53:119 Hydrology
Fall 2013

Instructor: Allen Bradley
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Lecture: 8:30 AM–9:20 AM MWF (2133 SC)

Office Hours: 9:30 to 10:30 AM MWF (4108 SC)
12:00 to 1:3o PM Tue/Thu (4108 SC) [until 31 Oct]
Or by arrangement

References: Bedient, P. B., W. C. Huber, and B. E. Vieux, Hydrology and Floodplain Analysis, 5th Edition, Pearson, 2013.

Dingman, S. L., Physical Hydrology, 2nd Edition, Waveland Press, 2008.

Viessman, Jr., W., and G. L. Lewis, Introduction to Hydrology, 5th Edition, Prentice Hall, 2003.

Linsley, R. K., M. A. Kohler, and J. L. H. Paulus, Hydrology for Engineers, McGraw-Hill, 1982.

Class Web Site: The class web site is http://www.engineering.uiowa.edu/~flood. The web site contains lesson objectives, reading assignments, class handouts, and homework assignments. To prepare for each class period, **you will need to (1) review the lesson plan, (2) do the reading assignments, and (3) make copies of handouts to bring to class.**

ICON: ICON will be used to post grades and to distribute certain course material and documents to students enrolled in the course.

Course materials and documents are proprietary information. They are for your individual use only. They may not be redistributed (in an original or modified form) under any circumstances without prior consent of the Instructor.

Email: Late-breaking announcements and homework hints will occasionally be emailed to all students at your university account (as it appears on ICON). **You are responsible for receiving any and all information sent to your university email address, just as if the information had been given in class.**

Grading:

Homework	20 %
Project	10 %
Exams	70 %
Total	100 %

Attendance: Class attendance is not mandatory. Exceptions are for class examinations, team meetings, and project presentations. Students who choose to attend class are expected to arrive on time and behave in a professional manner.

For permission to be absent from a scheduled class activity (e.g., examination) to participate in authorized University activities, students must present before the absence a written statement signed by a responsible official specifying exactly the dates and times necessary for them to miss class. Students who are absent for medical or personal reasons are expected to present written evidence to verify the reason (an *Absence from Class Form* from http://www.registrar.uiowa.edu and other relevant documentation). If excused, the instructor will set a revised schedule for class work.

Homework: Homework problems are posted on the class web site with each lesson. Students will have 7 days to complete the assigned problems. Students must follow the Homework Guidelines to receive credit for their assignment. Each homework assignment must be turned in on time; homework assignments must be turned in to the instructor before class begins. Any homework received after begins on the due date is late.

Late homework will only be accepted if (1) it is turned in before the graded assignment has been returned, and (2) the student has fewer than two previous late assignments. **Late assignments must be turned in before the beginning of class (i.e., before the assignment has been returned).**

Unannounced quizzes may be given during class. Quizzes will be short (5 to 10 minutes) and cover material from recent homework assignments or material from class that day. Other individual or group problem-solving assignments may also be given in class. Quizzes and in-class assignments count towards the homework grade.

Collaboration: Exams are designed to test how well students understand the fundamental principles covered by the assignments (among other things). Students are encouraged to discuss homework assignments and analysis approaches to gain a deeper understanding. However, homework submissions must represent a **student's independent effort**. Put another way, students may collaborate by discussing homework problems and working out solutions together; but when preparing the document that will be submitted for a grade (a homework submission), each student must work independently. Copying someone's homework, sharing copies of figures or tables or spreadsheets with others, and giving (or receiving) a copy of someone's homework (a paper or electronic version), are all examples of cheating. Students who cheat will be disciplined according to the College of Engineering's regulations on Academic Misconduct.

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Description: *This course covers* the fundamental processes of the water cycle, including precipitation, evaporation, infiltration, and runoff. Quantitative approaches are developed for characterizing watersheds and stream networks, predicting components of the water cycle, and simulation of rainfall-runoff processes.

After taking this course you will be able to carry out hydrologic assessments of watersheds, use hydrologic methods for predicting streamflow and design discharges, and apply hydrologic concepts for hazard assessment and stormwater management.

Lecture Topics:

Hydrologic Processes

- Water Budgets
- Precipitation
- Evaporation
- Infiltration and Unsaturated Groundwater flow
- Surface Water
- Runoff Generation

Hydrologic Analysis & Prediction

- Baseflow Separation and Prediction
- Streamflow Prediction
- Unit Hydrograph Concepts
- Flow Routing

Hydrologic Engineering Applications

- Hydrologic Modeling
- River Network Properties
- Hydrologic Design
- Drought Assessment

Exams:

Exam 1 (Wednesday, October 9)
Exam 2 (Monday, November 11)
Final Exam (To be determined)

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Homework Guidelines

General Guidelines

The engineering problem solving approach will be used in this class for all homework submissions. The specific format to use is described below.

Your homework submission is meant to document an engineering problem and its solution. Equations and numbers alone are insufficient to document the problem and solution. Instead, you need to describe the problem (in sentences) and the steps in the solution so that another engineer can follow the work. Also, your submission is meant to represent your final solution. Use scratch paper to figure out how to solve the problem. Afterwards, document the problem and solution on your homework submission in an orderly and professional manner.

Homework assignments must be neat and legible. Use may use engineering paper or the Microsoft Word Template for your submission. Solutions must be clearly marked (underline and label). Sketches and figures must done on computer (e.g., AutoCAD) or hand-drawn using a straight-edge. Plots and graphs may be done using a computer, when appropriate. Assignments that are messy, or do not follow the format shown below, will be returned for no credit. **Each individual homework problem** should be stapled **in turned in separately**.

