# COURSE GUIDE

Dean, Prof. Daniela Tărniceriu

.....

1. Program info

| | |
|---|---|
| 1.1 Higher education institution | "Gheorghe Asachi" Technical University of Iaşi |
| 1.2 Faculty / Department | Electronics, Telecommunications and Information Technology |
| 1.3 Department | Telecommunications and Information Technologies |
| 1.4 Field | Electronic Engineering, Telecommunications and Information Technology |
| 1.5 Study level | Bachelor's Degree Studies |
| 1.6 Study program / Qualification | Telecommunications Systems and Technologies |

2. Course info

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 Course name: **Digital Signal Processing** | | | | | | Code: EDID305ET | |
| 2.2 Course organizer (lecturer) | | Sef lucr. dr. ing. Nicolae Cleju | | | | | |
| 2.3 Teaching assistants | | Sef lucr. dr. ing. Nicolae Cleju | | | | | |
| 2.4 Year of study | 3 | 2.5 Semester | 5 | 2.6 Assessement | E | 2.7 Type of subject | DID |

3. Estimated total time (hours per semester for teaching activities)

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Number of hours per week | 5 | 3.2 lecture | 3 | 3.3 seminar/laboratory | 2 |
| 3.4 Total number of hours in curricula | 70 | 3.5 lecture | 42 | 3.6 seminar/laboratory | 28 |

| Time distribution | hours |
|---|---|
| Textbook, course support, references and course notes study | 40 |
| Library, electronic platforms and on site documentation | 10 |
| Seminar/laboratory preparation, homework, reports, portfolios and essays | 14 |
| Tutoring | 2 |
| Assessment | 4 |
| Other activities | 4 |

| | |
|---|---|
| 3.7 Total individual study hours | 74 |
| 3.9 Total hours per semester | 144 |
| 3. 10 Number of credit points | 6 |

4. Prerequisites (where applicable)

| | |
|---|---|
| 4.1 curricula type | |
| 4.2 competence type | • Fundamentals of mathematical analysis; basic knowledge of discrete signals |

5. Infrastructure (where applicable)

| | |
|---|---|
| 5.1. for lectures | Blackboard, video projector |
| 5.2. for laboratories | Computers with simulation software Matlab R2013 |

6. Specific competences

| | |
|---|---|
| Professional competences | • Analyze discrete, linear and time-invariant, characterize these systems and compute their response to usual input signals<br>• Characterize discrete, linear and time-invariant systems using the Z transform as well as in the time domain<br>• Evaluate the performance of designed linear time-invariant systems<br>• Evaluate advantages of different filter design methods and choose an optimal one |
| Transversal competences | • Master the adequate mathematical formalism and the specific terminology<br>• Use mathematical models to model simple real-life technical challenges<br>• Evaluate advantages and disadvantages of various solutions and identify the optimal one |

7. Course targets (as resulting from 6. Specific competences table)

| | |
|---|---|
| 7.1 Course main target | Students should acquire knowledge and be able to use the central elements of digital signal processing for basic applications (discrete signals and the sampling process, the Z transform for analyzing linear time invariant systems, basic filtering techniques and types of filters) |
| 7.2 Course specific targets | - Understand the sampling processs and its limitations<br>- Analyze discrete linear time invariant systems and characterize them<br>- Use a basic digital filter for processing signals in time or frequency domain<br>- Implement a filtering process in an engineering application or programming language |

8. Contents

| **8. 1 Lectures** | **Teaching methods** | **Notes** |
|---|---|---|
| Fundamentals of analog-digital and digital-analog conversion | Exposition and slides<br>Explanations and discussion<br>Case studies<br>Connections with related disciplines | 1 lecture |
| Discrete signals and systems | | 2 lectures |
| The Z transform and its application for analysis of discrete, linear, time-invariant systems | | 3 lectures |
| Discrete signal and system analysis in the frequency domain | | 3 lectures |
| The discrete Fourier transform | | 2 lectures |
| Basic design methods for IIR and FIR filters | | 2 lectures |
| Applications of digital signal processing | | 1 lecture |

References:


- D. Tarniceriu, *Bazele prelucrarii numerice a semnalelor*, Ed. Politehnium, Iaşi, 2008.
- D. Tărniceriu, *Filtrare digitală, Ed. Tehnopres, Iasi* 2004.
- Proakis, J. G., Manolakis, D. G., *Introduction to Digital Signal Processing*, New York Macmillian, 1992.
- V. Oppenheim, R. W. Shafer, *Discrete - Time Signal Processing*, Englewood Cliffs, NJ. Prentice Hall, 1989.
- Ciochină, S., *Prelucrarea numerică a semnalelor*- partea I, U. P. B., 1995.
- Naforniţă, I., Câmpeanu, A., Isar, A., *Semnale, circuite şi sisteme*, Universitatea Politehnica Timişoara, 1995.
- Papoulis, A., *Signal Analysis*, McGraw - Hill, New York, 1977.

| 8. 2 Laboratory | Teaching methods | Notes |
|---|---|---|
| 1. Safety regulation and introduction to Matlab | Solving laboratory application in Matlab<br>Exercises<br>Discussions<br>Case studies | |
| 2. Working with 1-D signals (timeseries) | | |
| 3. Working with 2-D signals (images) | | |
| 4. Working with 3-D signals (video data) | | |
| 5. Discrete systems | | |
| 6. Implementation of systems in Simulink | | |
| 7. Properties of discrete systems | | |
| 8. Convolution | | |
| 9. The discrete Fourier transform and its applications | | |
| 10. Common pulses used in communications | | |
| 11. Filter design by poles and zeros placement | | |
| 12. Oscillators | | |
| 13. Recovery of missed laboratories | | |
| 14. Final test | | |
| References:<br>Moodle webpage | | |

9. Course contents corroboration with the expectations of the epistemic community representatives, professional associations **and** relevant employers in the field of the program

| |
|---|
| This course introduces the basic notions of digital signal processing which are are useful in most domains of IT engineering. In particular, knowledge of data sampling, linear filters and the discrete Fourier transform are essential for electrical and electronics engineers in the industry. |

10. Assessment

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Percentage of final grade |
|---|---|---|---|
| 10.4 Lectures | Correctness and accuracy of responses to exercises and theoretical questions | Final evaluation: written exam | 60% |
| 10.5 Applications | Lab activity during all the semester (accuracy of the implementation, interpretation of the simulation results, answers) | Oral answers, practical demonstration | 40% |
| | Correctness and accuracy of responses to exercises and theoretical questions | Intermediary written tests[1]: 3 tests with 1 exercise, on weeks 5 / 8 / 11 | |
| | Final laboratory test: Correctness of the | Practical implementation in Matlab, | |

| | | | |
|---|---|---|---|
| | implementation of an exercise | | |
| 10.6 Minimum performance standard | | | |
| Knowledge of basic concepts (for example characteristics of linear filters, Z transform of simple signals), solving a basic exercise | | | |

Completion date:
11.09.2019

Course organizer signature,
S.l.dr.ing. Nicolae Cleju

Teaching assistant signature,
S.l.dr.ing. Nicolae Cleju

Department approval date,

16. SEP. 2019

Department director signature,
Conf.dr.ing. Luminița Scripcariu

i *Se va preciza numărul de teste şi săptămânile în care vor fi susţinute.*