# SYLLABUS

## 1. Data about the program of study

| | | |
|---|---|---|
| 1.1 | Institution | The Technical University of Cluj-Napoca |
| 1.2 | Faculty | Electronics, Telecommunications and Information Technology |
| 1.3 | Department | Bases of Electronics |
| 1.4 | Field of study | Electronics and Telecommunications Engineering |
| 1.5 | Cycle of study | Bachelor of Science |
| 1.6 | Program of study/Qualification | Telecommunications Technologies and Systems/Engineer, Applied Electronics/Engineer |
| 1.7 | Form of education | Full time |
| 1.8 | Subject code | TST-E19.00, EA-E19.00 |

## 2. Data about the subject

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.1 | Subject name | | | | | Signals Theory | | | | | |
| 2.2 | Subject area | | | | | Signals, circuits and systems | | | | | |
| 2.3 | Course responsible/lecturer | | | | | Prof. Marina Ţopa, PhD | | | | | |
| 2.4 | Teachers in charge of applications | | | | | Assist. Prof. Ervin Szopos, PhD | | | | | |
| 2.5 | Year of Study | II | 2.6 | Semester | 1 | 2.7 | Assessment | Exam | 2.8 | Subject category | DID/DOB |

## 3. Estimated total time

| Year / Sem. | Subject name | No. of weeks | Course [hours/week] | Applications [hours/week] S | L | P | Course [hours/sem.] | Applications [hours/sem.] S | L | P | Indiv. study | TOTAL | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| II / 1 | Signals Theory | 14 | 2 | 1 | 1 | | 28 | 14 | 14 | | 74 | 130 | 5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3.1 | Number of hours per week | 4 | 3.2 | of which, course | 2 | 3.3 | aplications | 2 |
| 3.4 | Total hours in the curriculum | 56 | 3.5 | of which, course | 28 | 3.6 | aplications | 28 |

| Individual study | Hours |
|---|---|
| Manual, lecture material and notes, bibliography | 28 |
| Supplementary study in the library, online and in the field | 20 |
| Preparation for seminars/laboratory works, homework, reports, portfolios, essays | 20 |
| Tutoring | 3 |
| Exams and tests | 3 |
| Other activities | |

| | | |
|---|---|---|
| 3.7 | Total hours of individual study | 74 |
| 3.8 | Total hours per semester | 130 |
| 3.9 | Number of credit points | 5 |

## 4. Pre-requisites (where appropriate)

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| 4.1 | Curriculum | |
| 4.2 | Competence | Mathematical notions: complex numbers, Laplace transform, computation of simple integrals. Relations and theorems for electric circuits. |

## 5. Requirements (where appropriate)

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| 5.1 | For the course | Amphitheatre, Cluj-Napoca |
| 5.2 | For the applications | Laboratory, Cluj-Napoca |

## 6. Specific competences

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|---|---|---|
| Professional competences | Theoretical knowledge (what the student must know): | After completing the discipline, the students will have the following theoretical knowledge:<br>- Classification of signals and systems with respect to different criteria;<br>- Time and frequency domaine analysisof time-continuous periodic and aperiodic signals;<br>- Time and frequency domain description of time-continous liniar time-invariant systems;<br>- The sampling theorem and reconstruction of analog signals from samples;<br>- Modulation procedures with harmonic carrier: amplitude modulation and special amplitude modulation procedures, frequency and phase modulation; demodulation procedures. |
| | Acquired skills (what the student is able to do): | After completing the discipline, the students will be able to:<br>- Find the mathematical model of the time-continuous signals;<br>- Computeand plot the spectra for time-continuous periodic and aperiodic signals;<br>- Find the mathematical model for time-continuous liniar time-invariant systems;<br>- Find the respons of a time-continuous liniar time-invariant system to an excitation;<br>- Plot the frequency characteristics (Bode plots) for a system;<br>- Analyse several modulated signals. |
| | Acquired abilities: (what type of equipment the student is able to handle) | After completing the discipline, the students will be able to:<br>- Use the OrCAD software for the analysis of passive circuits;<br>- Model several time-continuous liniar time-invariant systems using the OrCAD software;<br>- Measure the parameters of the frequency plots. |
| | In accordance with Grila1 and Grila2 RNCIS | C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology<br>C2. To apply basic methods for signal acquisition and processing<br>C3. To apply knowledge, concepts and basic methods regarding computing systems' architecture, microprocessors, microcontrollers, programming languages and techniques<br>C4. To design, implement and operate data, voice, video and multimedia services, based on the understanding and application of fundamental concepts from the field of communications and information transmission. |
| Cross competences (Grila1 and Grila2 RNCIS) | | N.A. |

## 7. Discipline objectives (as results from the key competences gained)

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|---|---|---|
| 7.1 | General objectives | Developing the competences regarding analysis of signals and systems. |
| 7.2 | Specific objectives | 1. Knowledge and understanding of basic approaches regarding signals and systems.<br>2. Development of skills and abilities for the analysis of time-continouos signals.<br>3. Development of skills and abilities for the analysis of time-continouos liniar time-invariant systems. |

