2017

Stochastic Hydrology

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Oregon State University
School of Civil and Construction Engineering
CE 540/BEE 525 – STOCHASTIC HYDROLOGY (SPRING 2017)
CRN: 57373/58382, Sec: 001, Credits: 3

Tuesday, Thursday | 1200-1320 HOURS |
ROOM KEAR 205

Instructor: Dr. Meghna Babbar-Sebens (211 Owen, 541-737-8536)
meghna@oregonstate.edu

Office Hours: **By appointment**

Credit Hours: 3
- **Lecture Hours:** 3 per week
- **Lab/Recitation Hours:** n/a

Course Prerequisites: Hydrology (CE 512/BEE 512)

Course Materials on Canvas: https://oregonstate.instructure.com

Text: Class Notes and handouts, including following recommended additional materials:

- Probability and Statistics in Hydrology, V. Yevjevich, Water Resources Publications, 1972.
- Stochastic Processes in Hydrology, V. Yevjevich, Water Resources Publications, 1972.
- Stochastic Approaches to Water Resources, Vol. 1, H.W. Shen, 1976.
- Statistical methods in Hydrology, C.T. Haan, Iowa State Press, 2002.

Required Supplies: None. Handouts will be provided on Blackboard.

Examinations: No exams.

Grading Policy: Homeworks – 50%
Project – 35%
Project presentation – 15%

Homework Policy:
Homework will be assigned regularly and is due at the beginning of class on the specified due date. If you will be out of town, please make arrangements to have a friend or classmate turn in your

homework for you, or turn it in early directly to me. Feel free to discuss your homework with your fellow students. However, you have to submit an individual homework and your submission should be an honest reflection of your effort and your grasp of the material.

Each assignment requires:

1. Your name on each page of stapled solutions
2. A legible and well-organized step-by-step presentation (in pencil) of the solutions (include problem diagrams). Some students prefer to type up solutions and that is fine.
3. Boxed answers presented with proper units (when applicable)

Solutions will be made available after your assignments have been collected

Statement Regarding Students with Disabilities
"Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098.

DAS e-mail address is Disability.Services@oregonstate.edu.

Statement of Expectations for Student Conduct, i.e., cheating policies: http://oregonstate.edu/admin/stucon/achon.htm

Class Attendance: Attendance is mandatory. You are expected to attend every class and participate. If you are unable to attend for a good reason, notify the instructor before that class. If you do miss class, it is your responsibility to find out from another student what was covered and any administrative information presented.

Disruptive Behavior: While the university is a place where the free exchange of ideas allows for debate and disagreement, all classroom behavior and discourse should reflect the values of respect and civility. Behaviors that are disruptive to the learning environment will not be tolerated. OSU's policy on disruptive behavior may be found at:
http://oregonstate.edu/admin/stucon/disruptivebehavior.htm

Course Description:
This course provides an introduction to fundamental concepts that are needed for stochastic modeling of hydrologic processes. At the

end of the course, the students are expected to be able to:

- Understand and identify stochastic processes in hydrology
- Identify sources of uncertainty in hydrologic models
- Understand basic concepts of probability theory and random functions
- Apply these concepts to solve problems related to uncertainty analysis in hydrologic analysis, modeling, and forecasting
- Read, understand, and interpret scientific literature on stochastic hydrology

Topics covered include:

1. Probability and Statistics: Descriptive statistics, probability theory, random variables, random functions, hydrologic statistics
2. Time series: Auto-correlation, AR process, MA process, ARMA process, ARIMA process, modeling, transfer function, spectral analysis, forecasting
3. Markov chains: Transition probabilities, steady state Markov chains
4. Data assimilation: state space formulation, static linear predictor, kalman filters

Tentative Course Outline:

Wk	Tu	Lecture/Topic	Th	Lecture/Topic
1	4/4	Introduction, descriptive statistics, random variables	4/6	Independence, random functions, **HW 1**
2	4/11	Random functions, Moments of a distribution ***(V)***	4/13	Random Variables and distributions **Guided Project Lab (Kear 302)**
3	4/18	Commonly used probability distributions,	4/20	Parameter estimation, Covariance and correlation
4	4/25	Time Series Analysis: Realizations and Ensembles, Stationarity, Auto-correlation and correlogram ***(V)***	4/27	Time Series Analysis: Spectral density, test of significance, removing periodicities ***(V)***
5	5/2	Time series Analysis: Spectral density, test of significance, removing periodicities **HW 2** **HW 1 due**	5/4	Time series Analysis: Partial Autocorrelation function, ARIMA/Box Jenkins models, Identifying model structure
6	5/9	Time series Analysis: Partial Autocorrelation function, ARIMA/Box Jenkins models, Identifying model structure	5/11	Time Series Analysis: Parameter estimation and Calibration
7	5/16	Time Series Analysis: Parameter estimation and Calibration **HW 3** **HW 2 due**	5/18	**Guided Project Lab (Kear 302)**
8	5/23	Time Series Analysis: Model Selection, Forecasting ***(V)***	5/25	Markov chains: Transition probabilities, steady state Markov chains
9	5/30	Markov chains: Transition probabilities, steady state Markov chains	6/1	Data Assimilation: Kalman filter
10	6/6	Data Assimilation: Kalman filter	6/8	**Project Presentations** **HW 3 due by Friday, 6/8.**