Tamkang University Academic Year 108, 2nd Semester Course Syllabus

Course Title	ESTIMATION AND CONTROL	Instructor	TYAN FENG
Course Class	TENXM1A MASTER'S PROGRAM, DEPARTMENT OF AEROSPACE ENGINEERING, 1A	Details	◆ General Course ◆ Selective ◆ One Semester

Departmental Aim of Education

Ⅰ. To lay down a concrete foundation of professional ethics in aerospace and aeronautical engineering, and to cultivate the students' ability in multidisciplinary expertise and continuous learning.

Ⅱ. To setup the students' hands-on ability of and the ability in resolving problem, so that both practical implementations and theories can be emphasized.

Ⅲ. To foster students with diligent and sociable attitude in work, and broadeded international perspective.

Subject Departmental core competences

A. To equip with specific aerospace engineering knowledge and expertise.(ratio:25.00)

B. Be able to master information, capable of utilizing computer to assist solving problems, and possess the ability of conducting learning new knowledge.(ratio:20.00)

C. Be able to design and conduct experiments as well as to analyze, and to solve practical aerospace related engineering problems.(ratio:25.00)

D. Be able to write professional research papers in the field of aerospace engineering. (ratio:10.00)

E. Have a creative thinking, complete analyzing, effective communication, the spirit of teamwork and the ability to solve industrial problems.(ratio:20.00)

Subject Schoolwide essential virtues

1. A global perspective. (ratio:15.00)

2. Information literacy. (ratio:20.00)

3. A vision for the future. (ratio:15.00)

5. Independent thinking. (ratio:50.00)

Course Introduction	This course covers mathematical approaches to the best possible way of estimating the state of a general system. The goal of the course is to present state estimation theory in the most clear yet rigorous way possible, while providing enough advanced material and references so that the student is prepared to contribute new material to the state of the art. Engineers are usually concerned with implementation, and so the material presented is geared towards discrete time systems.

The correspondences between the course's instructional objectives and the cognitive, affective, and psychomotor objectives.

Differentiate the various objective methods among the cognitive, affective and psychomotor domains of the course's instructional objectives.

I. Cognitive : Emphasis upon the study of various kinds of knowledge in the cognition of the course's veracity, conception, procedures, outcomes, etc.

II.Affective : Emphasis upon the study of various kinds of knowledge in the course's appeal, morals, attitude, conviction, values, etc.

III.Psychomotor: Emphasis upon the study of the course's physical activity and technical manipulation.

No.	Teaching Objectives	objective methods
1	1. Be familiar with the basic operations of vectors and matrices.. 2. Understand the basic arithmetic of linear system theory. 3. Capable of setting up digital filter (estimator) equations. 4. Understand how to use computer to solve estimation problems in engineering. 5. Develop the ability of analyzing control problems with mathematics.	Cognitive
2	Understand the basic arithmetic of linear system theory.	Cognitive
3	Capable of setting up digital filter (estimator) equations.	Cognitive
4	Understand how to use computer to solve estimation problems in engineering.	Cognitive
5	Develop the ability of analyzing control problems with mathematic tools.	Cognitive

The correspondences of teaching objectives : core competences, essential virtues, teaching methods, and assessment

No.	Core Competences	Essential Virtues	Teaching Methods	Assessment
1	ABCDE	1235	Lecture, Discussion	Testing, Discussion(including classroom and online)

2	ABCDE	1235	Lecture, Discussion	Testing, Discussion(including classroom and online)
3	ABCDE	1235	Lecture, Discussion	Testing, Discussion(including classroom and online)
4	ABCDE	1235	Lecture, Publication	Testing, Discussion(including classroom and online)
5	ABCDE	1235	Lecture, Discussion	Testing, Discussion(including classroom and online)

Course Schedule

Week	Date	Course Contents	Note
1	109/02/17 ~ 109/02/23	Linear systems theory	
2	109/02/24 ~ 109/03/01	Linear systems theory	
3	109/03/02 ~ 109/03/08	Probability theory	
4	109/03/09 ~ 109/03/15	Probability theory	
5	109/03/16 ~ 109/03/22	Least Squares Estimation	
6	109/03/23 ~ 109/03/29	Least Squares Estimation	
7	109/03/30 ~ 109/04/05	Propagation of state and covariances	
8	109/04/06 ~ 109/04/12	Propagation of state and covariances	
9	109/04/13 ~ 109/04/19	The discrete Kalman filter	
10	109/04/20 ~ 109/04/26	Midterm Exam	
11	109/04/27 ~ 109/05/03	The discrete Kalman filter	
12	109/05/04 ~ 109/05/10	The continuous-time Kalman filter	
13	109/05/11 ~ 109/05/17	The continuous-time Kalman filter	
14	109/05/18 ~ 109/05/24	The H-infinity filter	
15	109/05/25 ~ 109/05/31	The H-infinity filter	
16	109/06/01 ~ 109/06/07	Nonlinear Kalman filter	
17	109/06/08 ~ 109/06/14	Nonlinear Kalman filter	
18	109/06/15 ~ 109/06/21	Final Exam	

Requirement	Work Hard.
Teaching Facility	Computer, Projector
Textbooks and Teaching Materials	1. Dan Simon, "Optimal State Estimation," Wiley Interscience, 2006 2. R. F. Stengel, "Optimal Control and Estimation," Dover, 1994.
References	1. R. G. Grown and P. Y. C. Hwang, "Introduction to Random Signals and Applied Kalman Filtering with MATLAB Exercises and Solutions," John Wiley, 1997 A. Gilbert, "Applied Optimal Estimation," 1974. G. M. Siouris, "An Engineering Approach to Optimal Control and Estimation Theory," John Wiley & Sons, 1996. F. L. Lewis, "Optimal Estimation with Introduction to Stochastic Control Theory," John Wiley & Sons, 1986.
Number of Assignment(s)	8 (Filled in by assignment instructor only)
Grading Policy	◆ Attendance： % ◆ Mark of Usual：15.0 % ◆ Midterm Exam： 35.0 % ◆ Final Exam： 50.0 % ◆ Other〈 〉： %
Note	This syllabus may be uploaded at the website of Course Syllabus Management System at http://info.ais.tku.edu.tw/csp or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at http://www.acad.tku.edu.tw/CS/main.php . **※ Unauthorized photocopying is illegal. Using original textbooks is advised. It is a crime to improperly photocopy others' publications.**