Subject Description Form

Subject Code	EE3051
Subject Title	Systems and Control
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA201
Objectives	1. To introduce the principles and techniques used in the analysis and design of feedback 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. 3. ***System diagrams and simulations*:** Block diagram, Signal flow graphs, Mason's formula, Simulation of continuous systems using Matlab. 4. ***Time domain analysis of linear systems*:** First-order systems, Second-order systems, Transient response, Steady-state response, Routh-Hurwitz stability criterion. 5. ***Frequency domain analysis of linear systems*:** Frequency response, Bode Diagrams, Gain margin and phase margin, Polar plots, Nyquist stability criterion, Nichols plots. 6. ***Compensators and PID controllers:*** Compensators, PID controllers, Controller tuning. 7. ***State-space analysis*:** State-space models, Transfer matrix, State transition matrixt. **Laboratory Experiment:** Three-term controller Open-loop frequency response Modular position control system

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 tests	30%	√	√	√							
3. Laboratory reports	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	38 Hrs.
▪ Laboratory	8 Hrs.
Other student study effort:	
▪ Laboratory preparation/report	12 Hrs.
▪ Self-study	47 Hrs.
Total student study effort	105 Hrs.

Reading List and References

Reference books:

1. K. Ogata, Modern Control Engineering, 4th Edition, Prentice-Hall, 2002
2. B.C. Kuo, Automatic Control Systems, 7th Edition, Prentice-Hall, 1995
3. R.C. Dorf and R.H. Bishop, Modern Control Systems, 10th Edition, Prentice-Hall, 2004
4. M. Gopal, Control Systems: Principles and Design, 3rd Edition, McGraw-Hill, 2008