CE 444 – Urban Hydrology and Hydraulics

Code and Name: CE 444 – Urban Hydrology and Hydraulics
Credit Hours: 3 (Lecture: 3, Tutorial: 1)

Textbook:
- Water Resources Engineering: Chin, D.A., 3rd Edition, Pearson, 2013.
Other References:
- *Urban Drainage, David Butler† and John W. Davies, 2nd Edition, 2004.*
- *Hydrology and Hydraulic Systems, by RAM Gupta, 4th Ed, 2016.*
- *Introduction to Hydraulics and Hydrology with applications for stormwater management, John Gribben, 4th Ed, 2014*
- *Course handouts: distributed on a regular basis to provide more information on the topic.*

Course Description:
The aim of the course is to study the hydrology and drainage requirements of urban areas. Throughout the course, we introduce the effects of urbanization on the hydrological cycle, develop basic methods of hydrological analysis including rainfall-runoff models and flood frequency analysis. We review the basics of rainfall analysis and hydraulics, and apply this to storm, foul and combined sewer design. We explore sewer flow and quality models, stormwater management and the increasing influence of 'sustainability principles'. In this course, more stresses will be given to impacts of urban development on stormwater quantity and quality; management of urban stormwater including re-use and groundwater interaction; design of stormwater quantity and quality management structures including detention basins, retention basins, infiltration basins, sedimentation basins and artificial wetlands. During the course, students will get familiar to use a number of software such as EPASWMM, QGIS and Hydraulic Toolbox, HY8 packages.

Pre-requisites: CE340 Water Resources Engineering
Co-requisites: None

Course Learning Outcomes:
With relation to ABET Student Outcomes (From Fall 2019-SOs: 1-7)
1. Calculate areal precipitation, conduct rainfall data analysis, outlier's analysis, data gap covering, frequency analysis and generation of IDF curves (1);
2. Carry out watershed delineation digitally using QGIS (1);
3. Design a crossing drainage structure using HY8 package (1,2);
4. Calculate sheet flow and water spread on roads and determine peak discharge using rational/CN method (1);
5. Hydraulic design of road storm inlets (curb and grated inlets) (2);
6. Determine the optimum dimensions of retention and bioretention systems (2);
7. Develop a complete storm drainage model for urban areas using EPA-SWMM package (1);

Topics to be covered:
- Introduction to urban hydrology and effects of urbanization and climatic changes on hydrological cycle.
- Rainfall data analysis and development of IDF curves and unit hydrographs.
- Elements of Storm Networks. Urban catchment modeling using rational, Unit Hydrograph and Convolution
- Road Hydraulics: design of storm ditch; storm sewer pipes; gullies and gutters and storm drainage structure.
- Design of retention and detention ponds, infiltration basins and artificial wetlands,
- Best management practices and various methods to mitigate adverse hydrological impacts of urbanizations,
- Introduction to software packages: EPA-SWMM, Hydraulic Toolbox, HY8, QGIS for stormwater management.

Grading Policy:
The grading for the course is: 60% coursework and 40% Final Exam. The course work consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes 2 to 3 quizzes for the remaining 20% that is modified by the course instructor.