Subject Description Form

Subject Code	EIE3103
Subject Title	Digital Signals and Systems
Credit Value	3
Level	3
Pre-requisite	EIE2106 Signal and System Analysis or EIE2108 Fundamentals of Internet and Multimedia Technologies
Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with basic concepts and techniques for the modelling and analysis of discrete-time signals and systems. 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 digital signals and systems. 2. Understand the modelling of linear discrete-time systems. 3. Use different techniques to analyze and design discrete-time systems. 4. Apply software tools to laboratory exercises for experimenting with theories, and to the analysis and design of discrete-time systems. 5. Appreciate the advantages and disadvantages of using the different representations and modelling approaches. Category B: Attributes for all-roundedness 6. Present ideas and findings effectively.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Fourier Representations for Discrete-time Signals Mathematical Description of Discrete-Time Signals. Discrete Fourier Series. Discrete-Time Fourier Transform. Discrete Fourier Transform. Relationship Among Various Fourier Transforms. 2. Discrete-Time Systems Time-Domain Analysis of Discrete-Time Systems. Unit pulse response. Difference Equation Representation. Convolution. 3. System Analysis Frequency Response of LTI Discrete-Time Systems. Concept of Filtering: Lowpass, Bandpass and Highpass Filters. FIR Filters and IIR Filters. Linear and Circular Convolution. FIR Filter Analysis. Filtering Examples to Different Signals. 4. z-Transform Definition and Properties of z-Transform. Inverse z-Transform: Power Series Expansion, Partial-Fraction Expansion. z-Transfer Analysis of LTI Systems. 5. Filter design FIR filter design using windows, FIR design by frequency sampling, etc.

Laboratory Experiments:

1. Linear Time-Invariant Discrete-time Systems
2. Fourier Analysis of Discrete-time Signals
3. Convolution and Correlation
4. Application of Digital Filters

Teaching/ Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3, 5	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3, 5	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	4, 6	Students will make use of the software MATLAB and/or LabView to simulate various theories and visualize the results.

Assessment Methods in Alignment with 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
1. Continuous Assessment	50%						
• Laboratory sessions	14%				✓		✓
• Short quizzes	18%	✓	✓	✓		✓	
• Tests	18%	✓	✓	✓		✓	✓
2. Examination	50%	✓	✓	✓		✓	✓
Total	100%						

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

Specific Assessment Methods/Tasks	Remark
Short quizzes	These 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.
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. M.J. Roberts, *Fundamentals of Signals & Systems,* McGraw-Hill, 2008. 2. James H. McClellan, Ronald W. Schafer and Mark A. Yoder, *DSP First: A Multimedia Approach,* Prentice-Hall, 1999.	
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