Summer 2019

# CE 321-041: Water Resources Engineering

Paul Schorr

JOHN A. REIF, JR. DEPARTMENT OF
CIVIL AND ENVIRONMENTAL ENGINEERING
NJIT

## CE 321 – Water Resources Engineering - Summer 2019 – May 25 to July 13
## Section 041

**Texts:** Water Resources Engineering (**W**), Wurbs & James, ISBN 0-13-081293-5, 2002, 1st Edition, Prentice Hall, New Jersey
Concrete Pipe Design Manual (**C** ) , American Concrete Pipe Association, 2011, 19th printing, www.concretepipe.org,
Instream Aeration, (**I**) W.Whipple,Jr, Brig.Gen., Water Resources Research Institute, 1969

**Course Coordinator:** Prof. Yuan Ding, Office: 235 Colton Hall, Newark, N.J.; 973-642-7046; e-mail: ding@njit.edu

**Instructor**: Adjunct Professor: Paul Schorr, PE, PP, MASCE; 609-933-3900 cell; schorr@njit.edu email;
Office hours: by appointment, Colton Hall, 3–4 pm Saturday ; Class hours: 9:30 – 12 , break, 1 – 3:30
Class room:

**Prerequisites**: CE 200, CE 200A, Math 279. The course provides training in developing water supplies under normal and extreme (i.e. drought, floods) conditions; in hydrologic techniques such as surface and ground water yield, hydrograph analysis and routing (detention, reservoir) analyses, probabilistic methods related to hydrologic studies. Water quality issues are briefly discussed.

| month/day - eq.week | Topic | Reading Assignment | Problems Team Presentation | Concepts |
|---|---|---|---|---|
| 5/25 – 1<br><br>5/25 – 2 | Introduction (Chapter 1)<br><br>Hydrology (Chapter 2) | **C – ii-10**<br>**W- pp 1--106**<br>**I -** | A 2.3,12 15<br>B 2,5,13,16<br>C 2.6,14, 17<br>D **C forward- C1** | transparency<br>Incompressible<br>mass & energy |
| 6/1 - 3<br><br>6/1 - 4 | Hydrology (Chapter 2)<br><br>Open Channel Hydraulics (Chapter 5) | **C – 11-24**<br>**W-pp 107,151,252-303**<br>**I – 18-23** | A 5.17; **C-2-1**<br>B 5.12; **C-2-3**<br>C 5.13.; **C-2-5**<br>D 5.2 ; **C-3-15-24** | common ground<br>Manning<br>Bernoulli |
| 6/8 – 5<br><br>6/8 – 6 | Hydrologic Frequency Analysis (Chapter7)<br>Exam -1 | **C –**<br>**W-pp408-455**<br>**I – 13-17** | A 7.16a, e; 7<br>B 7.16b, f; 11<br>C 7.16c, 5; **C**<br>D 7.16d, 6; **C** | Starting time,<br>time step,<br>reconstruction |
| 6/15 – 7<br><br>6/15 - 8 | Modeling Watershed Hydrology (Chapter 8)<br>“ | **C –**<br>**W-pp463-502**<br>**I -152-179** | A 8.15, 24<br>B 8.13, 23<br>C 8.8, 22<br>D 8.2, 1 | Scale<br>Analog<br>Digital |
| 6/22 – 9<br><br>6/22 – 10 | Modeling Watershed Hydrology (Chapter 8)<br>Exam -2 | **C –**<br>**W-pp502-525**<br>**I -** | A 8.25<br>B 8.27<br>C 8.28<br>D 8.29 | Trial & Error<br>Solver<br>Numerical methods |
| 6/29 – 11<br><br>6/29 – 12 | Field Trip –?<br>USGS 01389005 ?<br>PVWC ? | **C –**<br>**W-**<br>**I -** | A<br>B<br>C<br>D | Institution<br>Federal<br>State<br>NJ vs NY |
| 7/6 | July 4th week | July 4th week | | July 4th week |
| 7/13 – 13<br><br>7/13 – 14 | Groundwater Engineering (Chapter 9) | **C –**<br>**W-pp534-576,602-609**<br>**I -** | A 9.2m , 16ft,<br>B , 3ft, 17ft<br>C 7ft,<br>D 13ft, | Reservoir<br>Springs<br>Streams<br>Percolation |

