Subject Description Form

Subject Code	EE3011B
Subject Title	Control Systems and Signal Processing
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2111
Objectives	1. To introduce the principles and techniques for system modelling and analysis so as to enable designing of appropriate controllers; 2. To introduce the principles and techniques used in the analysis and design of feedback control systems, both classical and modern, with the aid of computer aided control system design package; 3. To provide the foundation on signal processing algorithms for the later subjects; and 4. To develop in-depth applications of concepts and design techniques in digital control, filtering and signal processing.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Model a realistic plant with time domain and frequency domain analysis techniques; b. Analyse the basic characteristics and able to design a control system; c. Apply appropriate signal processing techniques and able to design appropriate filters for data analysis.
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; transfer functions. 2. ***Time domain analysis of linear systems***: First-order systems, second-order systems, steady-state error analysis, Routh-Hurwitz stability criterion. 3. ***Frequency domain analysis of linear systems***: Frequency response, stability in frequency domain, Bode diagrams, gain margin and phase margin, polar plots, Nyquist stability criterion, Nichols plot, Compensators, PID controllers. 4. ***Stability and transient analysis***: Stability of closed-loop systems; transient and steady state response and analysis. 5. ***Signal processing techniques and implementation***: DFT, FFT, power spectrum, windowing; computation of convolution and correlation, autocorrelation, cross correlation. **Laboratory Experiments:** Modular position control system Open-loop frequency response Digital signal analysis and filter design

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
Lectures	✓	✓	✓
Tutorials	✓	✓	✓
Experiments	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Examination	60%	✓	✓	✓
2. Class Test	15%	✓	✓	✓
3. Laboratory performance and reports	15%	✓	✓	✓
4. Assignment reports	10%	✓	✓	✓
Total	100%			

The outcomes on analysis and design are assessed by the usual means of examination and tests.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	33 Hrs.
▪ Laboratory	6 Hrs.
Other student study effort:	
▪ Laboratory preparation/report	12 Hrs.
▪ Self-study	49 Hrs.
Total student study effort	100 Hrs.

Reading List and References

Reference books:

1.M. Gopal: Control Systems, 3rd Edition, Tata McGraw-Hill, 2008.
2.K. Ogata, Modern Control Engineering, Prentice-Hall, 2010
3.Z. M. Hussain, A. Z. Sadik, P.O'Shea ,Digital signal processing: an introduction withMATLAB and applications, Springer, 2011.