AE 157: Automatic Control & Systems Design for Aerospace Systems
Professor Kamran Turkoglu, Department of Aerospace Engineering, San Jose State University, Spring 2018

Syllabus

Contact Information

Instructor: Kamran Turkoglu
Office Location: ENG 272C
Email: kamran.turkoglu@sjsu.edu
Office Hours: Tuesday, 8-10am
Class Hours: Monday-Wednesday, 10.30am - 11.45am
Classroom: Boccardo Business Center 004
Prerequisites: "C" or better in Math 129A, Math 133A, and AE 138
Class Code:
Website: http://www.engr.sjsu.edu/kamran/

TA: (Grader) Zach Hughes - zachary.hughes@sjsu.edu
Problem solving hours: TBA
TA/Grader Office Hours: TBA

Mid-term Exam(s):
There will be 2(two) 75min in-class written exams, and 4(four) 15min written Quizes.
Quizes and (final) exams cannot be made up without a valid, documented excuse (i.e. Dr.'s note).
There is NO make up exam policy!!

Final Exam
There will be a final project with a due date of May 21st, 2018 Monday at 12pm (with online delivery in Canvas). NO late deliveries will

Text Book:
- K. Ogata, Modern Control Engineering, Prentice Hall.
- Classnotes
- Handouts
(HIGHLY Recomended) Reference(s):
- R. Murray, Feedback Control Theory, Caltech, 2015
- Farid Golnaraghi, Benjamin C. Kuo, Automatic Control Systems, Wiley, 2009

Schedule

Important
*If you miss a lecture, please make sure that you obtain the notes of that specific class from your class-mates.
'I did not know how to do this problem, because I missed lecture the day this material was covered' is, unfortunately, NOT a valid excuse!*

Important
*All Monday classes will be held online, while all Wednesday classes will meet in person, in BBC_04!*

Important
Students will have 1(one) week grace period where they could share any possible concern about their grade of that specific assignment. After that 1(one)-week grace period, the grades will be final. PLEASE do not come and discuss your HW-01 on Week14 ...etc. !

- Week-1:
  - (01/23) Wednesday:
    - Introduction and class material review

- Week-2:
  - (01/29) Monday ONLINE :
- Introduction to Control Systems (1/2)
  - Reading Assignment Week 01: (Ogata) Chapter 1 - Introduction to Control Systems
    - (01/31) Wednesday:
      - Introduction to Control Systems (2/2)

- Week-3:
  - (02/05) Monday ONLINE:
    - Introduction to Matlab and Simulink
  - (02/07) Wednesday:
    - Laplace Transform
    - HW_01 out!!
    - Reading Assignment Week 02: (Ogata) Chapter 2 - Laplace Transform

- Week-4:
  - (02/12) Monday ONLINE:
    - Mathematical Modeling of Dynamic Systems (1/2)
    - Reading Assignment Week 03: (Ogata) Chapter 3 - Mathematical Modeling of Dynamic Systems
  - (02/14) Wednesday:
    - Mathematical Modeling of Dynamic Systems (2/2)

- Week-5:
  - (02/19) Monday ONLINE:
    - Transient Response Analysis (1/2)
    - Reading Assignment Week 04: (Ogata) Chapter 4 - Transient Response Analysis
  - (02/21) Wednesday:
    - Transient Response Analysis (2/2)
    - Quiz_01 !!!
    - HW_01 in!!
    - HW_02 out!!

- Week-6:
  - (02/26) Monday ONLINE:
    - Basic Control Actions and Response of Control Systems (1/2)
    - Reading Assignment Week 05: (Ogata) Chapter 5 - Basic Control Actions and Control Response
  - (02/28) Wednesday:
    - Basic Control Actions and Response of Control Systems (2/2)

- Week-7:
  - (03/05) Monday ONLINE:
    - Root Locus Analysis (1/2)
    - Reading Assignment Week 06: (Ogata) Chapter 6 - Root Locus Analysis
  - (03/07) Wednesday:
    - HW-02 in !!!
    - Root Locus Analysis (2/2)
    - Control Systems Design (1/2)
    - Reading Assignment Week 07: (Ogata) Chapter 7 - Control System Design

- Week-8:
  - (03/12) Monday ONLINE:
    - Control Systems Design (2/2)
  - (03/14) Wednesday:
    - Frequency Response Analysis (1/2)
    - Reading Assignment Week 08: (Ogata) Chapter 8 - Frequency Response Analysis

- Week-9:
  - (03/19) Monday:
    - Exam_01 !!!
  - (03/21) Wednesday:
    - Quiz_02 !!
    - HW_03 out !!
    - Frequency Response Analysis (cont’d) (2/2)

- Week-10:
  - (03/26) Monday:
    - SPRING BREAK!! No Class!
  - (03/28) Wednesday:
    - SPRING BREAK!! No Class!
Course Description

Course Goals
- Develop an understanding of aerospace automatic control systems design and develop specific strategies to tackle practical engineering problems in aerospace engineering.
- Provide background in automatic control systems design with specific applications on aircrafts, spacecraft and satellites.
- Develop an understanding of the fundamental elements in classical control theory as applied to the aircrafts and spacecrafts.

