Cairo University
Faculty of Engineering

Aerospace Engineering Department

Course Specifications

Program(s) on which this course is given:	M. Sc. – Flight Mechanics and Control Option
Department offering the program:	Aerospace Engineering
Department offering the course:	Aerospace Engineering
Academic Level:	Graduate
Date	
Semester (based on final exam timing)	☐ Fall ☐ Spring

A- Basic Information

1. Title:	Robust Control			**Code:**	Aero 752			
2. Units/Credit hours per week:	Lectures	2	Tutorial	1	Practical	-	Total	3

B- Professional Information

1. Course description:	The course addresses Design of Robust Control Systems with application to Aerospace Systems. The course material includes: 1) Stability of continuous robust control systems 2) Robust Stability of interval polynomials , 3) Kharitonov theorem and extensions, 4) Argoun's theorem and its applications. 5) Edge theorem for robustness of bilinear systems. 6) Robustness of systems described in State Space, 7) Stability of interval matrices, 8) measures of robustness, 9)Applications of robustness to Aerospace Systems. 10) Diagonal Dominance Design.
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding**
	Modelling of real-life physical systems, Linearization. Significance and modeling of perturbations.
	Properties and features of Robust systems.
	b) Intellectual Skills
	Ability to formulate real physical systems into mathematical models with perturbations.
	Understanding the relationship between physical systems and perturbed mathematical models**.** Application of classical control methods to perturbed systems.
	c) Professional and Practical Skills
	Computation and plotting of system response-Ability to relate nominal stability to stability under perturbations.
	Ability to design robust control systems to achieve certain response and stability goals.
	d) General and Transferable Skills
	Matlab (mathematical programming tool) - Simulations. Matrix algebra- Laplace Transform mathematics and their connection to the physical behavior linear systems.

3. Contents

Topic	Total hours	Lectures hours	Tutorial/ Practical hours
1) Modeling and Stability consideration in linear control system, Stability of continuous robust control systems, 2) Modeling of perturbations of Flight and Space systems	3	2	1
3) Formulation of the problem of robust stability, 4) Robust Stability of interval polynomials . 3) Kharitonov theorem and extensions,	6	4	2
5) Argoun's theorem and its applications.	6	4	2

6) Edge theorem for robustness of bilinear systems	3	2	1
7) Robustness of systems described in State Space,	6	4	2
8) Robust Control of Linear Systems	6	4	2
9) Stability of interval matrices, Parel, Toda and Yedavalli's methods	6	4	2
10) Measures of robustness, Application of classical control methods to perturbed systems.	3	2	1
11)Applications of robustness to Aerospace Systems. 10) Diagonal Dominance Design.	6	4	2
Total Hours	45	30	15
4. Teaching and Learning Methods	Lectures (24)	Practical Training/ Laboratory (15)	Seminar/Workshop (-)
	Class Activity (6)	Case Study (-)	Projects (-)
	E-learning ( )	Assignments /Homework (15)	Other:

5. Student Assessment Methods

• **Assessment Schedule**	**Week**
-Assessment 1: Class test	5
- Assessment 2: Class assignments (Homework)	Every other week (6 assignments)
-Assessment 3; Project Assignment	N/A
-Assessment 4; Presentations	N/A
-Assessment 5; Midterm Exam	7
-Assessment 6; Final Exam	End of semester
• **Weighting of Assessments**	
-Mid-Term Examination	15%
-Final-term Examination	60%
-Class assignments (Homework)	15%
-Class Test (s)	10%
-Presentation	N/A
-Total	100%

6. List of References

1- Papers by Argoun. Hollot, Barmish, Yedavalli and others.

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7. Facilities Required for Teaching and Learning

Projector

Course Coordinator:	**Prof. Mohamed Bahey Argoun**
Head of Department:	**Prof. Ayman Hamdy Kassem**