# THE OHIO STATE UNIVERSITY

## **Fundamentals of Flight Vehicle Control**

### AEROENG 3521

#### **Credit Hours:**

3.00

#### **Course Levels:**

Undergraduate (1000-5000 level)

#### **Course Components:**

Lecture Recitation

#### **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.

#### Prerequisites and Co-requisites:

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

#### **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

#### **Course Topics:**

- Fundamentals of dynamic systems
- Review of solution of differential equations by the Laplace transform methods
- Block-Diagram Algebra
- 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
- (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
- 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;
- Vehicle Simulations : Aircraft lateral and longitudinal dynamics simulations via state-space and MATLAB; Spacecraft attitude and rendezvous dynamics simulations via state-space and MATLAB
- 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.
- Response to random inputs: Mean, variance, RMS, Fourier transform, Power spectral density, mean square response to random inputs, gust and launch responses, MATLAB utility functions

#### **Designation:**

Required