Student Learning Objectives
- Outline the fundamental concepts of classical control theory as applied to aircraft and spacecraft.
- Describe transient response analysis in aircraft and satellites.
- Formulate basic control actions and frequency response of aerospace automatic control systems.
- Explain the concept of feedback and its function in aerospace vehicles.
- Analyze stability and stability margins in aerospace vehicle motions.
- Outline the fundamentals of modern control theory as it is applied to aerospace vehicles
- Determine the natural frequencies and damping ratios of aerospace vehicle dynamics.
- Evaluate the effect of feedback on aircraft and satellite control system performance.
- Justify the significance of the negative and positive feedback.
- Derive transfer functions and plot vehicle time and/or frequency response.
- Use frequency response design techniques to design closed-loop control systems: rate-damping, attitude control, altitude control.
- Design a satellite control law using classical/modern automatic control system design principles (such as PID, pole placement ... etc.).
- Design a 3-axis control law for an aerospace vehicle.

### Exams
- 2 (Two) 75 minutes in-class Mid-term exams
- Final project.

### Grading
- 4 (Four) Quizes 10%
- Homework 10%
- Two 75 min Exams 50%
- Final Project 30%

### Important !!
All exams must be taken to receive a passing grade.

### Grading Policy
- 100 - 95% A
- 94.99 - 90% A-
- 89.99 - 85% B+
- 84.99 - 80% B
- 79.99 - 75% B-
- 74.99 - 70% C+
- 69.99 - 65% C
- 64.99 - 60% C-
- 59.99 - 56% D+
- 55.99 - 53% D
- 52.99 - 50% D-
- < 50% F

### Important !!!!
This is only a rough scale. This scale may be adjusted depending on the performance of the class. Any adjustments to the scale will only lower the cut-offs to achieve a specified grade; cut-offs will not be raised beyond those listed here.

### Academic Success
Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five hours over the length of the course (hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

### Faculty Web Page and MYSJSU Messaging
Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on my faculty web page at [http://www.engr.sjsu.edu/kamran](http://www.engr.sjsu.edu/kamran) responsible for regularly checking with the messaging system through MySJSU (or other communication system as indicated by the instructor) to learn any university policies.

### University Policies

#### Dropping and Adding
Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies [http://info.sjsu.edu/static/catalog/policies.html](http://info.sjsu.edu/static/catalog/policies.html). Add/drop deadlines can be found on the current academic year calendars document on the Academic Cale [http://www.sjsu.edu/provost/services/academic_calendars/](http://www.sjsu.edu/provost/services/academic_calendars/). The Late Drop Policy is available at [http://www.sjsu.edu/aars/policies/latedrops/policy/](http://www.sjsu.edu/aars/policies/latedrops/policy/). Stay aware of the current deadlines and penalties for dropping classes.

http://www.engr.sjsu.edu/kamran/ae157/spring2018/syllabus_ae157.html
Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising. Consent for Recording of Class and Public Sl
Instructor Material University Policy S12-7, http://www.sjsu.edu/senate/docs/S12-7.pdf, requires students to obtain instructor's permission to record the c

- Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's perm
- Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You

**Academic integrity**

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University Academic Integrity Policy S07-2 at

http://www.sjsu.edu/senate/docs/S07-2.pdf requires you to be honest in all your academic course work. Faculty members are required to report all infr
- Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at http://www.sjsu.edu/studentconduct/

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacu
- Presidential Directive 97-03 at http://www.sjsu.edu/president/docs/directives/ requires that students with disabilities requesting accommodations must reg

**Student Technology Resources**

Computer labs for student use are available in the Academic Success Center at http://www.sjsu.edu/at/asc/ located on the 1st floor of Clark Hall and in the

A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112. These items include DV and HD digital c

**SJSU Peer Connections**

Peer Connections, a campus-wide resource for mentoring and tutoring, strives to inspire students to develop their potential as independent learners while t

In addition to offering small group, individual, and drop-in tutoring for a number of undergraduate courses, consultation with mentors is available on a drc

Peer Connections is located in three locations: SSC, Room 600 (10th Street Garage on the corner of 10th and San Fernando Street), at the 1st floor entrance

Consent for Recording of Class and Public Sharing of Instructor Material

**University Policy S12-7**, requires students to obtain instructor’s permission to record the course.

- Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor’s permissio
- It is suggested that the greensheet include the instructor’s process for granting permission, whether in writing or orally and whether for the w
- In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as