Fundamentals of signals and systems

Course instructor: Dr. Baraka Maiseli

Department of Electronics and Telecommunications Engineering
College of Information and Communication Technologies
University of Dar es Salaam

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Course information

Course code

TE 231

Course weight

Total credits: 8 Units

Prerequisite

- MT 171 (One variable calculus and differential equations for non-majors)
- MATLAB

Objective

To reveal mathematical tools necessary to analyze signals and systems in time and frequency domains.

Course information

Outcomes

Upon completion of the course, you are expected to

- Describe properties of signals in time and frequency domains
- Transform signals from time domain into frequency domain, and vice versa
- Describe characteristics of noise
- Explain how noise affects signals
- Derive effects of networks on signals
- Explain systems and give their practical examples
- Establish relationships between signals and systems

Course information

Assessment

- Coursework: 40%
- Final Examination: 60%

Delivery mode (hours/semester)

- Lecture: 30
- Tutorial: 15
- Practical: 20
- Assignment: 15

Total: 80

Course contents

Unit 1: Description of signals and systems in time domain

- What is a signal?
- Classification of signals
- Classification of systems
- Operation on signals
- Linear time invariant systems (LTI)
- Impulse responses of LTI systems
- Responses of LTI systems

Course contents

Unit 2: Description of signals and systems in frequency domain

- Fourier series analysis of periodic signals
- Fourier transforms of signals and systems
- Transfer functions of LTI systems
- Transmission of signals through distortionless systems Power
- spectral density of signals
- Energy spectral density of signals
- Power and energy spectral densities of LTI systems' outputs

Course contents

Unit 3: Probability and random variables

- Probability and sample space
- Random variables
- Statistical averages for random variables
- Common probability models

Course contents

Unit 4: Random signals and noise

- Random processes
- Correlation of random processes
- Power spectral density of random processes
- Transmission of random processes through LTI systems
- Gaussian process
- White and colored noise
- Narrowband random process

Course contents

Unit 5: Linear time invariant networks

- Transfer functions
- Convolution
- Filters and noise
- Signal-to-noise ratio and noise figure

Recommended references

1. B. Carlson, P. B. Crilly, and J. C. Rutledge, Communication Systems: An introduction to Signals and Noise in Electrical Communication, McGraw-Hill Higher Education, 4th ed, 2002.
2. P. Z. Peebles, Jr, Probability, Random Variables and Random Signal Principles, McGraw-Hill International ed, 4th ed, 2001.
3. H. P. Hsu, Signals and Systems, Schaum's Outlines, McGraw-Hill, 1995.
4. L. W. Couch II, Digital and Analog Communication Systems, Prentice Hall International ed, 5th ed, 2004.
5. Vinay K. Ingle and John G. Proakis, Digital Signal Processing Using MATLAB, Cengage Engineering, 2006