**ESSEX COUNTY COLLEGE**

**Engineering Technologies and Computer Sciences Division**

**CET 221 – Hydraulics and Drainage**

**Course Outline**

**Course Number & Name:**  CET 221 Hydraulics and Drainage

**Credit Hours:**  4.0 **Contact Hours:**  5.0 **Lecture:** 3.0 **Lab:**  2.0 **Other:**  N/A

**Prerequisites**:  Grade of “C” or better in CET 212

**Co-requisites:** MTH 114 **Concurrent Courses:** None

**Course Outline Revision Date:**  Fall 2010

**Course Description**: This course is an introduction to the fluid properties of water and the concepts of surface water hydrology. Topics covered include flow through pipes and channels and relationships between rainfall and runoff. Class time is divided between the study of theory and the application of this theory in the design of storm drainage systems. Laboratory exercises are included to complement lecture topics.

**Course Goals:** Upon successful completion of this course, students should be able to do the following:

1. compute values of relevant parameters for static pressure and pressure flow in a pipe;

2. compute values of relevant parameters for flow through hydraulic devices;

3. compute values of relevant parameters for open channel flow;

4.    compute peak flow and hydrographs for runoff from small watersheds; and

5.    design simple stormwater management systems.

**Measurable Course Performance Objectives (MPOs)**: Upon successful completion of this course, students should specifically be able to do the following:

1. Compute values of relevant parameters for static pressure and pressure flow in a pipe:

* 1. *compute static pressure on various surfaces in a container of water;*
  2. *compute flow quantity through a pipe using Bernouli’s Equation;*
  3. *compute energy head and head losses for pressure flow;* and
  4. *sketch the energy and hydraulic grade lines for simple pressure flow*

2. Compute values of relevant parameters for flow through hydraulic devices:

2.1 *compute flow over a weir;*

2.2 *compute flow through an orifice;* and

2.3 *compute flow through a siphon*

**Measurable Course Performance Objectives (MPOs)** (continued):

3. Compute values of relevant parameters for open channel flow:

* 1. *compute normal depth for open channel flow;*
  2. *compute critical depth for open channel flow;*
  3. *compute a stream rating curve;*
  4. *compute flow through a culvert;* and
  5. *utilize Excel software to compute flow*

4. Compute peak flow and hydrographs for runoff from small watersheds:

* 1. *delineate drainage area on a contour map;*
  2. *compute time of concentration for a drainage area;*
  3. *compute peak runoff using the Rational Method;*
  4. *compute peak runoff using the NRCS Method;* and
  5. *compute and sketch runoff hydrographs using the NRCS Method*

5. Design simple stormwater management systems:

* 1. *design a simple storm sewer system;* and
  2. *design a replacement culvert for a stream under a road*

**Methods of Instruction**: Instruction will consist of lecture, problem solving, and laboratory exercises.

**Outcomes Assessment:** Test and exam questions are blueprinted to course objectives. Rubrics are used to assess the lab reports and term project for the presence of course objectives. Data is collected and analyzed to determine the level of student performance on these assessment instruments in regards to meeting course objectives. The results of this data analysis are used to guide necessary pedagogical and/or curricular revisions.

**Course Requirements:** All students are required to:

1. Maintain regular attendance.

2. Complete homework assignments.

3. Sit for all tests and exams.

4. Read all assigned textbook pages.

5. Participate in classroom discussions.

6. Participate in lab exercises and complete lab reports.

**Methods of Evaluation:** Final course grades will be computed as follows:

**% of**

**Grading Components final course grade**

* **Homework, quizzes and class participation 10 – 15%**

A perusal of homework problems and quizzes and class discussion will indicate the extent to which students master course objectives.

* **3 or more Tests** (dates specified by the instructor) **30 – 40%**

Tests will show evidence of the extent to which students meet course objectives, including but not limited to identifying and applying concepts, analyzing and solving problems, estimating and interpreting results and stating appropriate conclusions using correct terminology.

* **Lab Reports 15 – 20%**

Lab reports will show evidence of applying course concepts to physical problems and to analyze errors and the ability to compose a technical report.

* Term Project 10 – 15%

The term project will show evidence of applying course concepts to real world problems and to design a solution and the ability to compose a technical report.

* **Final Exam** (comprehensive) **20 – 30%**

The same objectives apply as with tests, but it is anticipated that students will provide increased evidence of synthesizing a combination of concepts.

Note: The instructor will provide specific weights, which lie in the above-given ranges, for each of the grading components at the beginning of the semester.

**Academic Integrity:** Dishonesty disrupts the search for truth that is inherent in the learning process and so devalues the purpose and the mission of the College. Academic dishonesty includes, but is not limited to, the following:

* plagiarism – the failure to acknowledge another writer’s words or ideas or to give proper credit to sources of information;
* cheating – knowingly obtaining or giving unauthorized information on any test/exam or any other academic assignment;
* interference – any interruption of the academic process that prevents others from the proper engagement in learning or teaching; and
* fraud – any act or instance of willful deceit or trickery.

Violations of academic integrity will be dealt with by imposing appropriate sanctions. Sanctions for acts of academic dishonesty could include the resubmission of an assignment, failure of the test/exam, failure in the course, probation, suspension from the College, and even expulsion from the College.

**Student Code of Conduct:** All students are expected to conduct themselves as responsible and considerate adults who respect the rights of others. Disruptive behavior will not be tolerated. All students are also expected to attend and be on time for all class meetings. No cell phones or similar electronic devices are permitted in class. Please refer to the Essex County College student handbook, *Lifeline*, for more specific information about the College’s Code of Conduct and attendance requirements.

**Course Content Outline:** based on the text **Introduction to Hydraulics and Hydrology with Applications for Stormwater Management,** 3rd edition, by Gribbin; published by Delmar Learning, 2007.

**Week Topic**

1 Introduction, Pressure, Bouyancy

2 Fluid Flow, Bernoulli’s Principle

3 Weir flow, Orifice Flow, Lab 1: Sharp-Crested Weir

4 Weir Flow, Open Channel Flow

5 **Test 1**, Pipe Flow, Lab 2: Broad-Crested Weir

6 Stream Flow

7 Culvert Flow, Lab 3: Bernoulli’s Principle

8 Drainage Area, Time of Concentration

9 **Test 2**, Rainfall, Lab 4: Orifice Flow

10 Rational Method

11 NRCS Method, Lab 5: Open Channel Flow

12 NRCS Method (continued), **Test 3**

13 Storm Sewers, Lab 6: Culvert Flow, **Term Project due**

14 Storm Sewers (continued), Review for Final Exam

15 **Final Exam**