Engineering Faculty Document No: 13-02

Date: March 5, 2003

TO: Faculty of Schools of Engineering

FROM: Faculty of the School of Aeronautics and Astronautics

SUBJECT: New Undergraduate Level Course

The Faculty of the School of Aeronautics and Astronautics has approved the new undergraduate course listed below. This action is now submitted to the Engineering Faculty with a recommendation for approval.

AAE 301 Signal Analysis for Aerospace Engineering
Sem. 1, Class 3, cr. 3.
Prerequisites: Math 265 and 266 or equivalents

Signal processing and spectral analysis for aerospace engineering. Fourier and fast Fourier transforms. Vibration analysis; estimation of natural frequencies, wing vibrations. Introduction to linear circuits, operational amplifiers and filtering. Noise suppression.

Reason: This course provides students with the basic engineering skills needed to formulate and solve problems that require signal processing in the presence of measurement uncertainties. Applications are taken from the subdisciplines of aerospace engineering: structures, propulsion, aerodynamics, and dynamics and control. Students analyze data from laboratory experiments.

This course has been taught three times under the temporary number AAE 490F with enrollments of 26, 56 and 58 students, all from AAE.

Thomas N. Farris, Professor and Head
School of Aeronautics & Astronautics

AAE 301

Signal Analysis for Aerospace Engineering

Description:

Signal processing and spectral analysis for aerospace engineering. Fourier and fast Fourier transforms. Vibration analysis: estimation of natural frequencies, wing vibrations. Introduction to linear circuits, operational amplifiers and filtering. Noise suppression.

Format: 3 hrs lecture per week

Credit hours: 3

Status: Elective

Offered: Fall

Pre-requisite: Math 265 and 266 or equivalent

Co-requisite: None

Course Instructor: Staff

Text: Course packets

Assessment Method: Three exams, Homework and a Final exam**.**

Course Objectives:

This course provides A&AE undergraduates with an ability to use analog and digital signal processing techniques with linear circuits to solve problems in aerospace engineering. As a result the students will be able to

- estimate natural frequencies from data (e.g. wing vibration).
- estimate the signal in noise
- design low, band and high pass filters
- extract the underlying spectrum from time history
- analyze and design elementary linear circuits.

Necessary Background:

The course is targeted at first semester juniors and therefore expects the standard background for students at that level. Since extensive use will be made of Matlab's signal processing and Simulink toolboxes, students must have the basics of Matlab programming.

Topics (number of Lectures):

Time domain analysis and Fourier series (5)

Fast Fourier Transform (5)

Aerospace Applications (2)

Estimating sinusoids in noise (4)

Wing vibration and natural frequencies (3)

Laplace transforms review (3)

Resistors, capacitors and inductors (4)

Operational amplifiers (3)

Designing linear circuits for filters (3)

Steady state response (3)

Tuned vibration damper (2)

Butterworth filters for noise suppression (4)

Exams and review (4)

Relationship of course to program objectives:

This course provides students with the basic engineering skills needed to formulate and solve problems that require either signal processing in the presence of measurement uncertainties (AAE Program Objective 2a). Applications are to be taken from the sub disciplines of aerospace engineering: structures, dynamics, aerodynamics, control and propulsion. Students will be able to analyze data from laboratory experiments.

September 19, 2002