Subject Description Form

Subject Code	EIE2106
Subject Title	Signal and System Analysis
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with basic concepts in signal acquisition and analysis techniques. 2. To provide students with an analytical foundation for further studies in Communication Engineering and Digital Signal Processing.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the representations and classifications of the signals and systems. 2. Understand the time domain and frequency domain representations of continuous-time signals. 3. Use different techniques to analyze continuous-time systems. 4. Apply software tools to laboratory exercises for experimenting with theories, and to the analysis of continuous-time signals and systems. 5. Understand the acquisition process of discrete-time signals. Category B: Attributes for all-roundedness 6. Present ideas and findings effectively. 7. Think critically and learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Introduction Basic principle of signal acquisition devices and systems: speech and audio signals, images and videos, electroencephalography signals, etc. Human perception of signals. Mathematical representation of signals: Revision of complex numbers, the Euler theorem, sinusoidal waves and phasor representation. 2. Fourier Representations for Continuous-Time Signals Revision of definite and indefinite integrations. The Fourier series. Concept of frequency and spectrum. The Fourier Series and Fourier Transform. Frequency domain representation of continuous-time signals. 3. Continuous-time System Analysis Properties of continuous-time systems: causality, time Invariance, linearity. Linear time invariant (LTI) continuous-time system and convolution integral. Frequency response of LTI continuous-time systems. Ideal filters: filter classifications, ideal filter frequency responses, bandwidth. Examples of filters. 4. Digital Signal Acquisition Sample-and-hold. Analogue-to-digital (A/D) and digital-to-analogue (D/A) conversion. Quantization. Fourier transform of discrete-time signals. Sampling and aliasing. Shannon sampling theorem and Nyquist rate. Introduction to the discrete Fourier transform.

5. Programming in Matlab
   Matrix operations and variables. Plots and graphics. Programming constructs.

Laboratory experiments:

1. Lab 1: Introduction to Matlab programming
2. Lab 2: Signal Analysis using Fourier Series
3. Lab 3: Signal Analysis using Fourier Transform

Teaching/ Learning Methodology

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2, 3, 5, 7	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3, 5, 7	These are supplementary to lectures. Students will be able to clarify concepts and to gain a deeper understanding of the lecture material. Problems and application examples are given and discussed.
Laboratory sessions	3, 4, 6, 7	Students will make use of the software MATLAB to simulate various theories and visualize the results.

Alignment of Assessment and Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1. Continuous Assessment (total 40%)								
• Laboratory sessions	9%			✓	✓		✓	✓
• Short quizzes	13%	✓	✓	✓		✓		
• Tests	18%	✓	✓	✓		✓		✓
2. Examination	60%	✓	✓	✓		✓		✓
Total	100%							

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

Specific Assessment Methods/Tasks	Remark
Short quizzes and assignments	They can measure the students' understanding of the theories and concepts as well as their comprehension of subject materials.
Tests and examination	End-of-chapter-type problems are used to evaluate the students' ability in applying concepts and skills learnt in the classroom; Students need to think critically and to learn independently in order to come up with an alternative solution to an existing problem. They need to present their solutions in a logical and systematic manner in the tests and the examination.
Laboratory sessions	Oral examination based on the laboratory exercises will be conducted to evaluate student's technical knowledge and communication skills.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**

Reading List and References

References:

1. Chaparro, Luis F., *Signals and systems using* MATLAB, Academic Press, 2nd Edition, 2014.
2. M.J. Roberts, *Fundamentals of Signals & Systems,* McGraw-Hill, 2008.
3. James H. McClellan, Ronald W. Schafer and Mark A. Yoder, *Signal Processing First,* Prentice-Hall, 2003.

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