## 8. Contents

| 8.1 Lecture (syllabus) | | Teaching methods | Notes |
|---|---|---|---|
| 1 | Introduction into signals theory. Basic operations of signals. Sinusoidal signals. | Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation | Use of .ppt presentations, projector, blackboard |
| 2 | Harmonic analysis of periodic signals. Harmonic Fourier series. Properties of harmonic Fourier series. | | |
| 3 | Applications of Fourier series: spectrum of periodic unit impulse signal, spectrum of periodic square wave. Unit-step and unit impulse signal. | | |
| 4 | Spectral analysis of impulses. Fourier transform. | | |
| 5 | Properties of Fourier transform. Applications: spectra of unit impulse, square wave, triangle signals. | | |
| 6 | Introduction into systems theory. Classification of systems. Description of liniar invariant analog systems: differential equation, unit impulse response, transfer function. | | |
| 7 | Description of liniar invariant analog systems: unit step response, frequency response, gain and phase. | | |
| 8 | Logarithm frequency characteristics plots (Bode plots). | | |
| 9 | Applications of systems description. | | |
| 10 | Signals sampling. Sampling theorem. Spectral analysis of sampled signals. | | |
| 11 | Amplitude modulation. Special amplitude modulation procedures. | | |
| 12 | Position and frequency modulation. | | |
| 13 | Applications of sampling and amplitude, frequency and phase modulation. | | |
| 14 | Review. Preparation for examination. | | |
| 8.2. Applications (Seminar) | | **Metode de predare** | **Observaţii** |
| 1 | Introduction into signal theory. Complex numbers. Sinusoidal signals. | Solving of problems and review of some theoretical aspects. | Use of blackboard, but also of computer and projector. |
| 2 | Spectra of harmonic and nonharmonic periodic signals. | | |
| 3 | Spectra of impulses. Fourier transform. | | |
| 4 | Liniar invariant analog systems. | | |
| 5 | Bode plots. | | |
| 6 | Sampled signals. | | |
| 7 | Modulated signals. | | |
| 8.3. Applications (laboratory) | | **Metode de predare** | **Observaţii** |
| 1 | Introduction into OrCAD. | Didactic and experimental proof, didactic exercise, team work | Use of Orcad software |
| 2 | Spectrum of periodic signals. | | |
| 3 | Spectrum of periodic square wave. | | |
| 4 | First order systems. | | |
| 5 | Sampled signals. | | |
| 6 | Amplitude modulated signals. | | |
| 7 | Lab recovery and finalization of laboratory activity. | | |

Bibliography

1. Victor Popescu – *Semnale, circuite şi sisteme. Teoria semnalelor*, Editura Casa Cărţii de Ştiinţă, Cluj-Napoca, 2001.
2. Marina Dana Ţopa – *Semnale, circuite şi sisteme. Teoria sistemelor*, Editura Casa Cărţii de Ştiinţă, Cluj-Napoca, 2002.
3. Ioana Sărăcuţ, Erwin Szopos, Victor Popescu – *Teoria semnalelor. Culegere de probleme,* Editura U.T. Press, Cluj-Napoca, 2010.
4. Ioana Sărăcuţ, Victor Popescu – *Teoria semnalelor. Culegere de grile,* Editura U.T. Press, Cluj-Napoca, 2010.

5. Ioana Popescu, Erwin Szopos, Victor Popescu, Marina Dana Ţopa – *Semnale, circuite şi sisteme. Indrumător de laborator IV,* Editura Casa Cărţii de Ştiinţă, Cluj-Napoca, 2003.
6. pagina web a disciplinei prezentări curs, lucrări de laborator): http://www.bel.utcluj.ro/scs/rom/ts_main.html

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

10. Evaluations

| Activity type | 10.1 | Assessment criteria | 10.2 | Assessment methods | 10.3 | Weight in the final grade |
|---|---|---|---|---|---|---|
| Course | | The level of acquired theoretical knowledge. | | 4 written tests TC (20p) | | Max 20% |
| Seminar | | The level of acquired skills and abilities | | 4 written tests TS (20p) | | Max 20% |
| Laboratory | | The level of acquired skills and abilities | | 4 written tests TL (20p) | | Max 20% |
| Examen | | The level of acquired theoretical knowledge, of skills and abilities | | Written examination E (50p): theory (20p) and problems (30p) | | Max 50% |
| Final mark = (TC+TS+TL+E)/10 | | | | | | |
| 10.4 Minimum standard of performance | | | | | | |
| TC+TS+TL>20p si E>20p | | | | | | |

Date of filling in
12.02.2015

Course responsible
Prof. Marina Ţopa, PhD

Teachers in charge of applications
Assist. Prof. Ervin Szopos, PhD

Date of approval in the department
12.02.2015

Head of department
Prof. Sorin Hintea, PhD