CURRICULUM COMMITTEE REPORT

The Curriculum Committee recommends the following courses to the Graduate Board for approval at its October 27, 2016 meeting.

New Courses:

ECE 584 Estimation Theory

The Graduate School

THE UNIVERSITY OF MAINE

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October 3, 2016

To: Curriculum Committee:
Scott Delcourt
Ali Abedi
Pat Burnes
Deborah Rooks-Ellis
Grant Miles
Xuan Chen
Deborah Rollins

Fr: Erin Twitchell, Administrative Specialist

Re: **Curriculum Committee, October 4th, 2016 Stodder Hall, Room #48**

The following courses will be presented on **Tuesday, October 4th at 2 p.m.** in the Graduate School's Conference Room, 48 Stodder Hall.

1. 2:10-2:20 ECE 584

   Ali Abedi

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GRADUATE SCHOOL

THE UNIVERSITY OF MAINE

NEW COURSE PROPOSAL/MODIFICATION/ELIMINATION FORM FOR GRADUATE COURSES

Graduate course proposals, modifications, or eliminations must be submitted to the Graduate School no later than the 3rd of each month. Please refer to the Graduate School website for the Curriculum Committee meetings schedule. Electronic signatures and submission is required.

Please return the completed e-form with appropriate signatures and documentation to the Graduate School by saving the form to your desktop and sending as an attachment to erin.twitchell@maine.edu. Please include in the subject line 'Course Proposal' and the course designator and number.

GRADUATE PROGRAM/UNIT **Electrical and Computer Engineering**

COURSE DESIGNATOR **ECE** COURSE NUMBER **584** EFFECTIVE SEMESTER **S'17**

COURSE TITLE **Estimation Theory**

REQUESTED ACTION

NEW COURSE (check all that apply, complete Section 1, and submit a complete syllabus):

- [x] New Course
- [ ] New Course with Electronic Learning
- [ ] Experimental

MODIFICATION (Check all that apply and complete Section 2):

- [ ] Designator Change
- [ ] Number Change
- [ ] Title Change
- [ ] Description Change
- [ ] Prerequisite Change
- [ ] Credit Change
- [ ] Cross Listing (must be at least 400-level)[1]
- [ ] Other (specify)

ELIMINATION:

- [ ] Course Elimination

ENDORSEMENTS

Please sign using electronic signatures. If you do not already have a digital signature, please click within the correct box below and follow the on-screen instructions.

Leader, Initiating Department/Unit(s)

9/19/2016

College(s) Curriculum Committee Chair(s) (if applicable)

9-20-16

College Dean(s)

Graduate School [sign and date]

1. Courses cross-listed below 400-level require the permission of the Graduate School.

SECTION 1 (FOR NEW COURSE PROPOSALS)

Proposed Catalog Description (include designator, number, title, prerequisites, credit hours):

This graduate level course is designed to follow the stochastic processes course. The main goal of this course is to help students understand concepts of estimation theory with specific focus on stochastic prediction. Both theoretical and practical aspects of estimation theory are covered. Topics include: modeling linear dynamic systems, linear prediction and filtering, implementation issues, non-linear prediction, and diagnostics statistics. Computer simulation will be used to implement the theories and solve real world problems such as navigation using sensors.
Note: Students are required to have knowledge of probability theory and advanced statistics.

Prerequisite: ECE 515 or Instructor's Permission

Credits: 3

Components (type of course/used by Student Records for MaineStreet) – *Multiple selections are possible for courses with multiple non-graded components:*

☐ Applied Music ☐ Clinical ☐ Field Experience/Internship ☒ Research ☐ Studio
☐ Laboratory ☐ Lecture/Seminar ☐ Recitation ☐ Independent Study ☐ Thesis

Text(s) planned for use:

Kalman Filtering: Theory and Practice, M. S. Grewal, A. P. Andrews, 4th Ed, Wiley, 2014, ISBN: ISBN: 978-1-118-85121-0

Course Instructor (include name, position, teaching load):

Dr. Ali Abedi, Professor of Electrical and Computer Engineering, Load: 2-2.

Reason for new course:

This course was first offered under experimental number ECE-584 in summer 2010 to train students for their research. It was offered again in Summer 2015 under ECE 598 special topics and since the research program in wireless communications area has grown and established more now, we plan to offer this every other year.

Does the course addition require additional department or institutional facilities, support and/or resources, e.g. new lab facilities, computer support and services, staffing (including graduate teaching assistants), or library subscriptions and resources?

◉ No. The department will not request additional resources for this course.

○ Yes. Please list additional resources required and note how they will be funded or supported.

What other departments/programs are affected (e.g. course overlap, prerequisites)? Have affected departments/programs been consulted? Any concerns expressed? Please explain.

No other departments offer similar course. Therefore, there is no effect on other departments. As a side note, students in School of computing might be interested to take this course.

How often will this course be offered? Will offering this course result in overload salary payments, either through the college or CED, either to the instructor of this course or to anyone else as a result of rearranging teaching assignments?

Every other year during Spring or summer semesters. If it is offered in Summer, yes, overload will be requested through CED. If it is offered during Spring, no overload will be required.

