

CIEE E3250: Hydrosystems Engineering

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Lectures: MW 4:10-5:25, 834 Mudd

Prerequisites: Statistics (SIEO W3600 or equivalent)
Fluid mechanics (ENME E3161, MECE E3100 or equivalent)

Grades: Two in class exams (15% each). Closed book; 4 sheets of notes allowed.
Final exam (30%). Closed book; 12 sheets of notes allowed.
8 problem sets (30%)
In-class modeling exercise (10%)

Textbook: Hydrology, An Introduction. by Wilfried Brutsaert; Cambridge, 2005 (required).
Note: Some material not covered in textbook.

What you can expect to learn:

- What are the physical processes that control the flow of water through hydrosystems.
- A critical appreciation for established methods used to quantify these processes, i.e., their origins, assumptions and limitations.
- How these methods can be used to solve basic hydrosystems engineering problems.
- The necessary basis and background for more complex problems and applications.

What's expected of you:

- Attend every class, and arrive on time.
- Review lecture notes after each class, and read assigned sections of the textbook.
- Complete problem sets on time.

Tentative schedule and reading assignments: (Grey barred text not required except where noted)

1. Wed 1/21: Hydrologic cycle and global water budget; regional water balance; watersheds. *Section 1.1-1.4.2; Page 9-10 (grey bar); Equation 1.10; Section 4.4.1(grey bar p.142 only)*
2. Mon 1/26: Surface energy balance; radiation physics; global and surface net radiation. *Page 6; Section 2.6 including grey bars, except 2.6.2 and 2.6.3.*

3. Wed 1/28: Longwave and shortwave components of surface net radiation. *Page 6; Section 2.6 including grey bars, except 2.6.2 and 2.6.3; SolarRad.xls*
4. Mon 2/2: **PS#1 due.** Atmospheric moisture. *Section 2.1 including grey bars; Section 2.2 through p. 30 and also section 2.2.2 (ignore atmospheric stability); MoistAirIGL.pdf; Clausius-Clapeyron.pdf; Clausius-Clapeyron.xls*
5. Wed 2/4: Moist air statics and thermodynamics. *Section 2.1 including grey bars; Section 2.2 through p. 30 and also section 2.2.2 (ignore atmospheric stability)*
6. Mon 2/9: Precipitation mechanisms and measurements. *Section 3.1, 3.2, 3.3.1, 3.5*
7. Wed 2/11: **PS#2 due.** *Radio Detection And Ranging.*
8. Mon 2/16: Evaporation processes and measurement methods. *Section 4.1, 4.4.1, 4.4.3, 4.5*
9. Wed 2/22: Quantitative estimates of evaporation and transpiration. *Section 2.5.2, 4.2.2 (Bulk Transfer only); p. 122-123 (Bowen Ratio); Section 4.3.1, 4.3.2; p. 133-135; VelocityProfile.pdf; PenmanEquation.pdf*
10. Mon 2/23: **PS#3 due.** Saturated groundwater flow. *Section 8.1, 8.3.1; GWText.pdf Chapter 7.1-7.3*
11. Wed 2/25: Analytical solutions for flow in confined and unconfined aquifers. *Section 8.4.1; GWText.pdf Chapter 7.4; GWFlowEquation.pdf; SubsurfaceVariables.pdf*
12. Mon 3/2: **Exam #1.** Covers Jan 23 - Feb 20
13. Wed 3/4: Steady-state well hydraulics. *GWText.pdf Chapter 7.5*
14. Mon 3/9: Transient well hydraulics; superposition. *GWText.pdf 7.4-7.5*
15. Wed 3/11: **PS#4 due.** Numerical discretization of groundwater flow equations. (--)
16. Mon 3/16: *SPRING BREAK*
17. Wed 3/18: *SPRING BREAK*
18. Mon 3/23: Numerical solutions for flow in confined and unconfined aquifers. (--)
19. Wed 3/25: Unsaturated groundwater flow. *Section 8.2 (skip Laplace Eq – pore size dist), 8.3.2, 8.3.4*
20. Mon 3/30: **PS#5 due.** Surface infiltration. *Section 9.1, 9.2, 9.3; GreenAmpt.pdf*
21. Wed 4/1: Groundwater Flow Modeling Exercise.
22. Mon 4/6: **PS#6 due.** Groundwater Flow Modeling Exercise, continued.
23. Wed 4/8: Surface runoff at a point. *Section 9.4 (p. 332-333), 9.4.3 (p. 337-338)*
24. Mon 4/13: **Exam #2.** Covers Feb 25 - Apr 7
25. Wed 4/15: River basin discharge and streamflow measurement. *Section 11.1, 11.2.1, 11.3*
26. Mon 4/20: Flood hydrographs and unit hydrographs. *Section 12.1.1, 12.2.1 (p. 472-474)*
27. Wed 4/22: **PS#7 due.** Hydrologic design; random variables; probability distributions *Section 13.1, 13.2.1*
28. Mon 4/27: Nonparametric and parametric probability models; flood likelihood and risk analysis. *Section 13.2.3, 13.2.4, 13.2.5*
29. Wed 4/29: Hydrologic probability models. *Section 13.4.1, 13.4.2*
30. Mon 5/4: **PS#8 due.** Hydrologic probability models, continued. *Section 13.4.1, 13.4.2*
- Finals Week: **Final Exam**