Subject Description Form

Subject Code	EE3005 / EE3005A / EE3005B
Subject Title	Systems and Control
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2111
Objectives	1. To introduce the principles and techniques used in the analysis and design of control systems. 2. To provide the foundation for the later subjects in the areas of power systems, drives and control.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Analyse the stability, transient response and steady-state response of continuous time systems. b. Design compensators and controllers for control systems. c. Model systems using block diagram and signal flow graph and evaluate the properties of the overall systems. d. Write technical reports and present the findings.
Subject Synopsis/ Indicative Syllabus	1. ***Introduction to control system analysis*****:** Open-loop control systems, Closed-loop control systems, Effects of feedback, Examples of control systems. 2. ***Mathematical modelling of dynamic systems*****:** Electrical and electro-mechanical system components, Transducers and actuators, Laplace transform, Transfer functions. Differential equation, State space, Transfer functions, Block diagram, Signal flow graphs, Mason's formula 3. ***Time domain analysis of linear systems*****:** First-order systems, Second-order systems, Transient response, Steady-state response, Routh-Hurwitz stability criterion. Root-locus analysis 4. ***Frequency domain analysis of linear systems*****:** Frequency response, Bode Diagrams, Gain margin and phase margin, Polar plots, Nyquist stability criterion, Nichols plots. 5. ***Compensators and PID controllers:*** Compensators, PID controllers, Controller tuning. Ziegler-Nichols tuning, Model-based tuning, internal mode control. Sensitivities and Design Tradeoffs 6. ***Common Challenges*****:** Fuzzy control, neural network control, AI control. **Laboratory Experiment:** PID control Fuzzy controller

Teaching/Learning Methodology

Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiments are designed to supplement the lecturing materials. The students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	✓	✓	✓	
Tutorials	✓	✓	✓	
Experiments	✓	✓		✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	✓	✓	✓	
2. Class test	15%	✓	✓	✓	
3. Laboratory reports	15%	✓	✓		✓
4. Assignment	10%	✓	✓	✓	
Total	100%				

The outcomes on analysis and design are assessed by the usual means of examination and tests whilst those on technical reporting and presentation are evaluated by the experiments and reports.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	33 Hrs.
▪ Laboratory	6 Hrs.
Other student study effort:	
▪ Laboratory preparation/report	12 Hrs.
▪ Self-study, revision and assignment	54 Hrs.
Total student study effort	105 Hrs.

Reading List and References

Reference books:

1. M.F. Golnaraghi and B.C. Kuo, Automatic Control Systems, 10th Edition, Prentice-Hall, 2017
2. R.C. Dorf and R.H. Bishop, Modern Control Systems, 14th Edition, Pearson, 2022
3. M. Gopal, Control Systems: Principles and Design, 4th Edition, McGraw-Hill, 2012