EE 5322- Intelligent Control Systems

COURSE SYLLABUS AND ADMINISTRATIVE POLICY

Updated: Saturday, September 08, 2018 by F.L. Lewis

This is a UTA Web-Based Course. The internet URL is linked to
http://www.uta.edu/utari/acs
Related webpages:
   Systems and Controls Thrust Area
   EE 5322 Homepage

UT Arlington Honor Code

I pledge, on my honor, to uphold UT Arlington’s tradition of academic integrity, a
tradition that values hard work and honest effort in the pursuit of academic
excellence.

I promise that I will only submit work that I personally create or contribute to group
collaborations, and reference any work from other sources. I will follow the highest
standards of integrity and uphold the spirit of the Honor Code.

Catalog Information: EE 5322. INTELLIGENT CONTROL SYSTEMS (3-0). Principles
of intelligent control including adaptive, learning, and self-organizing systems. Neural networks
and fuzzy logic systems for feedback control. Discrete event systems and decision-making
supervisory control systems. Manufacturing work-cell control. Advanced sensor processing
including Kalman filtering and sensor fusion.

Prerequisite: consent of instructor. A knowledge of EE 5307 Linear Dynamical Systems is
desirable

Course Objectives: To provide students with a firm foundation in Intelligent, Learning, and
Decision-making control systems. To study classical sensor fusion techniques such as Kalman
Filtering and also novel intelligent control systems based on neural networks and fuzzy logic
systems. To study formats for decision systems including expert systems, discrete event systems,
Petri nets, and their relations to fuzzy logic and rule-based systems. MATLAB simulations will
provide design experience and insight for intelligent control system design.

Topics Covered: see separate schedule.

Class hours: T Th 330-450pm, NH 110

Instructor: F.L. Lewis, tel: 272-5972, office: UTARI room 215 (off campus), lewis@uta.edu
Office hours: after class

Teaching Assistant: Victor Lopez, victor.lopezmejia@mavs.uta.edu
TA Office Hours:  Mondays and Thursdays from 10am to 1pm in NH132.

2)  Student Edition of Matlab
3)  Notes on the web.

Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Homework</td>
<td>20%</td>
</tr>
<tr>
<td>Exam 1</td>
<td>20%</td>
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<tr>
<td>Exam 2</td>
<td>25%</td>
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<tr>
<td>Pop quizzes in class</td>
<td>10%</td>
</tr>
<tr>
<td>Final Project report – in IEEE Format</td>
<td>25%</td>
</tr>
</tbody>
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The instructor reserves the right to make appropriate changes to the grading policy.

Submission of Homeworks and Posting of Solutions:
Homeworks and exams should be submitted to the GTA through Blackboard online. Solutions will also be posted on Blackboard.

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Student Learning Outcomes:

1. Students will understand the relation between various intelligent design tools including neural networks, fuzzy logic, Bayes methods, Dempster-Shafer, Petri Nets, and Rule-based Systems.
   **Assessment**: homeworks and design projects assigned in examinations.

2. Students will be able to perform designs with various intelligent control tools using MATLAB computer simulation toolboxes.
   **Assessment**: computer design and simulation projects assigned in homeworks.

3. Students will understand the relation between electrical engineering control systems methods and computer science design tools in applications such as mobile robots, decision and sensor fusion, and intelligent control architectures.
   **Assessment**: design and simulation projects on (1) sensor fusion/signal processing, and (2) mobile robots assigned in homeworks.

4. Students will understand the context of control systems design including the history of control and ethical responsibilities of engineers.
   **Assessment**: Final Project Report.

5. Students will learn to perform a survey and literature search and prepare a research paper with a unified presentation and exposition on a selected topic.
   **Assessment**: Final Project Report.

Relation to Program Objectives.  This is a course in modern learning and decision-making systems for feedback control. Objectives include presenting neural networks and fuzzy logic systems for feedback control, sensor fusion, and control decision making. Also presented are rule based systems including expert systems, discrete event systems, and Petri nets. Classical tools for
sensor fusion such as Kalman Filtering will be treated, as well as adaptive system identification techniques. This course builds on classical control techniques and modern state-variable systems and extends them to intelligent decision-making systems.

**Attendance** is not mandatory. However, it is more fun for me to teach to a full class. If attendance begins to tail off, I will start giving pop quizzes in class.

If you skip classes, you will find the homework and exams more difficult. Due to the pace of the lectures, copying someone else's notes may be an unreliable way of making up an absence. You are responsible for all material covered in class regardless of absences. **If you skip class, please do not ask questions next time about the material you missed. If you attend class, questions are always encouraged.**

You will need to use MATLAB, including the neural network, controls, and DSP toolbox. MATLAB is installed on the ACS network. Using the Student Edition of MATLAB you can install it on your own PC or MAC.

Check the **grading of the exams** thoroughly. You will have one week after the exam to see the GTA for regrading. After this period, the grade is final.

**Questions** during class are strongly encouraged. The worst thing I can do is move too slowly and bore you. The next worst thing I can do is move too quickly and confuse you. If either of these occurs, it is your responsibility to speak up. You are paying for an education, and if the material is not presented clearly with confusion being eliminated shortly after it sets in you are not getting what you contracted for. On the other hand, if I never confuse you I am being unduly conservative and hence not conscientious. There is a very fine balance here, with you as student and me as instructor each having very definite responsibilities for keeping open all channels of communication. It is extremely difficult to teach a course without some sort of real-time feedback.

