**Aerospace Engineering /College of Engineering**

**Aer E 331 – Flight Control Systems I**

**Spring 2018 Syllabus**

**Instructor: Benjamin Kwasa, bjkwasa@iastate.edu**

**1638 Howe Hall**

**Class: M/W/F, 12:10 pm-1:00 pm; 3:10 pm-4:00 pm**

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**Course Information**

**Description**

(3-0) Cr. 3. Linear system analysis. Control system designs using root-locus and frequency response methods. Applications in flight control systems.

**Student Learning Outcomes/Objectives**

By the end of the semester, the student should be able to:

* Have a firm understanding of Laplace and Z-transforms and their relation to differential equations.
* Have a firm grasp of linear system transfer functions, frequency responses, and related differential equations.
* Have a good practical understanding of dynamic parameters including time constants, natural frequencies, damping ratios, resonances, and bandwidths.
* Be able to design PID feedback control systems to achieve well-defined closed loop performance specifications, including dynamics and steady state error.
* Have a firm understanding of the root locus and Routh arrays, and their relation to polynomials, with emphasis on closed loop stability.

**Prerequisite or Co-requisite**

* Junior standing in Aerospace Engineering or permission of instructor.
* Prereq: AER E 355

**Textbook**

Feedback Control of Dynamic Systems

Author: Franklin

**Grading Policy**

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| --- | --- |
| **Percentage** | **Description** |
| 25% | Homework |
| 50% | Exams 1& 2 |
| 25% | Final Exam |

|  |  |  |
| --- | --- | --- |
| **Letter Grade** | **Percentage** | **Performance** |
| A to A- | 90-100% | Excellent to Nearly Excellent Work |
| B- to B+ | 80-89.99% | Mostly Good to Very Good Work |
| C- to C+ | 70-79.99% | Mostly Average to Above Average Work |
| D to D+ | 60-69.99% | Poor to Below Average Work |
| F | 0-59.99% | Failing Work |

**Topic Outline/Schedule**

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| --- | --- | --- | --- | --- |
| **Date** | **Week** | | **Topic** | **Reading** |
| 1/8 | 1 | M | Dynamic Responses | **Ch 3; Ch 6.1** |
| 1/10 | W | Dynamic Responses |
| 1/12 | F | Dynamic Responses |
| 1/15 | 2 | M | University Holiday (MLK) – No Classes | **Ch 3; Ch 6.1** |
| 1/17 | W | Dynamic Responses |
| 1/19 | F | Dynamic Responses |
| 1/22 | 3 | M | Feedback Control | **CH 4** |
| 1/24 | W | Feedback Control |
| 1/26 | F | Feedback Control |
| 1/29 | 4 | M | System Type Number | **CH 4** |
| 1/31 | W | System Type Number |
| 2/2 | F | System Type Number |
| 2/5 | 5 | M | System Type Number |  |
| 2/7 | W | Review |
| 2/9 | F | Exam 1 |
| 2/12 | 6 | M | Root Locus Concept | **CH 5** |
| 2/14 | W | Root Locus Concept |
| 2/16 | F | Root Locus Concept |
| 2/19 | 7 | M | Pole Placement | **CH 5** |
| 2/21 | W | Pole Placement |
| 2/23 | F | Pole Placement |
| 2/26 | 8 | M | Lead/Lag Compensation | **CH 5** |
| 2/28 | W | Lead/Lag Compensation |
| 3/2 | F | Lead/Lag Compensation |
| 3/5 | 9 | M | FRF: Gain & Phase Margins | **CH 6** |
| 3/7 | W | FRF: Gain & Phase Margins |
| 3/9 | F | FRF: Gain & Phase Margins |
| 3/12 | 10 | M | Spring Break – No Classes |  |
| 3/14 | W | Spring Break – No Classes |
| 3/16 | F | Spring Break – No Classes |
| 3/19 | 11 | M | FRF: Gain & Phase Margins |  |
| 3/21 | W | Review |
| 3/23 | F | Exam 2 |
| 3/26 | 12 | M | State Space Formulation | **CH 7** |
| 3/28 | W | State Space Formulation |
| 3/30 | F | State Space Formulation |
| 4/2 | 13 | M | State Feedback | **CH 7** |
| 4/4 | W | State Feedback |
| 4/6 | F | State Feedback |
| 4/9 | 14 | M | Sampled Systems | **CH 8** |
| 4/11 | W | Sampled Systems |
| 4/13 | F | Sampled Systems |
| 4/16 | 15 | M | Digital Control | **CH 8** |
| 4/18 | W | Digital Control |
| 4/20 | F | Digital Control |
| 4/23 | 16 | M | Review |  |
| 4/25 | W | Review |
| 4/27 | F | Review |
| 4/30 – 5/5 | | | Finals Week |  |

**Academic Dishonesty**

The class will follow Iowa State University’s policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the Dean of Students Office.

<http://www.dso.iastate.edu/ja/academic/misconduct.html>

**Disability Accommodation**

Iowa State University complies with the Americans with Disabilities Act and Sect 504 of the Rehabilitation Act. If you have a disability and anticipate needing accommodations in this course, please contact (instructor name) to set up a meeting within the first two weeks of the semester or as soon as you become aware of your need. Before meeting with (instructor name), you will need to obtain a SAAR form with recommendations for accommodations from the [Disability Resources Office](http://new.dso.iastate.edu/dr/student), located in Room 1076 on the main floor of the Student Services Building. Their telephone number is 515-294-7220 or email [disabilityresources@iastate.edu](mailto:disabilityresources@iastate.edu). Retroactive requests for accommodations will not be honored.

**Dead Week**

This class follows the Iowa State University Dead Week policy as noted in section 10.6.4 of the Faculty Handbook <http://www.provost.iastate.edu/resources/faculty-handbook>.

**Harassment and Discrimination**

Iowa State University strives to maintain our campus as a place of work and study for faculty, staff, and students that is free of all forms of prohibited discrimination and harassment based upon race, ethnicity, sex (including sexual assault), pregnancy, color, religion, national origin, physical or mental disability, age, marital status, sexual orientation, gender identity, genetic information, or status as a U.S. veteran. Any student who has concerns about such behavior should contact his/her instructor, [Student Assistance](http://new.dso.iastate.edu/sa/) at 515-294-1020 or email [dso-sas@iastate.edu](mailto:dso-sas%40iastate.edu), or the [Office of Equal Opportunity and Compliance](http://www.hrs.iastate.edu/hrs/node/99) at 515-294-7612.

**Religious Accommodation**

If an academic or work requirement conflicts with your religious practices and/or observances, you may request reasonable accommodations. Your request must be in writing, and your instructor or supervisor will review the request. You or your instructor may also seek assistance from the [Dean of Students Office](http://new.dso.iastate.edu/) or the [Office of Equal Opportunity and Compliance](http://www.hrs.iastate.edu/hrs/node/269).

**Academic Issues**

If you are experiencing, or have experienced, a problem with any of the above issues, email [academicissues@iastate.edu](mailto:academicissues@iastate.edu).