**COURSE GUIDE**
University year 2019 - 2020

Dean,
Prof. dr. ing. Daniela Tărniceriu

## 1. Program info

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|---|---|
| 1.1 Higher education institution | "Gheorghe Asachi" Technical University of Iaşi |
| 1.2 Faculty | Electronics, Telecommunications and Information Technology |
| 1.3 Department | Telecommunications and Informational Technologies |
| 1.4 Field | Electronics, Telecommunications, and Informational Technologies Engineering |
| 1.5 Study level | Bachelor |
| 1.6 Study program | Telecommunication Systems and Technologies |

## 2. Course info

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|---|---|---|---|---|---|---|---|
| 2.1 Course name/Code | | Communication Systems / EDID309T | | | | | |
| 2.2 Course organizer (lecturer) | | Şef lucr. dr. ing. Felix Diaconu | | | | | |
| 2.3 Teaching assistants | | Şef lucr. dr. ing. Felix Diaconu | | | | | |
| 2.4 Year of study | 3 | 2.5 Semester | 6 | 2.6 Assessement | Exam | 2.7 Category | DI |

## 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 | 21 |
| Library, electronic platforms and on site documentation | 12 |
| Seminar/laboratory preparation, homework, reports, portfolios and essays | 4 |
| Tutoring | 7 |
| Assessment | 6 |
| Other activities | - |

| | |
|---|---|
| **3.7 Total individual study hours** | 50 |
| **3.9 Total hours per semester** | 120 |
| **3. 10 Number of credit points** | 5 |

## 4. Prerequisites (where applicable)

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|---|---|
| 4.1 curricula type | None |
| 4.2 competence type | None |

**5. Infrastructure** (where applicable)

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|---|---|
| 5.1. for lectures | Course room with white board, PC and videoprojector |
| 5.2. for laboratories | Laboratory room with PCs, network and Matlab software |

**6. Specific competences**

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|---|---|
| **Professional competences** | - Use of fundamental elements regarding devices, circuits, systems, instrumentation and electronic technology<br>- Application of fundamental methods for signal acquisition and processing<br>- Design, implementation and operation of data, voice, video, and multimedia services, based on understanding and application of fundamental notions from communication field and information transmission<br>- Selection, set-up, configuration and exploitation of fixed or mobile telecommunication equipments and site equipping with common telecommunication networks |
| **Transversal competences** | - Systematic analisys of problems met in work and identification of elements which have accepted solutions, in order to fulfill professional tasks<br>- Defining of activities on stages and allocation of these to subordinates, with complete explanation of duties, according to hierarchical levels, ensuring efficient information exchange and inter-human communication<br>- Adaptation to new technologies, professional and personal development through continuous forming using printed documentation sources, specialized software and electronic resources in english |

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

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|---|---|
| 7.1 Course main target | Thorough knowledge of theoretical, methodological, and practical developments specific to transmission techniques used in modern telecommunication systems (coding, prediction, and modulation techniques, OFDM systems, implementing structures) |
| 7.2 Course specific targets | - Student must be able to prove that he acquired enough knowledge in order to understand studied notions<br>- Student must be able to critical understand, explain and interpret theoretical, methodological, and practical developments specific to digital signal processing<br>- Student must be able to correctly apply fundamental methods and principles in digital communication systems analysis in time, Z, and frequency domain<br>- Student must be able to carry out simple projects for synthesis of component blocks from digital communication systems structure |

**8. Contents**

| **8. 1 Lectures** | **Teaching methods** | **Notes** |
|---|---|---|
| DIGITAL TRANSMISSION OF ANALOG SIGNALS<br>PCM system model, signal sampling, effects. Signal quantizing. PCM transmission quality. Companding, encoding and decoding. PCM transmission systems. Differential PCM. Delta modulation (linear and adaptive DM, delta-sigma modulation, DM-PCM conversion). Linear predictive coding. | Exposing, discussions | |
| SIGNAL MULTIPLEXING<br>Frequency, time, and code signal multiplexing. Examples. Substitution of frequency multiplexing systems with time multiplexing systems. Digital hierarchies: PDH and SDH. | | |
| INTRODUCTION TO DIGITAL COMMUNICATIONS<br>Electrical representation, coding, types. Spectral analysis of binary signals. Modulation, data recording, and line coding. | | |
| BASEBAND DATA TRANSMISSIONS<br>Nyquist methods. Baseband digital signals. Partial response signaling. Precoding. Error probability. Frequency response splitting between transmitter and receiver. | | |
| DIGITAL MODULATIONS | | |

| | | |
|---|---|---|
| Introduction. Block models. Fold-over. PSK signals. DPSK signals.FSK signals. Differential detection. ASK signals. Signal bandwidth. QAM signals. QPSK signals. OQPSK signals. $\pi/4$ QPSK signals. QASK signals. OQASK signals. MSK signals. APK signals. SFSK signals. GMSK signals. GFSK signals. TFM signals. $Q^2$PSK signals. CSK signals. EDGE modulation. HPK modulation. MDMA (chirp) techniques. | | |
| OFDM<br>Introduction. Benefits and drawbacks. Guard intervals. Generation of OFDM signal. Cyclic prefix. OFDM synchronization. Example of OFDM system: IEEE 802.11a. Power spectral density of OFDM signals. OFDM receiver with coherent detection. Performance enhancement of OFDM transmission. Spectral limitation. Examples of OFDM systems: DAB and DVB. | | |


