Subject Description Form

Subject Code	AAE4006
Subject Title	Flight Mechanics and Control Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	**Pre-requisite:** AAE3004 Dynamical Systems and Control
Objectives	To provide students with a deep understanding of flight dynamics, static and dynamic stability and feedback control systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Design systems, components or processes to meet desired needs (including the basic modes of motion, related mechanism of fixed-wing aircraft and formulation of motion of a rigid systemic aircraft); and b. Use the techniques, skills and modern computational and information technology necessary for engineering practice (including analysis of equilibrium and stability for fixed-wing aircraft); and c. Function professionally in multidisciplinary teams.
Subject Synopsis/ Indicative Syllabus	**Introduction –** Mathematical tools for flight mechanics and control, configuration aerodynamics, flight performance, components of an automatic flight control system. **Flight Dynamics –**Reference frames, aircraft equation of motion, static equilibrium and trim, lift and pitching moment, control force, static longitudinal and lateral stability, linearized equation of motion, longitudinal dynamics, lateral-directional dynamics, maneuvering flight. **Aerodynamic Stability and Control** – Flying qualities requirements, stability and control derivatives, stability of longitudinal dynamics, stability of lateral-directional dynamics. **Flight Control Systems Design and Analysis –** Design of a flight control system based on linearized equations of motion, analyze the open loop response of the flight control system, analyze the closed-loop response of the flight control system, analyze the closed-loop stability.

Teaching/Learning Methodology

Lectures aim at providing students with an integrated knowledge required for understanding aircraft performance, static stability, dynamic stability and-feedback control. Theories and examples will be presented to cover the syllabus on general equations of motion for aircraft, models of aircraft, and conditions for equilibrium, linearization and solution of equations of motion. This forms the basis for analysis of trajectories, modes of motion as well as control analysis and synthesis.

Tutorials aim at enhancing the analytical skills of the students. Examples will be provided to teach students the skills of solving different flight mechanics and control problems using the knowledge of dynamic system and feedback control techniques. Students will be able to solve real-life problems using the knowledge they acquired in the class.

Experiments will provide students with experience in simulating the aircraft motion and how its configuration affects stability and control. The students are motivated to make assumptions to simplify a flight mechanics problem and then develop an automatic flight control system. These experiments are designed to train students how to apply theories to practical applications, how to analyze and present experimental data.

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

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Homework	20%	✓	✓	
2. Class test	10%	✓	✓	
3. Laboratory report	20%		✓	✓
4. Examination	50%	✓	✓	
Total	100 %			

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

Overall Assessment:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

	Examination is adopted to assess students on the overall understanding and the ability to apply the concepts. It is supplemented by tests, homework and laboratory reports which provided timely feedback to both lecturers and the students on various topics of the syllabus.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Laboratory/Tutorial	6 Hrs.
	Other student study effort:	
	▪ Self-study	45 Hrs.
	▪ Homework assignment	12 Hrs.
	▪ Laboratory report	12 Hrs.
	Total student study effort	**108 Hrs.**
Reading List and References	1. Stevens, B. L. and Lewis F. L., Aircraft Control and Simulation, John Wiley & Sons, latest edition. 2. Mclean, D. Automatic Flight Control Systems, Prentice Hall International 3. Etkin, B and Reid, L.D., Dynamics of Flight, John Wiley, latest version	

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