Syllabus and Course Description

Course Information

ECE-584: Estimation Theory (3 Cr. Hr.)
Lecture times: TBD, **Location:** TBD

Course description: This graduate level course is designed to follow the stochastic processes course. The main goal of this course is to help students understand concepts of estimation theory with specific focus on stochastic prediction. Both theoretical and practical aspects of estimation theory are covered. Topics include: modeling linear dynamic systems, linear prediction and filtering, implementation issues, non-linear prediction, and diagnostics statistics. Computer simulation will be used to implement the theories and solve real world problems such as navigation using sensors.

Note: Students need to have knowledge of probability theory and advanced statistics.

Prerequisite: ECE 515 (Random Variables and Stochastic Processes) or Instructor's permission.

Instructor Information

Instructor: Dr. Ali Abedi, Professor of Electrical and Computer Engineering
Office: 275 Barrows / ESRB, **Phone:** 207-581-2231, **E-mail:** ali.abedi@maine.edu
Office Hours: TBD

Instructional Materials and Methods

Textbook: Kalman Filtering: Theory and Practice, M. S. Grewal, A. P. Andrews, 4th Ed, Wiley, 2014, ISBN: ISBN: 978-1-118-85121-0 **(Required)**

Lecture Notes and Selected IEEE Transaction papers: lecture notes and titles of IEEE papers will be posted in **classroom.google.com**. Use code **TBD** to join this class on Google Classroom app or web interface. Students will need to use IEEE Xplore Digital Library to download the papers.

Grading and Course Expectations

Students' performance is evaluated based on the following items: HW 40%, Midterm 30%, Final 30%.

Learning Outcomes

Course goals

This is a foundational course in signal processing with specific focus on estimation theory and techniques. In this course, you will learn how to utilize matrices for advance signal processing and prediction in both linear and non-linear systems with discrete and continuous signals. This course prepares you for more advanced courses in signals and systems, communications, and control as well as several other courses in other disciplines including systems theory.

Student learning objectives

The learning objectives of this course are itemized as follows:

a) Learn how to use matrix theory including: matrix operations, decompositions, and quadratic forms in estimation theory.
b) Ability to model linear dynamic systems and analyze both continuous linear systems and discrete linear systems.

c) Learn theories behind linear prediction including Kalman filtering, Kalman-Bucy filtering, and optimal linear predictors techniques.
d) Ability to address implementation challenges such as round-off errors using factorization methods, and other pertinent implementation methods

e) Learn the theories behind non-linear prediction including affine Kalman filtering, linear approximation of non-linear methods, and unscented Kalman filtering.
f) Solve problems in practical applications using techniques such as diagnostics statistics, pre-filtering and data rejection, and suboptimal methods.

Homework Assignments:

All homework assignments are due at 12:00noon on dates posted on Google Classroom in PDF format. The HWs solutions are posted after the deadline. Late homework or HWs not following the format standard will NOT be accepted.

HW-1	Ch 1	1.1, 1.2, 1.3, 1.4
HW-2	Ch 2	2.2, 2.4, 2.6, 2.8, 2.10, 2.12, 2.14, 2.16
HW-3	Ch 5	5.2, 5.4, 5.6, 5.8, 5.10, 5.12, 5.14, 5.16
Midterm		
HW-4	Ch 7	7.1, 7.3, 7.5, 7.7, 7.9, 7.11, 7.13, 7.15
HW-5	Ch 8	8.2, 8.4, 8.6, 8.8, 8.10, 8.12, 8.14
HW-6	Ch 9	9.1, 9.3, 9.5, 9.7
Final Exam		

Please note the following four University of Maine policy statements:

1. **Academic Honesty Statement:** Academic honesty is very important. It is dishonest to cheat on exams, to copy term papers, to submit papers written by another person, to fake experimental results, or to copy or reword parts of books or articles into your own papers without appropriately citing the source. Students committing or aiding in any of these violations may be given failing grades for an assignment or for an entire course, at the discretion of the instructor. In addition to any academic action taken by an instructor, these violations are also subject to action under the University of Maine Student Conduct Code. The maximum possible sanction under the student conduct code is dismissal from the University.
2. **Students with disabilities statement:** If you have a disability for which you may be requesting an accommodation, please contact Disabilities Services, 121 East Annex, 581-2319, as early as possible.
3. **Course Schedule Disclaimer (Disruption Clause):** In the event of an extended disruption of normal classroom activities, the format for this course may be modified to enable its completion within its programmed time frame. In that event, you will be provided an addendum to the syllabus that will supersede this version.
4. **Sexual Violence Policy: Sexual Discrimination Reporting**
   The University of Maine is committed to making campus a safe place for students. Because of this commitment, if you tell a teacher about an experience of **sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct or any form of gender discrimination** involving members of the campus, **your teacher is required to report** this information to the campus Office of Sexual Assault & Violence Prevention or the Office of Equal Opportunity.
   If you want to talk in confidence to someone about an experience of sexual discrimination, please contact these resources: For *confidential resources on campus*: **Counseling Center: 207-581-1392** or **Cutler Health Center: at 207-581-4000**.
   For *confidential resources off campus*: **Rape Response Services:** 1-800-310-0000 or **Spruce Run**: 1-800-863-9909.
   Other resources: The resources listed below can offer support but may have to report the incident to others who can help: **For *support services on campus*: Office of Sexual Assault & Violence Prevention: 207-581-1406, Office of Community Standards: 207-581-1409, University of Maine Police: 207-581-4040 or 911. Or see the OSAVP website for a complete list of services at http://www.umaine.edu/osavp/**