activities.

**Be a premeditated learner!** Learning does not come from just listening, taking notes, and studying the night before the exam. Understand how you learn best and continuously improve on it. Make connections between the material covered in class and the world around you so you can make of this class not just a lecture but a life-learning experience.

**Cheating, Plagiarism, Scholastic Dishonesty, and Student Discipline:** Cheating is unethical and not acceptable. Plagiarism is using information or original wording in a paper without giving credit to the source of that information or wording: it is also not acceptable. Do not submit work under your name that you did not do yourself, ever. You may not submit work for this class that you did for another class. If you cheated or plagiarized, you will be subject to disciplinary action as stated in the UTEP undergraduate catalog policy.

*“Scholastic dishonesty (which includes the attempt of any student to present the work of another as his or her own, or any work which s(he) has not honestly performed, or attempting to pass any examination by improper means) is a serious offense and will subject the student to disciplinary action. The aiding and abetting of a student in any dishonesty is held to be an equally serious offense. All alleged acts of scholastic dishonesty should be reported to the Dean of Students for disposition. It is the Dean of Students’ responsibility to investigate each allegation, dismiss the allegation, or proceed with disciplinary action in a manner which provides the accused student his or her rights of due process.”*

Refer to <http://www.utep.edu/dos/acadintg.htm> for further information.

You must cite, reference, or quote information obtained from other sources so you give credit where credit is due. If you do not know how to do that, ask. In addition, when an assignment specifies that you must perform a task individually, asking for your classmates’ help is scholastic dishonesty. Do NOT copy any material, regardless of where you obtained it, into your own work. Do NOT submit work under your name if you did not

complete it entirely yourself; be honest and tell me you did it together. The consequences will be less severe when you are up front about it than when you try to hide it.

UTEP now has a site license for Turnitin.com, a plagiarism detection tool that you can also use to check your own work for this or other classes to prevent getting in trouble. I will report any instances of plagiarism and dishonesty to the Dean of Students Office and the grade for the assignment will be an "F" or "zero".

If you want to test your understanding of plagiarism, take the self-assessment at <http://education.indiana.edu/~frick/plagiarism> or visit <http://www.turnitin.com>

### **Students with Any Type of Disability:**

UTEP seeks to provide reasonable accommodations for all qualified individuals with disabilities, including learning disabilities. This university will adhere to all applicable federal, state, and local laws, regulations and guidelines with respect to providing reasonable accommodations as required affording equal educational opportunity. It is the student's responsibility to register with Center for Accommodation and Support Services (CASS) in the East Union Bldg., Room 106 within the first two weeks of classes, and inform the faculty member to arrange for appropriate accommodations.

**Center for Accommodation and Support Services (CASS) can also be reached in the following ways:**

**Web:** <http://sa.utep.edu/cass/>

**Monday thru Friday 8:00a.m.-5:00p.m.**

**Union Building East Room 106**

**Phone:(915) 747-5148**

**[cass@utep.edu](mailto:cass@utep.edu)**

### **Time Management**

The tentative schedule contains practice problems. Expect to spend three hours on preparation and learning assignments for every semester credit hour. Since this class is a 3-semester credit hour class, expect to spend about 9-10 hours out of class on assignments in addition to 3 hours of in-class time for a total of about 12 hours per week to obtain an "A" in this class. One of your tasks is to develop a Time Management Plan for yourself. This means that you will:

- 1) Create a weekly calendar containing you class times, your work times, your family activities, your breakfast, lunch and dinner activities, your physical activities and exercise (no excuses, you are a Kinesiology major!), time to go shopping, etc.
- 2) Create a semester calendar for including the months of August, September, October, November, and Decemeber, in which you enter your weekly activities and the quizzes and exams for each of your courses. Create your plan and stick to it!!