**Some philosophy.** I have an attitude toward learning which is based very heavily on independence and self-reliance; it can be summed up in the statement

"**Knowledge cannot be given, but comes only with great personal sacrifice and effort.**"

It is my job to make knowledge available to you and show you one attitude toward it based on my experience in the area. It is your job to make it a part of yourself and so your own personal possession.

**General UTA Policy**

**Attendance:** At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, my attendance policy is detailed above. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an
Engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/ao/fao/).

**Disability Accommodations:** UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including The Americans with Disabilities Act (ADA), The Americans with Disabilities Amendments Act (ADAAA), and Section 504 of the Rehabilitation Act. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a **letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

**The Office for Students with Disabilities, (OSD)** [www.uta.edu/disability](http://www.uta.edu/disability) or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability).

Counseling and Psychological Services, (CAPS) [www.uta.edu/caps](http://www.uta.edu/caps) or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

**Non-Discrimination Policy:** The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit [uta.edu/eos](http://uta.edu/eos).

**Title IX Policy:** The University of Texas at Arlington (“University”) is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. **For information regarding Title IX, visit [www.uta.edu/titleIX](http://www.uta.edu/titleIX)** or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.
**Academic Integrity:** Students enrolled in all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington’s tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents’ Rule* 50101, §2.2, suspected violations of university’s standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student’s suspension or expulsion from the University. Additional information is available at [https://www.uta.edu/conduct/](https://www.uta.edu/conduct/).

**Lab Safety Training:** Lab Safety Training is not required for this course.

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at [http://www.uta.edu/oit/cs/email/mavmail.php](http://www.uta.edu/oit/cs/email/mavmail.php).

**Campus Carry:** Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit [http://www.uta.edu/news/info/campus-carry/](http://www.uta.edu/news/info/campus-carry/).

**Student Feedback Survey:** At the end of each term, students enrolled in face-to-face and online classes categorized as “lecture,” “seminar,” or “laboratory” are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback via the SFS database is aggregated with that of other students enrolled in the course. Students’ anonymity will be protected to the extent that the law allows. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate
results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit http://www.uta.edu/sfs.

**Final Review Week:** for semester-long courses, a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located [insert a description of the nearest exit/emergency exit]. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Students should also be encouraged to subscribe to the MavAlert system that will send information in case of an emergency to their cell phones or email accounts. Anyone can subscribe at https://mavalert.uta.edu/ or https://mavalert.uta.edu/register.php

**Student Support Services:** UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at http://www.uta.edu/universitycollege/resources/index.php.

The IDEAS Center (2nd Floor of Central Library) offers free tutoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. To schedule an appointment with a peer tutor or mentor email IDEAS@uta.edu or call (817) 272-6593.

The English Writing Center (411LIBR): The Writing Center Offers free tutoring in 20-, 40-, or 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Our hours are 9 am to 8 pm Mon.-Thurs., 9 am-3 pm Fri. and Noon-6 pm Sat. and Sun. Register and make appointments online.
at http://uta.mywconline.com. Classroom Visits, workshops, and specialized services for graduate students are also available. Please see www.uta.edu/owl for detailed information on all our programs and services.

The Library’s 2nd floor Academic Plaza offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the library’s hours of operation. http://library.uta.edu/academic-plaza

**Emergency Phone Numbers**: In case of an on-campus emergency, call the UT Arlington Police Department at 817-272-3003 (non-campus phone), 2-3003 (campus phone). You may also dial 911. Non-emergency number 817-272-3381

From the UT Arlington Library.

Faculty members should feel free to incorporate any of the following information into your course syllabus or other course materials. All library services can be found by going to the main page. For direct links, see below.

**Library Home Page** library.uta.edu

**Resources for Students**

**Academic Help**
Academic Plaza Consultation Services library.uta.edu/academic-plaza
Ask Us ask.uta.edu/
Library Tutorials library.uta.edu/how-to
Subject and Course Research Guides libguides.uta.edu
Subject Librarians library.uta.edu/subject-librarians

**Resources**
A to Z List of Library Databases libguides.uta.edu/az.php
Course Reserves pulse.uta.edu/vwebv/enterCourseReserve.do
FabLab fablab.uta.edu/
Special Collections library.uta.edu/special-collections
Study Room Reservations openroom.uta.edu/

**Teaching & Learning Services for Faculty**
Copyright Consultation library-sc@listserv.uta.edu
Course Research Guide Development, Andy Herzog amherzog@uta.edu or your subject librarian
Data Visualization Instruction, Peace Ossom-Williamson peace@uta.edu
Digital Humanities Instruction, Rafia Mirza rafia@uta.edu
Graduate Student Research Skills Instruction, Andy Herzog amherzog@uta.edu or your subject librarian
Project or Problem-Based Instruction, Gretchen Trkay gtrkay@uta.edu
Undergraduate Research Skills Instruction, Gretchen Trkay gtrkay@uta.edu or your subject librarian.