

**CUNY CITY COLLEGE OF NEW YORK**  
**DEPARTMENT OF CIVIL ENGINEERING**  
**CE365 Hydraulic Engineering**

**Credits/Contact Hours:**

3crds, 5 hrs/week in two 1-hour lectures, one 2.0-hour lab-lecture, and one 1-hour lab

**Coordinator:**

Prof Piasecki, PhD  
Office: Steinmann ST102  
Tel: 212 650 83421  
Email: [mpiasecki@ccny.cuny.edu](mailto:mpiasecki@ccny.cuny.edu)

**Textbooks:**

1. *Fundamentals of Hydraulic Engineering Systems*, Houghtalen, Akan, Hwang, 4<sup>th</sup> Ed., Prentice Hall
2. *Computer Applications in Hydraulic Engineering*, Bentley Publishers, 8<sup>th</sup> Ed..

**Description:**

In this class you will learn about application of fluid mechanic principles to water infrastructure such as pipes and open channels. We will use real world situations in which we need to incorporate real phenomena, for example the effect of friction and also the fact that water does not flow uniformly as assumed to this point because in real life it is three-dimensional flow that affects our one-dimensional analysis environment. In particular we will address pipe flow, parallel pipes, applications of pumps and also water distribution networks. While this is pressurized flow we will also look into free surface flows which we encounter in streams, channels, and canals. Finally, we will look into some basic principles of overland flow that occurs after rainfall events and that we know as runoff, interception, and percolation (into the underlying groundwater layers). These topics are accompanied by a number of wet-lab experiments so you get a better understanding how some of the phenomena develop and we can measure their impact or influence on flow. 5 hr/wk; two 1.0-hour lecture; one 3.0-hour Lab, 3 cr.

**Prerequisites:**

CE264 Data Analysis  
CE350 Fluid Mechanics

**Instructor this Term:**

Spring 2020  
Prof Michael Piasecki, PhD  
Office: Steinmann ST102  
Tel: 212 650 83421  
Email: [mpiasecki@ccny.cuny.edu](mailto:mpiasecki@ccny.cuny.edu)  
Email lab TA: Said Mejia [saidmejia08@gmail.com](mailto:saidmejia08@gmail.com)

**Class Meeting Place and Office Hours:**

Class room: Lecture on Zoom  
ProbSol on Zoom  
Lab online videos  
Meeting times: Lecture M/W 11:00am – 11:50pm  
ProbSol W 2:00pm – 4:00pm  
Lab W every two weeks, due 14 days from assignment  
Office Hours: Online T 1:00pm – 3:00pm

**Course WebSite:**

<http://michaelpiasecki.org>  
... and then follow the "Courses" tab

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**Assessment Tools:** (In addition to the End of Course survey)

|                            |   |
|----------------------------|---|
| 1. Lab assignments (7)     | 21% (~3% each)                            |
| 2. Quizzes/exams (2)       | 22% (10% each)                            |
| 3. Project                 | 24%                                       |
| 4. Cumulative Final Exam   | 33%                                       |
| 5. Homework (~10 assigned) | 0% (assigned for voluntary consideration) |

**Course Learning Outcomes:** By the end of this class, the student should be able to:

|   |                       |
|---|-----------------------|
| 1. Understand the application of conservation and momentum principles to pipe flow      | [a, c, k]             |
| 2. Understand the need for incorporating friction into real world flows                 | [a, e, h]             |
| 3. Understand approaches to quantify friction impact on pipe flow and open channel flow | [a, e, h]             |
| 4. Understand the use of parallel and pipes in series for water networks                | [a, e, h]             |
| 5. Understand how a pump is selected and matches to system requirements                 | [a, e, h]             |
| 6. Understand how pumps operate when in parallel and when in series                     | [a, e, h]             |
| 7. Understand what governs free surface flow and how friction impacts the flow          | [a, e, h]             |
| 8. Understand the influence of control devices on flow and flow regimes                 | [a, c, j]             |
| 9. Understand basic characteristics of rainfall and what pathways are used for drainage | [a, e, h]             |
| 10. Understand the use of hydrographs and how interpret them vis-à-vis hyetographs      | [a, g, h, j, k]       |
| 11. Application of lab experiments to support theoretical considerations                | [a, b, c, e, g, j, k] |