References:
[1] Alexandru N.D., „Sisteme de comunicaţii", Ed. CERMI Iaşi, 2008.
[2] Diaconu F., Alexandru N.D., „Sisteme de comunicaţii. Îndrumător de laborator", Ed. STEF, Iaşi, 2008.
[3] Alexandru N.D., „Radiocomunicaţii digitale", vol.II, Comunicaţii digitale, Ed. STEF, Iaşi, 2006.
[4] Alexandru N.D., Graur, A., „Domotica", Ed. MEDIAMIRA, Cluj-Napoca, 2006.
[5] Couch II L.W., „Digital and Analog Communication Systems", Fifth Edition, Prentice Hall, 1997.
[6] Proakis J.G., Salehi M., „Communication Systems Engineering", Second Edition, Prentice Hall, 2002.
[7] Rappaport T. S., „Wireless Communications Principles and Practice", Second Edition, Prentice Hall, 2002.
[8] Alexandru N. D., Cotae P., „Tehnica Modernă a Comunicaţiilor", Rotaprint, Iaşi, 1990.
[9] Bogdan I., „Comunicaţii Mobile", Ed. Tehnopress, Iaşi, 2003.
[10] Glover I.A., Grant P.M., „Digital Communications" - book & solutions manual, First Edition, Prentice Hall, 2000.
[11] Haykin S., „Adaptive Filter Theory", Third Edition, Prentice Hall, 1996.
[12] Meyr H., Moeneclaey M., Fechtel St.A., „Digital Communication Receivers: Synchronization, Channel Estimation, and Signal Processing", John Wiley & Sons, Inc., 1998.
[13] Munteanu V., „Teoria Transmiterii Informaţiei", Ed. „Gh. Asachi", Iaşi, 2001.
[14] Peebles P.Z., „Digital Communications Systems", Prentice Hall Inc., 1987.
[15] Peebles P.Z., „Probability, Random Variables and Random Signal Principles", Second Edition, McGraw Hill Inc., 1987.
[16] Proakis J.G., "Digital Communications", Third Edition, Prentice Hall, 1995.
[17] Simon M.K., Alouini M.S., „Digital Communication over Fading Channels: A Unified Approach to Performance Analysis", John Wiley & Sons, Inc., 2000.
[18] Wilson S., „Digital Modulation and Coding", Prentice Hall, 1996.
[19] Ziemer R.E., Peterson R.L., „Digital Communications and Spread Spectrum Systems", MacMillan, 1985.
[20] Ziemer R.E., Peterson R.L., „Introduction to Digital Communication", MacMillan, 1992.


| **8. 2 Laboratory** | **Teaching methods** | **Notes** |
|---|---|---|
| 1. Introductive to Matlab program.<br>2. Uniform quantizing. Nonuniform quantizing.<br>3. Linear prediction DPCM transmission systems.<br>4. Delta modulation transmission systems.<br>5. Baseband transmissions. Eye diagram.<br>6. Data scrambling.<br>7. High Density Bipolar-n coding (HDBn).<br>8. Baseband transmissions with first Nyquist method. Equalizing.<br>9. Improved Nyquist filters.<br>10. Baseband transmissions with second Nyquist method. Partial response signaling.<br>11. ASK, BPSK digital modulations.<br>12. FSK, QAM, QPSK digital modulations.<br>13. Digital generation of waveforms.<br>14. Retrieves. | Practical demonstration, exercise, experiment | |


References:
Diaconu F., Alexandru N.D., „Sisteme de comunicaţii. Îndrumător de laborator", Ed. Stef, Iaşi, 2008, pp.1-52, ISBN 978-973-1809-18-2.

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

- The objectives of this discipline are in accordance with the educational plan, and are designed to transmit information and develop skills that are vital to the formation of the future electronics, telecommunications and information technology specialists.
- Various curriculae used throughout other national and international university centres, and the expectations of industry partners have been consulted for the development of the course guide.
- This discipline frequenty use specific knowledge and methods introduced in Mathematics and Signals, circuits and systems disciplines.

**10. Assessment**

| Activity type | 10.1 Assessment criteria | 10.2 Assessment methods | 10.3 Percentage of final grade |
|---|---|---|---|
| 10.4 Lectures | Acquired theoretical knowledge (quantity, correctness, accuracy) | Homeworks: 2 | 20% |
| | | Final assessment | 60% |
| 10.5 Laboratory | Being familiar with devices and working mode of specific instruments; instruments or achievements assessment, results processing and interpretation | - Written test<br>- Verbal answering<br>- Laboratory book (experimental works, reports)<br>- Practical demonstration | 20% |
| 10.6 Minimum performance standard | | | |
| Obtaining a minimum grade of 5 for each component of the final grade. | | | |

Completion date
12.09.2019

Course organizer signature,
Şef lucr. dr. ing. Felix Diaconu

Teaching assistant signature,
Şef lucr. dr. ing. Felix Diaconu

Department approval date

16. SEP. 2019

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