Random Processes and Kalman Filtering (ESE 425), Fall 2016

Syllabus

Time: T-Th 1:00 to 2:30 pm.
Room: Whitaker 218
Instructor: Mr. Randall Hoven, hovenr@ese.wustl.edu
Office/Hrs: Urbauer 211C. (Hours subject to change. See separate document.)
TA: Daniel Schneiderman, dschneiderman14@gmail.com; Reese Frerichs, reese.frerichs@gmail.com.
TA Hours: Mondays, 5:30-7 pm, Calc Help Room (Lopata 323)
Prereq: ESE 326 and ESE 351 or equivalent.

Course catalogue description: Probability and random variables; random processes; linear dynamic systems and random inputs; autocorrelation; spectral density; the discrete Kalman filter; applications; the extended Kalman filter for nonlinear dynamic systems. Kalman filter design using a computer package, mean square estimation; maximum likelihood; Wiener filtering and spectral factorization, LQG/LTR control.

Material covered, pace and schedule. The tentative plan is to cover the topics below, in the order given. (Each line is one week, with that Tuesday’s date given.)
5. 9/27. Gauss-Markov and Weiner processes. Linear systems.
7. 10/11. Transient analysis.
10. 11/1. Optimal estimation.
12. 11/15. The Kalman Filter and applications.
17. 12/20. FINAL EXAM on Dec. 20, 1-3 pm.

A homework set will be due every Tuesday, starting the 2nd week of class, except Oct. 25. Each midterm exam will be held on a Thursday and will cover lecture material through the previous Thursday. The Final exam will be comprehensive.

The Course Outline and more detailed schedule are provided separately, and may be updated as changes occur throughout the semester.
Communication: We will use Blackboard (bb.wustl.edu). Blackboard will be your source for class information such as the syllabus, homework assignments, etc. I also encourage you to communicate with me via email for help on homework, etc., and especially notice of absence.

Grades: Grades will be based on

- Homework, Attendance, Participation* (15%).
- Two mid-term exams (25% each, 50% of total).
- Comprehensive Final Exam (35% of total).

*There will be approximately 14 homework assignments. Attendance will be taken each class and the semester average will count as one homework. Participation in the PreReq quiz will count as one homework. Participation in the end-of-semester Student Evaluation will replace your lowest homework/attendance score with 100%.

Guidelines for grades: A = 90-100, B = 80-90, C = 70-80, D = 60-70, F = < 60. The actual distribution of scores could affect the thresholds used to convert to letter grades.

Pass/Fail Policy. If you take this class Pass/Fail, you must receive a minimum grade of C- to get a Pass; a D or F (including D+) is considered a Fail.

NOTE: All exams count. I do not drop the lowest one or average it with the Final, etc. The above allocation of points is firm. NO MAKE-UP EXAMS. NO EXTRA CREDIT.

You will receive a grade of zero for any exam you miss or any homework not turned in on time. There will be no “make-up” for exams missed. See below.

Missed lectures: Class attendance is considered mandatory. Attendance will be recorded and will contribute to your course grade. You (the student) are responsible for information and notices given in class.

For potential Attendance credit for a missed lecture, I require two things:

1. You must provide advanced notice (preferably by email time-stamped prior to that class’s start time). This is absolutely required.
2. The reason must be serious enough.

You may only sign an Attendance Sheet for yourself. Signing for someone else is a violation of the university’s policy on academic integrity and will not be tolerated.
Missed exams. All exams are scheduled prior to the semester. Those are the only
dates/times the exams will be given; no re-schedules or make-ups. Make sure you can
take the exams at the assigned times before the semester starts.

Any mid-term exam missed will receive a grade of zero unless I grant you an excused
absence. I require three things to consider granting an excused absence:

(1) You must provide advanced notice (by email time-stamped prior to the exam,
preferably 24 hours prior). This is absolutely required. It is too late to ask for
forgiveness after the exam has been given.
(2) The reason must be serious enough.
(3) You must provide documentation of the excuse (e.g., doctor’s note).

Missed mid-term exams, even if excused, will not be “made up”. A score will be
estimated for you based on your other work and that of the rest of the class. Missing two
mid-term exams, even if excused, will result in a grade of Incomplete for the course.

Final Exam. The Final Exam is part of this course and it is mandatory! It is scheduled on
Dec. 20, 1-3 pm, so check your schedule now and ensure you can make that scheduled
exam period. There is no make-up or other scheduled time for the Final. Missing the
Final will result in a grade of Incomplete or F for the course.