**Topics:**

|  |            |
|--|------------|
| 1. Piping Systems, parallel and in series                                | 1 lecture  |
| 2. Pipe Flow Friction and Minor losses                                   | 2 lectures |
| 3. Pipe Network Systems  | 2 lectures |
| 4. Components of Pipe Networks   | 2 lectures |
| 5. Pumps: types of pumps   | 1 lecture  |
| 6. Pumps: characteristics, dim-less numbers for design                   | 2 lectures |
| 7. Pumps in parallel and series  | 2 lectures |
| 8. Open Channel Flow: energy consideration, and Froude number            | 2 lectures |
| 9. Momentum equation in OCF  | 2 lectures |
| 10. Friction and uniform flow in open channels                           | 2 lectures |
| 11. Flow control devices in open channels                                | 2 lectures |
| 12. Hydrologic Principles: rainfall characteristics, initial abstraction | 2 lectures |
| 13. Computing hydrographs, Peak runoff computations, RDF graphs          | 1 lecture  |
| 14. Surface runoff computations  | 1 lecture  |

**Estimated ABET Professional Content:**

Engineering sciences 2 cr or 67%, Engineering design 1 cr or 33%

**Attendance and Late Submission Policy:**

Attendance to Class lectures will not be tracked; we assume that you as an individual will know best whether or not to attend class lectures. Lab session attendance, however, will be recorded. Lab report submissions are due one week after you participated in the lab session. Deadline is 12:00noon on that Wednesday. Lab reports are to be submitted via email ONLY to the TAs. Late submission of lab reports is strongly discouraged and will result in point deductions. Every day late will result in another 20% deduction, i.e. 5 days late means you will not receive any credit.

**Calculator Policy:** Students may ONLY use a Texas Instruments 30XIIS calculator during exams (including mid terms) in this course. This calculator is on NCEES' approved list for calculators that may be used during the FE and PE licensing exams. There will NO exceptions.

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**Academic Integrity Policy:**

For a class this size it is imperative that you coordinate your group work. While discussion of topics among yourself is permissible, I expect that the group works on their own and that it hands in its own unique work.

Additional requirements for academic integrity are outlined in the following document:

[http://www.cuny.edu/about/administration/offices/la/Academic\\_Integrity\\_Policy.pdf](http://www.cuny.edu/about/administration/offices/la/Academic_Integrity_Policy.pdf)

**Disability Policy:**

In compliance with CCNY policy and equal access laws, appropriate accommodations are administered by the AccessAbility Center. Students who register with AccessAbility, and are entitled to specific accommodations, must request a letter from AccessAbility to present to the Professor that states what their accommodations are. If specific accommodations are required for a test, students must present an "Exam Administration Request Form" from AccessAbility, at least one week prior to the test date in order to receive their accommodations.

