Fundamentals of Flight Vehicle Control

AEROENG 3521

Description / Conditions

Transcript Abbreviation:
Fnd Flt Veh Cntl

Course Description:
Linear dynamic systems analysis using Transfer function (Laplace Transformation based) methods and State Space (matrix theory based) methods with emphasis on aircraft and spacecraft models.

Course Levels:
Undergraduate (1000-5000 level)

Designation:
Required

General Education Course:
(N/A)

Cross-Listings:
(N/A)

Course Detail

Credit Hours (Minimum if “Range” selected):
3.00

Max Credit Hours:
(N/A)

Select if Repeatable:
Off
Maximum Repeatable Credits:
(N/A)

Total Completions Allowed:
(N/A)

Allow Multiple Enrollments in Term:
No

Course Length:
14 weeks (autumn or spring)
12 weeks (summer only)

Off Campus:
Never

Campus Location:
Columbus

Instruction Modes:
In Person (75-100% campus; 0-24% online)

Prerequisites and Co-requisites:
Prereq: 3520, and enrollment as AeroEng-BS student (No pre-majors can enroll in this class).

Electronically Enforced:
No

Exclusions:
(N/A)

**Course Goals and Learning Objectives**

**Course Goals / Objectives:**
Understanding and appreciation of common features of linear time-invariant (LTI) systems encountered in various engineering disciplines
Obtain the responses of LTI systems and quantify their performances both within open-loop and closed-loop environments
Cast various mechanical, aerospace, electrical and electro-mechanical systems into forms amenable to the methods they learn in this course
Identification of characteristic parameters of LTI's from the studies of experimental/test responses

Check if concurrence sought:
No
Contact Hours
## Contact Hours:

<table>
<thead>
<tr>
<th>Topic</th>
<th>LEC</th>
<th>REC out-of-class</th>
<th>REC in-class</th>
<th>Weekly LAB out-of-class</th>
<th>Weekly LAB in-class</th>
</tr>
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<tbody>
<tr>
<td>Fundamentals of dynamic systems</td>
<td>3.0</td>
<td>3.0</td>
<td>0</td>
<td>0.0</td>
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<tr>
<td>Review of solution of differential equations by the Laplace transform methods</td>
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<td>Block-Diagram Algebra</td>
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<tr>
<td>First -order Linear (LTI) systems Vehicle Simulations : Aircraft lateral and longitudinal dynamics simulations via transfer functions and MATLAB; Spacecraft attitude and rendezvous dynamics simulations via transfer functions and MATLAB</td>
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<tr>
<td>(LTI) Frequency-domain (Frequency Response) specifications. Connection between time domain and frequency domain, specifications and Bode plots. MATLAB Utility functions; Stability of LTI systems – Routh-Hurwitz criterion; Root Locus Technique</td>
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<td>Multivariable (LTI) systems - State space (Time-domain) representation: The connection between state space and transfer function viewpoints, State-space Transition and Response by simulation; MATLAB Utility functions;</td>
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<tr>
<td>Vehicle Simulations : Aircraft lateral and longitudinal dynamics simulations via state-space and MATLAB; Spacecraft attitude and rendezvous dynamics simulations via state-space and MATLAB</td>
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<td>Introduction to Digital systems: discrete difference equations, z-transform, sample and hold discrete sytems; block diagramming and open and closed-loop transfer functions, z-transform inversion, frequency domain in the z-plane.</td>
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<td>Topic</td>
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<td>Response to random inputs: Mean, variance, RMS, Fourier transform,</td>
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<tr>
<td>mean square response to random inputs, gust and launch responses,</td>
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<td>MATLAB utility functions</td>
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**Grading and Texts**

**Grading Plan:**
Letter Grade

**Course Components:**
Lecture
Recitation

**Grade Roster Component:**
Lecture

**Credit by Exam (EM):**
No

**Grades Breakdown:**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Homework</td>
<td>20%</td>
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<tr>
<td>Midterm exams (2)</td>
<td>50%</td>
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<tr>
<td>Final exam</td>
<td>30%</td>
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Representative Textbooks and Other Course Materials:

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<tr>
<th>Title</th>
<th>Author</th>
<th>Year</th>
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<tr>
<td>No Textbooks and Other Course Materials Entered.</td>
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**ABET Student Learning Outcomes**

**ABET-CAC Criterion 3 Outcomes:**
(N/A)

**ABET-ETAC Criterion 3 Outcomes:**
(N/A)

**ABET-EAC Criterion 3 Outcomes:**

| Substantial contribution (3-6 hours) | 1 | an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics |
| Some contribution (1-2 hours) | 2 | an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors |
| Some contribution (1-2 hours) | 4 | an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts |
| Some contribution (1-2 hours) | 6 | an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions |
| Some contribution (1-2 hours) | 7 | an ability to acquire and apply new knowledge as needed, using appropriate learning strategies |

**Embedded Literacies (UG courses only)**

**Embedded Literacies Info:**

**Attachments / Additional Notes or Comments**

**Attachments:**
(N/A)
Additional Notes or Comments:
(N/A)