Homework policies:

• Homework assignments will be available via Blackboard. You will have an
assignment due every week, starting the 2nd week of class. It is your responsibility
to know the assignment.

• Homework must be put in the bin outside Urbauer 211, marked “ESE 425
HOVEN”, by 6 pm on Tuesday.

• Homework put in the wrong homework bin, or put in the bin after the due date
and time, will receive a grade of zero. (If you have a good reason, and if I’m
notified in advance, it is OK to scan your homework and email it to me by the due
date/time.)

• Homework solutions and grades will be available on Blackboard (after the due
date/time). Your graded homework will be returned in the Pendaflex folders,
Lopata Level 3. (Also check the “ESE 425” folder at the end of the other folders.)

• Show your work! An answer with no work or large gaps will receive minimal
credit. It is your responsibility to make all steps and calculations clear to the
homework grader.

• Homework is part of your grade. Each homework set will count as about 1% of
your total course score, for a total of about 14% of total course score (more than
an entire letter grade).

• Homework is a critical part of learning. Do not expect it to be easy or quick.
Expect it to take 6-9 hours per week.

• You may ask me or the TA for help with your homework. You may also
collaborate with other students. However, you may not simply copy someone
else’s work. This is a violation of the university’s policy on academic integrity
and will not be tolerated.
Exam Policies.

- Mid-term exams will be administered in our normal classroom at the normal class time. All are scheduled on Thursdays.
- You must be on time.
- Seating for exams might be assigned. You will be notified of seat assignments prior to the exam.
- Cheating in any form (including letting others cheat from you) will not be tolerated. The minimum penalty will be a score of zero for that exam. Other possible penalties include a grade of F for the course and referral to the Engineering School’s Discipline Committee.
- Talking to another student during the exam is considered cheating. If you have any questions during the exam, ask me (or exam proctor).
- You will be told what you may use during an in-class exam, potentially including formula sheets or the textbook. But in no case may you use calculators, lap-tops, ipods, cell phones, earphones, or other electronic devices. Use of such devices during an in-class exam will be considered a form of cheating.
- No restroom breaks or other breaks during the exam. Once you leave the room, you are done with your exam.

Accommodation for Disabilities. If you need exam accommodations based on the impact of a disability, you must show me a copy of your Cornerstone VISA (email of a scanned copy is OK) at least one week prior to the first exam you will take with Cornerstone.

Accommodations based upon sexual assault:
The University is committed to offering reasonable academic accommodations to students who are victims of sexual assault. Students are eligible for accommodation regardless of whether they seek criminal or disciplinary action. Depending on the specific nature of the allegation, such measures may include but are not limited to: implementation of a no-contact order, course/classroom assignment changes, and other academic support services and accommodations. If you need to request such accommodations, please direct your request to Kim Webb (kim_webb@wustl.edu), Director of the Relationship and Sexual Violence Prevention Center. Ms. Webb is a confidential resource; however, requests for accommodations will be shared with the appropriate University administration and faculty. The University will maintain as confidential any accommodations or protective measures provided to an individual student so long as it does not impair the ability to provide such measures.

If a student comes to me to discuss or disclose an instance of sexual assault, sex discrimination, sexual harassment, dating violence, domestic violence or stalking, or if I otherwise observe or become aware of such an allegation, I will keep the information as private as I can, but as a faculty member of Washington University, I am required to immediately report it to my Department Chair or Dean or directly to Ms. Jessica Kennedy, the University’s Title IX Coordinator. If you would like to speak with the Title IX Coordinator directly, Ms. Kennedy can be reached at (314) 935-3118, jw kennedy@wustl.edu, or by visiting her office in the Women’s Building.
Additionally, you can report incidents or complaints to Tamara King, Associate Dean for Students and Director of Student Conduct, or by contacting WUPD at (314) 935-5555 or your local law enforcement agency.

You can also speak confidentially and learn more about available resources at the Relationship and Sexual Violence Prevention Center by calling (314) 935-8761 or visiting the 4th floor of Seigle Hall.

**Bias Reporting:**
The University has a process through which students, faculty, staff and community members who have experienced or witnessed incidents of bias, prejudice or discrimination against a student can report their experiences to the University’s Bias Report and Support System (BRSS) team. See: [brss.wustl.edu](http://brss.wustl.edu)

**Mental Health:**
Mental Health Services’ professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. See: [shs.wustl.edu/MentalHealth](http://shs.wustl.edu/MentalHealth)