

Course Syllabus

Title of Course

EEL 6617, Multivariable Linear Control

Class Periods: M W F 7, 3:00-3:50PM

Location: CHE 0316

Academic Term: Fall 2019

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Instructor:

Dr. Jacob Hammer

hammer@mst.ufl.edu

Office Phone Number 392-4934

Office Hours: MWF 3:50-4:40PM

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

- NA
- NA

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Course Description

Transfer matrix theory of systems, emphasis on feedback, internal stability, model matching and the assignment of invariant factors.

Course Pre-Requisites / Co-Requisites

EEL 5182, MAS 4105

Course Objectives

- **Specific Outcomes of Instruction:** A course on the transfer matrix theory of linear multivariable systems. The course will cover the theory of linear feedback control systems, using transfer matrices as the basic description of a system. The main control theoretic topics will be stabilization and pole assignment for multivariable systems.
- **Brief List of Topics to Be Covered**
- The algebraic theory of transfer matrices; Canonical forms (5 weeks).
- Integer invariants (Controllability and Observability indices) (2 weeks).
- Internal stability of composite systems (1 week).
- Model matching and stabilization of linear systems (2 weeks).
- State feedback and the Rosenbrock Theorem (2 weeks).
- Input/output assignment of invariant factors (2 weeks).

Materials and Supply Fees

List if applicable

Required Textbooks and Software

None

Recommended Materials

1. Kailath, "Linear systems", Prentice-Hall, NJ, 1980 (Chapters 6, 7, 8).

C.C. MacDuffee, "The theory of matrices", Chelsea Publishing Company, NY.

H.H. Rosenbrock, "State space and multivariable theory", John Wiley and Sons, NY.

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is recommended but not required.

Missed homeworks and exams can be made up, if properly justified.

Excused absences must be in compliance with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance> [_\(http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance\)_](http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance)) and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets	10 each	10%
Midterm Exam	100	35%
Final Exam	100	55%

100%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.0 - 100.0	A	4.00
90.0 - 92.9	A-	3.67
87.0 - 89.9	B+	3.33
83.0 - 86.9	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 - 76.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 65.9	D	1.00

60.0 - 62.9 D- 0.67

0 - 59.9 E 0.00

More information on UF grading policy may be found at: <http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>
(<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>)

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals> (<https://evaluations.ufl.edu/evals>). Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/> (<https://evaluations.ufl.edu/results/>).

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received

unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu (<mailto:rbielling@eng.ufl.edu>)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu (<mailto:taylor@eng.ufl.edu>)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu (<mailto:nishida@eng.ufl.edu>)

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html> [\(https://registrar.ufl.edu/ferpa.html\)](https://registrar.ufl.edu/ferpa.html)

Campus Resources:

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Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu \(mailto:umatter@ufl.edu\)](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc> [_\(http://www.counseling.ufl.edu/cwc\)_](http://www.counseling.ufl.edu/cwc), and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](https://titleix.ufl.edu/) [_\(https://titleix.ufl.edu/\)_](https://titleix.ufl.edu/), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu \(mailto:title-ix@ufl.edu\)](mailto:title-ix@ufl.edu)

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/> [\(http://www.police.ufl.edu/\)](http://www.police.ufl.edu/).

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml>
[_ \(https://lss.at.ufl.edu/help.shtml\)_](https://lss.at.ufl.edu/help.shtml).

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>
[_ \(https://www.crc.ufl.edu/\)_](https://www.crc.ufl.edu/).

Library Support, <http://cms.uflib.ufl.edu/ask> [_ \(http://cms.uflib.ufl.edu/ask\)_](http://cms.uflib.ufl.edu/ask). Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>
[_ \(https://teachingcenter.ufl.edu/\)_](https://teachingcenter.ufl.edu/).

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>
[_ \(https://writing.ufl.edu/writing-studio/\)_](https://writing.ufl.edu/writing-studio/).

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf
[. \(https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf\)](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process> [. \(http://www.distance.ufl.edu/student-complaint-process\)](http://www.distance.ufl.edu/student-complaint-process).

Course Summary:

Date	Details	
Fri Dec 16, 2016	 final grades (https://ufl.instructure.com/courses/369408/assignments/3902192)	due by 11:59pm
Wed Sep 5, 2018	 Homework 1 (https://ufl.instructure.com/courses/369408/assignments/3902193)	due by 11:59pm
Fri Sep 14, 2018	 Homework 2 (https://ufl.instructure.com/courses/369408/assignments/3902194)	due by 11:59pm
Mon Sep 24, 2018	 Homework 3 (https://ufl.instructure.com/courses/369408/assignments/3902195)	due by 11:59pm
Mon Oct 1, 2018	 Homework 4 (https://ufl.instructure.com/courses/369408/assignments/3902196)	due by 11:59pm
Mon Oct 8, 2018	 Homework 5 (https://ufl.instructure.com/courses/369408/assignments/3902197)	due by 11:59pm
Mon Oct 15, 2018	 Homework 6 (https://ufl.instructure.com/courses/369408/assignments/3902198)	due by 11:59pm

Date	Details	
Mon Oct 29, 2018	 Homework 7 (https://ufl.instructure.com/courses/369408/assignments/3902199)	due by 11:59pm
Thu Nov 1, 2018	 midterm exam (https://ufl.instructure.com/courses/369408/assignments/3902202)	due by 11:59pm
Fri Nov 2, 2018	 Homework 8 (https://ufl.instructure.com/courses/369408/assignments/3902200)	due by 11:59pm
Wed Dec 5, 2018	 Homework 9 (https://ufl.instructure.com/courses/369408/assignments/3902201)	due by 11:59pm
Mon Dec 10, 2018	 final exam (https://ufl.instructure.com/courses/369408/assignments/3902191)	due by 11:59pm