Water Resources, Hydrologic and Environmental Sciences
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CE 522 ENGINEERING HYDROLOGY

INSTRUCTOR

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Office Hours: MWF 1:00 - 2:00 PM – A222 Engineering Bldg.

TEXTBOOKS AND REFERENCES

The following books and references have been placed on reserve at the Morgan Library.

1. *Applied Hydrology* by Ven Te Chow, David Maidment, and Larry W. Mays. McGraw Hill, 1988.
2. *Hydrology, An Introduction* by Wifried Brutsaert. Cambridge University Press, 2005
3. *Dynamic Hydrology* by Peter S. Eagleson. McGraw Hill, 1970.
4. *Kinematic Wave Modeling in Water Resources* by Vijay P. Singh. John Wiley and Sons, Inc. 1996.
5. *Probability, Statistics, and Decision for Civil Engineers,* by Jack R. Benjamin and C. Allin Cornell. McGraw Hill, 1970.
6. *Hydrology, an Introduction to Hydrologic Science* by Rafael L. Bras. Addison Wesley, 1990.
7. *Introduction to Hydrology* by Warren Viessman, John Knapp, Gary Lewis, Terence Harbaugh. Crowell, Harper and Row, 1977.
8. Class handouts.
9. http://www.engr.colostate.edu/~ramirez/ce_old/classes/ce522_ramirez/CE522-new.htm

COURSE OBJECTIVES

This course emphasizes engineering applications of hydrologic science. Rainfall-runoff analysis. Lumped and distributed flow routing. Reservoir and river flood routing. Kinematic, diffusive and dynamic waves. Precipitation data analysis and optimal interpolation. Hydrologic design: risk analysis, hydro-economic analysis, and analysis of uncertainty. Bayesian decision analysis. Design storms. Design flows. Hydrologic reservoir design. Watershed modeling applied to hydrologic design.

COURSE EVALUATION

Homework
2 Midterm Exams
Final Exam

SCHEDULE

Lecture MWF 8:00 - 8:50 AM – Room Clark A206

CE 522 ENGINEERING HYDROLOGY

COURSE OUTLINE

TOPIC

Linear System Theory and Rainfall-Runoff Analysis
- Unit hydrograph theory
- Instantaneous unit hydrograph (IUH)
- IUH analysis methods: Harmonic analysis
  - Fourier transforms
  - Laplace transforms
- Linear channel
- Linear reservoir
- Nash model

River and Reservoir Flood Routing
- Flood Routing
- Reservoir flood routing methods:
  - Mass curve method
  - Storage indication method
  - Puls method
  - Goodrich method
  - Coefficient method
  - Woodward method
  - Others
- Linear Muskingum method:
  - Analytical Solution
  - Hydraulic analogy
  - Parameter estimation procedures.
- Multiple reach Muskingum method
- Nonlinear Muskingum method:
- Muskingum-Cunge method
- Distributed flow routing - Wave motion
  - Kinematic wave and Overland Flow
    - Analytical solution - Overland flow problem
    - Linear and non-linear numerical solutions
    - Overland Flow with spatially variable infiltration
  - Routing of diffusive and dynamic waves

Hydrologic Design
- Design scale
- Design Level
  - Risk Analysis
  - Hydroeconomic Analysis
- First Order Analysis of uncertainty
- Composite Risk Analysis
- Risk Analysis of safety factors and safety margins
- Hydrologic design under natural and parameter uncertainty
  - Bayes risk

COURSE OUTLINE

TOPIC

Opportunity Losses
Value of Sample Information

Precipitation data analysis.
Data analysis
Modeling
Mean Areal Precipitation: Thiessen polygons - Isohyets - IWD Methods
Kriging
Kriging with covariances
Kriging with semivariograms
Kriging with generalized covariances
Co-Kriging
Orographic Influences and their analysis

Design Storms
Design precipitation depth
Point precipitation
Areal precipitation
Intensity-Duration-Frequency (IDF) Curves
Design Hyetographs
Storm event-based analysis
IDF-based analysis
Estimated Limiting Storms
Frequency analysis