Subject Description Form

Subject Code	AAE3004
Subject Title	Dynamical Systems and Control
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	**Pre-requisite:** AMA2111 Mathematics I **OR** AMA2112 Mathematics II
Objectives	1. To introduce basic concepts and methods of feedback control and automatic control systems; 2. To introduce mathematical modeling of physical elements in dynamic systems; 3. To provide basic understanding of behaviour of first- and second-order systems due to typical inputs, and concepts of time-domain specifications; 4. To introduce basic concepts of frequency response and frequency domain specifications; 5. To introduce feedback control and its application to improve the overall system behaviour; and 6. To present the basic concepts of proportional-and-integral-and-derivative control, and the setting of control parameters to meet the system goals.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify, formulate and solve problems in aviation engineering by applying knowledge of dynamical systems and control (including transfer function and response of a first- or second-order system both in time and frequency domains); b. Design and conduct experiments, as well as analyze how the system dynamic behavior is related to system specifications and its improvements according to the specifications (including Routh-Hurwitz stability criterion); and c. Have knowledge of contemporary issues of dynamical system and control (including applications of proportional, integral and derivative feedbacks in control systems) to understand the impact of engineering solutions in a global and societal context.
Subject Synopsis/ Indicative Syllabus	**Dynamic Responses of First-Order and Second-Order Systems -** Mathematical modeling of dynamic systems (elements or interconnection of elements) by differential equations, critical parameters of first-order and second-order systems, system response analysis due to step, ramp and impulse inputs using Laplace transform. **Frequency Response of First-Order and Second-Order Systems -** Harmonic response, root locus, Bode diagrams, frequency domain specifications, frequency response applications, Nyquist criterion and Nyquist plots. **Fundamental Methods of Feedback Control -** Analysis of open-loop and closed-loop systems, transfer functions, block diagrams, time-domain specifications, time-domain analysis of control systems, system stability, Routh-Hurwitz stability criterion. **Basic Feedback Controller-** Automatic controllers, P, PD, PID controllers, Steady

	state error.
Teaching/Learning Methodology	The teaching and learning methods include lectures, tutorials, lab sessions, and reading sections. The lectures aim at providing students with an integrated knowledge required for understanding and analyzing dynamic systems and fundamental feedback control. The tutorials aim to enhance students' analytical skills. Examples on system modelling, dynamic response of linear systems, and performance and stability of control systems will be involved. Students will be able to solve real-world problems. The lab sessions involve applying the knowledge acquired in class to solve real-world problems by designing feedback control systems. The lab sessions also train students in the analysis and presentation of experimental data.

Teaching/Learning Methodology	Intended subject learning outcomes to be cover		
	a	b	c
1. Lecture	✓	✓	✓
2. Tutorial	✓	✓	✓
3. Laboratory	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Assignment	20%	✓	✓	✓
2. Mid-term test	10%	✓	✓	
3. Lab report	20%	✓	✓	✓
4. Examination	50%	✓	✓	
Total	100%			

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

Overall Assessment:

0.50 x Examination + 0.50 x Continuous Assessment

Assessment:

Assignment, lab report and mid-term test are used in continuous assessment to provide students with timely feedback and help them understand course materials as they progress. The final examination is used to evaluate students' overall

	understanding of the course and their ability to apply the knowledge they have acquired.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	30 Hrs.
	▪ Lab	6 Hrs.
	Other student study effort:	
	▪ Week 7 Reading week	3 Hrs.
	▪ Self-study	45 Hrs.
	▪ Assignment	21 Hrs.
	Total student study effort	**105 Hrs.**
Reading List and References	1. K. Ogata, Modern Control Engineering, Prentice Hall, latest edition. 2. N.S. Nise, Control Systems Engineering, John Wiley, latest edition.	

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