| | | | | |
|---|---|---|---|---|
| 7/20 - 15 | Final Exam | | | |

GRADING Weight Range

Exam 1 (100 points - curve) 20% - 15%

Exam 2 (100 points - curve) 20% - 15%

Field Trip & Report ( 100 points) 20% - 15%

Team Problem Presentation (100 points) 20% - 40%

Final Exam (100 points - curve) 20 % - 15%

The final grade will be based upon the following percentages utilizing the total points achieved by the students as weighted above.

| | |
|---|---|
| A = | 90 to 100% |
| B+ = | 85 to 89% |
| B = | 80 to 84% |
| C+ = | 70 to 79% |
| C = | 60 to 69% |
| D = | 50 to 59% |
| F = | Below 50% |

*The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.

The use of electronic devices (other than calculators) is strictly prohibited during class hours except for search problems. (Severe Penalties May Result).

CONCEPTS & DISCIPLINES - Fluid Statics
Fluid Kinematics
Flow of an incompressible ideal fluid
Impulse-momentum principal
Flow of a real fluid
Fluid flow in a pipe
Open channel flow
Dimensional Analysis

**Schedule:** **(-,-,-)**
**Professional Component**: Engineering Topics
**Program Objectives Addressed:** **1, 2**
**Prepared By:** Prof. Ding, revision in italics by Adj. Prof. Schorr

**Outcomes Course Matrix – CE 321 – Water Resources Engineering to be revised by Coordinator**

| Strategies, Actions and Assignments | ABET Student Outcomes (1-7) | Program Educational Objectives | Assessment Measures |
|---|---|---|---|
| **Student Learning Outcome 1: Define fluid properties and statics and hydrology within regulatory water resources framework for structures, agencies and global driving forces** | | | |
| Illustrate basic fluid properties, fluid statics & kinematics. | 1 | 1 | Weekly homework and exams. |
| Discuss the design of water structures impacted by fluids and agencies | 1 | 1, 2 | Weekly homework and exams. |
| **Student Learning Outcome 2: Develop the principles and equations for open channel and pressure flow (momentum analysis also).** | | | |
| Develop the continuity, Bernoulli equations and friction loss equations (entropy). | **1** | **1** | Weekly homework and exams. |
| Provide distinct and detailed examples of how these equations are utilized in design and natural systems | **1, 2** | **1, 2** | Weekly homework and exams. |
| **Student Learning Outcome 3: Design storm water/ water/*wastewater treatment plant,* distribution and pressure flow systems (pressure flow, pumps and network analysis).** | | | |
| Provide design solutions and examples for surface water, culvert and reservoir systems. | 2 | 1 | Design problems. |
| Introduce actual engineering modelling design problems (SWMM, HEC, excel) | 2 | 1, 2 | Design problems. |
| **Student Learning Outcome 4: Illustrate and develop the equations and design principles for open channel flow. Included in this objective is sanitary and storm sewer design and flood control hydraulics (varied flow).** | | | |
| Develop the principles of reservoir,stream,groundwater hydraulics and hydrology controlled by structures and agencies in extreme events | 1 | 1 | Homework and exams. |
| Provide design principles for sanitary and storm sewer design along with drainage analysis and groundwater | 2 | 1 | Homework and exams. |
| Introduce the varied flow principles and their application. Discuss the use | 2, 7 | 1, 2 | Homework and exams. |

| | | | |
|---|---|---|---|
| of software-based ***& other*** solutions such as HEC-2 | | | |

**CEE Mission, Program Educational Objectives and Student Outcomes**

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our program educational objectives are reflected in the achievements of our recent alumni:

1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Alumni will advance their skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 – Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Revisions by Schorr (italics) : 5/25/2019 tbd