Subject Description Form

Subject Code	AAE6103
Subject Title	Advanced Control Theory for Aircraft
Credit Value	3
Level	6
Pre-requisite/ Co-requisite/ Exclusion	N/A
Objectives	To provide students with theories of advanced flight control including nonlinear adaptive control, optimal control, sliding mode control, and controller stability analysis.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) possess the essential knowledge and skills in advanced flight control theories. b) design flight controllers which can deal with real-life model uncertainties or disturbances. c) analyze the closed-loop stability of the designed flight controller. d) apply the advanced control theories to control the aircraft.
Subject Synopsis/ Indicative Syllabus	**Introduction of Flight control –** flight control structure, aerodynamic model, model uncertainties, wind disturbances. **Nonlinear dynamic inversion –** nonlinear dynamic inversion algorithm, extensions of nonlinear dynamic inversion. **Sliding mode control** – sliding surface, finite-time convergence, disturbance rejection **Optimal control** – cost function, nonlinear optimization, model predictive control **Fault-tolerant control** – fault detection and diagnosis, fault tolerant flight control **Controller stability analysis** – closed-loop stability, Lyapunov stability

Teaching/Learning Methodology

1. The teaching and learning methods include lecture/tutorial sessions, homework assignments and mini project.

2. Scientific examples and problems are raised and discussed in class/tutorial sessions.

Teaching/Learning Methodology	**Intended subject learning outcomes**			
	a	b	c	d
1. Lecture/Tutorial	√	√	√	√
2. Homework assignment	√	√	√	√
3. Mini project	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Homework assignment	20%	√	√	√	√
2. Mini project report	40%	√	√	√	√
3. Examination	40%	√	√	√	√
Total	100 %				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.4 × End of Subject Examination + 0.6 × Continuous Assessment

The continuous assessment consists of two components: homework assignments and mini project report. Homework assignments are aimed at evaluating the progress of students' study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt. The mini project serves to provide students a guided study with the basic research elements.

The examination is used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Laboratory	6 Hrs.
	Other student study effort:	
	▪ Literature Review and Self-learning	30 Hrs.
	▪ Assignments	20 Hrs.
	▪ Mini-project and Laboratory Reports	22 Hrs.
	Total student study effort	111 Hrs.
Reading List and References	1. H. K. Khalil, *Nonlinear Systems*. 2002, Third Edition 2. E. Shtessel, Y., Edwards, C., Fridman, L., Levant, A., *Sliding Mode Control and Oservation*. 2014: Springer, Latest Edition 3. Mclean, D. *Automatic Flight Control Systems*, Prentice Hall International, Latest Edition.	

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