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**Class Schedule:**

| <b>Class #</b> | <b>In class textbook topics</b> |  |
|----------------|---------------------------------|--|
| #1             | 08/26                           | Introduction to Class, Syllabus, Grading, Lab, Expectations, |
| #2             | 08/31                           | Chapter 3.1 – 3.7 Pipe Friction                              |
| #3             | 09/02                           | Chapter 3.1 – 3.7 Pipe Friction                              |
|                | 09/07                           | <b>No Class =&gt; College Closed</b>                         |
| #4             | 09/09                           | Chapter 3.8 – 3.11 Pipe Minor Losses                         |
| #5             | 09/14                           | Chapter 3.12 Pipes in Parallel and Series                    |
| #6             | 09/16                           | Chapter 3.12 Pipes in Parallel and Series                    |
| #7             | 09/21                           | Chapter 4.1 – 4.3 Branching Pipe Systems                     |
| #8             | 09/23                           | Chapter 4.4 Pipe Networks                                    |
|                | 09/28                           | <b>No Class =&gt; College Closed</b>                         |
| #9             | 09/29                           | Chapter 4.4. Pipe Network Demand                             |
| #10            | 90/31                           | <b>Quiz #1</b>   |
| #11            | 10/05                           | Chapter 5.1 – 5.4 Pump types                                 |
| #12            | 10/07                           | Chapter 5.5 – 5.6 Pumps in Series and Parallel               |
|                | 10/12                           | <b>No Class =&gt; College Closed</b>                         |
|                | 10/14                           | Chapter 5.7 – 5.9 Pump Operation                             |
| #13            | 10/19                           | Chapter 5.10 Pump Characteristics and dim-less numbers       |
| #14            | 10/21                           | <b>Quiz #2</b>   |
| #15            | 10/26                           | Chapter 6 Open Channel Flow                                  |
| #16            | 10/28                           | Chapter 6.1 – 6.2 Classification and Uniform Flow            |
| #17            | 11/02                           | Chapter 6.3 – 6.4 Energy Principles and Conjugate Depth      |
| #18            | 11/04                           | Chapter 6.3 – 6.4 Energy Principle Cont'ed                   |
| #19            | 11/09                           | Chapter 6.3 – 6.4 Froude Numbers and Flow Regimes            |
| #20            | 11/11                           | Chapter 6.5 Momentum Principle and Hydraulic Jumps           |
| #21            | 11/16                           | Chapter 6.6 &.7 &.8 Gradually Varied Flow                    |
| #22            | 11/18                           | Chapter 8.5 Hydraulic Structures: Weirs                      |
| #23            | 11/23                           | Chapter 11.1 – 11.3 Basic Hydrologic Concepts                |
|                | 11/25                           | <b>No Class =&gt; Thxgiving</b>                              |
| #24            | 11/30                           | Chapter 11.2 Design Storm                                    |
| #25            | 12/02                           | Chapter 11.3 Excess Rainfall: SCS Procedure                  |
| #26            | 12/07                           | Chapter 11.4 Design Runoff: Unit Hydrograph                  |
| #27            | 12/09                           | Chapter 11.6 Rainfall Runoff: Rational Method                |
|                |                                 |  |
|                |                                 |  |
|                |                                 |  |
|                | 05/--/19                        | <b>Final Exam</b>  |

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**Laboratory Schedule:**

| <i>Experiment #</i> | <i>Lab Experiment/topic</i>                    | <i>Groups</i> | <i>Location</i> |
|---------------------|--|---------------|-----------------|
|                     |  |               |                 |
| #1                  | 09/02 Hydrostatic Pressure                     |               | online          |
| #1                  | 09/09 Hydrostatic Pressure                     |               | online          |
| #2                  | 09/16 Fluid Friction and Minor Losses in Pipes |               | online          |
| #2                  | 09/23 Fluid Friction and Minor Losses in Pipes |               | online          |
| #3                  | 09/30 Bernoulli Principle                      |               | online          |
| #3                  | 10/07 Bernoulli Principle                      |               | online          |
| #4                  | 10/14 Pumps in Series and Parallel             |               | online          |
| #4                  | 10/21 Pumps in Series and Parallel             |               | online          |
| #7                  | 10/28 Outfall Diffuser                         |               | online          |
| #7                  | 11/04 Outfall Diffuser                         |               | online          |
| #5                  | 11/11 Sharp-crested Weirs                      |               | online          |
| #5                  | 11/18 Sharp-crested Weirs                      |               | online          |
|                     | 11/25 <b>No Lab =&gt; Thxgiving</b>            |               |                 |
| #5                  | 12/02 Sharp-crested Weirs <b>Due Date!</b>     |               | online          |
|                     | 12/09 <b>No Lab =&gt; Review</b>               |               | online          |
|                     |  |               |                 |