## Tentative schedule

Week	Lesson	Material Covered	Practice Problems
1	Lesson 1: Introduction	Class Introduction, Chapter 1: Fundamental Properties of Water In the 1960's Dr. Hunter Rouse, an expert on fluid mechanics, made a series of videos with physical models made to demonstrate many of the concepts discussed in this class. The videos are excellent and the physical models are much more instructive than the computer simulations prevalent today. I recommend that you watch all of them. The link to the full files is: <a href="http://www.iuhr.uiowa.edu/research/publications-and-media/films-by-hunter-rouse/">http://www.iuhr.uiowa.edu/research/publications-and-media/films-by-hunter-rouse/</a>	1.2.3, 1.3.1, 1.3.4, 1.4.1, 1.5.1, 1.5.5
	Lesson 2: Background Concepts from Fluid Mechanics	Chapter 1: Fundamental Properties of Water, Chapter 2: Water <b>Pressure and Pressure Forces</b> , How a toilet works, Surface Tension	2.2.1, 2.2.2, 2.2.7, 2.8.1
2	Lesson 3: Pipe Flow	Chapter 3: Water Flow in Pipes Read a Moody Chart	3.3.1, 3.3.2, 3.3.3, 3.5.1, 3.5.3, 3.5.5, 3.7.1, 3.11.1, 3.11.3, 3.11.8
	Lesson 4: Pipe Flow	Chapter 3: Water Flow in Pipes Basic Hydraulic Principles, Closed Conduit Flow, and Pipe Flow Presentation Note: This chapter is a review of material covered in Thermal-Fluid Systems, a prerequisite to this class. If you chose to take this class without the prerequisite you are responsible for learning much of the material on your own.	
3	Lesson 5: Pipe Flow	Chapter 3: Water Flow in Pipes How to Read a Moody Diagram, and Minor Losses	
	Lesson 6: Open Channel	Chapter 6: Open Channel Flow Manning Equation and Energy	6.1.1, 6.1.2, 6.2.1, 6.2.3, 6.2.4, 6.4.1, 6.4.3, 6.4.7, 6.5.3, 6.8.1
4	Lesson 7: Open Channel	Chapter 6: Open Channel Flow Specific Energy and Non Uniform Flow	
	Lesson 8: Open Channel	Chapter 6: Open Channel Flow Hydraulic Jump, Opening of Spillway (where is the water sub and supercritical?, how is the energy safely dissipated?)	
5	Lesson 9: Open Channel	Chapter 6: Open Channel Flow Gradually Varied Flow, Different Profiles of Gradually Varying Flow, and Shear Stress Failure	
	Lesson 10: Flow Measurement	Chapter 9: Water Pressure, Velocity, and Discharge Measurements <b>USGS Gauging Stations</b> <a href="http://waterdata.usgs.gov/nwis/uv/?site_no=04124000&amp;agency_cd=USGS">http://waterdata.usgs.gov/nwis/uv/?site_no=04124000&amp;agency_cd=USGS</a> (go over diurnal trends)	9.2.1, 9.4.1,
6		Practice and review for exam.	
	<b>R October 1<sup>st</sup></b>	<b>First Exam</b>	
7	Lesson 11: Hydraulic Structures	Chapter 8: Hydraulic Structures Detention Pond Routing	
	Lesson 12: Erosion	Erosion and Failure of Hydraulic Structures (Extra Material) Stream Formation and Erosion	12.3.1, 12.4.1, 12.4.3, 12.4.5, 12.5.1, 12.6.1
8	Lesson 13: LID	Low Impact Development (Extra Material)	
	Lesson 14: Rainfall/Runoff	Chapter 11: Hydrology for Hydraulic Design	11.1.2, 11.1.3, 11.1.5, 11.1.7, 11.4.5, 11.5.3, 11.6.1, 11.7.1, 11.8.1, 11.8.3
9	Lesson 15, 16: Rainfall/Runoff	Chapter 11: Hydrology for Hydraulic Design	
10	Lesson 17: Statistical Hydrology	Statistical Hydrology	
	Lesson 18: Groundwater	Groundwater Hydraulics ( <a href="#">Heath Basic Textbook</a> ) Note: we will use the free USGS textbook above rather than our textbook Water Movement in the Soil	7.1.1, 7.1.3, 7.1.5, 7.1.9, 7.1.10, 7.2.5



Week	Lesson	Material Covered	Practice Problems
11	Lesson 19: Groundwater	Groundwater Hydraulics Introduction to Finite Difference	
	Lesson 20: Groundwater	Groundwater Hydraulics	4.1.1, 4.1.2, 4.1.5, 4.1.9, 4.2.1, 4.2.3, 4.2.7, 4.2.6
12	Lesson 21: Groundwater	Chapter 4: Pipelines and Pipe Networks	
	Lesson 22: Pipe Systems	Chapter 4: Pipelines and Pipe Networks Online Calculator, EGL and HGL tips	
13	Lesson 23: Pipe Systems	Chapter 4: Pipelines and Pipe Networks	
	Lesson 24: Pipe Systems	Chapter 4: Pipelines and Pipe Networks	
14	Lesson 25: Pumps	Chapter 5: Water Pumps <a href="http://www.rainforrent.com/Training/PumpTraining.pdf">http://www.rainforrent.com/Training/PumpTraining.pdf</a> <a href="http://www.pumpfundamentals.com/centrifugal-pump-tips.htm">http://www.pumpfundamentals.com/centrifugal-pump-tips.htm</a> <a href="http://www.peerlessxnet.com/documents/B-4003.pdf">http://www.peerlessxnet.com/documents/B-4003.pdf</a>	5.6.1, 5.11.1, 5.11.2, 5.11.5
	November 26	<b>NO class. Thanksgiving Break</b>	
15		<b>Review for midterm, Chapter 4: Pipelines and Pipe Networks</b>	
	<b>December 3<sup>rd</sup></b>	<b>Second Midterm</b>	
		<b>Virtual Review for Final Exam</b>	
	<a href="#">Final Exam</a>	Final Exam Cheat sheet: two 8.5x11 sheets/ <b>one side per sheet</b> Thursday, December 10 <sup>th</sup> 10:00 am–12:45 pm	