[*Instructor Note:* One continuous complaint from consulting engineers is that new graduates no longer can produce acceptable calculation sheets. Time is money in engineering. Calculations will be checked by colleagues or supervisors and therefore must be clear, thorough and presentable.]

Specific Format

Use the following format for your homework submissions:

Date: 2 September 2013 53:119, HW Problem #2 Name

Problem 2. Problem Title (something you can get from the assignment itself)

Statement: A brief but complete description of the problem to be solved.

> Include a *Diagram* if necessary. Note all the given information. Clearly state the desired result.

Solution: An organized, annotated, step-by-step documentation of the solution to the problem.

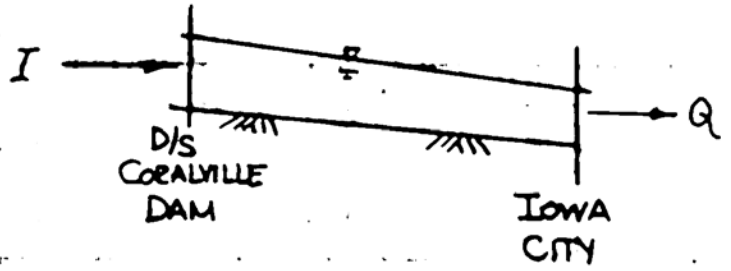
> Write-out in detail the formulation of the solution. Provide comments for each major step (or part) of the solution. Your text should explain the equations, numbers, and figures that follow, as well as any necessary assumptions. Reference any materials (spreadsheet tables and/or figures) that are attached. Underline the final answer for each part. Finally, add any additional comments to justify your answer, i.e. does the answer make sense physically?

PROBLEM 2: RIVER ROUTING

STATEMENT:

THE HYDROGRAPH (SHOWN BELOW IN TABLE 1) IS MEASURED AT THE GAGE DIRECTLY DOWNSTREAM OF CORALVILLE RESERVOIR. ESTIMATE THE DISCHARGE HYDROGRAPH AT IOWA CITY (BURLINGTON STREET) USING THE MUSKINGHAM ROUTING METHOD.

$X = 0.2$
$K = 120$ min
$\Delta t = 60$ min (1 hr)



SOLUTION:

FOR THE MUSKINGHAM ROUTING METHOD:

$$Q_{j+1} = C_1 I_{j+1} + C_2 I_j + C_3 Q_j$$

THE MUSKINGHAM CONSTANTS ARE:

$$C_1 = \frac{\Delta t - 2KX}{2K(1-X) + \Delta t} = \frac{60 - 2(120)(0.2)}{2(120)(1-0.2) + 60} = 0.04762$$

$$C_2 = \frac{\Delta t + 2KX}{2K(1-X) + \Delta t} = \frac{60 + 2(120)(0.2)}{2(120)(1-0.2) + 60} = 0.42857$$

$$C_3 = \frac{2K(1-X) - \Delta t}{2K(1-X) + \Delta t} = \frac{2(120)(1-0.2) - 60}{2(120)(1-0.2) + 60} = 0.52381$$

THE MUSKINGHAM RIVER ROUTING WAS CARRIED OUT USING A SPREADSHEET. THE RESULTS ARE SHOWN IN TABLE 1.

Table 1 Muskingham Routing

Time (hour)	(Given) I (cfs)	$C_1 I_{j+1}$ (cfs)	$C_2 I_j$ (cfs)	$C_3 Q_j$ (cfs)	Outflow Q (cfs)
0	1000				1000.0
1	2500	119.0	428.6	523.8	1071.4
2	4500	214.3	1071.4	561.2	1846.9
3	3130	149.0	1928.6	967.4	3045.1
4	2750	131.0	1341.4	1595.0	3067.4
5	2500	119.0	1178.6	1606.7	2904.4
6	2130	101.4	1071.4	1521.3	2694.2
7	1750	83.3	912.9	1411.2	2407.4
8	1350	64.3	750.0	1261.0	2075.3
9	1000	47.6	578.6	1087.1	1713.3

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Homework Submission Checklist

Heading – Each Page of Submission

Check that each page has the following items in the heading:

- ☐ Due date of the assignment
- ☐ Course number (53:119) is included
- ☐ Homework Problem Number (e.g., Problem #2)
- ☐ Your name
- ☐ Page numbers for the problem (e.g., 1/5, 2/5, ... 5/5)

Prepare each problem separately, starting the page numbering at 1. If you turn in more than one problem, **staple each problem separately**. This will make life much easier for your instructor (and grader).

Sections

- ☐ **Problem** section heading; *problem number* and *title* are included.
  - o You don't need to make up new titles; use the one on the assignment.

- ☐ **Statement** section heading is included.
- ☐ There is a brief (but complete) description of the problem to be solved.
- ☐ A Diagram is included *if necessary*.
  - o In general, if one diagram is sufficient for all parts of the problem solution, included it in the **Statement** section. If several diagrams are needed, they should be included as part of the **Solution** section.
- ☐ Given data are included *or* described (if too lengthy to repeat in this section).
- ☐ The items you will be solving for are clearly stated.
- ☐ Someone in CEE who is not taking the class could understand the problem to be solved.

- ☐ **Solution** section heading is included.
- ☐ Each part of the solution is clearly marked with a letter and title
  - o *Example:* b) Estimation of Areal-Average Precipitation
- ☐ Each step (or set of calculations) has annotation describing what is being done
  - o This does not need to be lengthy; short statements like "Compute the drainage area of the watershed" are fine preceding a calculation.
- ☐ Any assumptions made are stated.
- ☐ Refer to included materials (Tables or Figures) by name and number.
  - o *Example:* The results are shown in Table 2.1.
- ☐ The final solution for each part is underlined.
- ☐ Someone in CEE who is not taking the class could understand how the problem was solved.