SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Electronics, Telecommunications and Information Technology
1.3 Department	Bases of Electronics
1.4 Field of study	Electronic Engineering, Telecommunications and Information Technologies
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Applied Electronics / Engineer
1.7 Form of education	Full time
1.8 Subject code	12.00

2. Data about the subject

2.1 Subject name	Electronic devices						
2.2 Subject area	Electronic devices and circuits						
2.3 Course responsible/lecturer	Assist.prof. Laura-Nicoleta IVANCIU, PhD eng. laura.ivanciu@bel.utcluj.ro						
2.4 Teachers in charge of applications	Assist.prof. Laura-Nicoleta IVANCIU, PhD eng. laura.ivanciu@bel.utcluj.ro Assist.prof. Emilia ȘIPOS, PhD eng. - emilia.sipos@bel.utcluj.ro						
2.5 Year of study	I	2.6 Semester	2	2.7 Assessment	E	2.8 Subject category	DD/DI

3. Estimated total time

3.1 Number of hours per week	4	of which : 3.2 course	2	3.3 seminar / laboratory	2
3.4 Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar / laboratory	28
Distribution of time					hours
Manual, lecture material and notes, bibliography					23
Supplementary study in the library, online specialized platforms and in the field					-
Preparation for seminars / laboratories, homework, reports, portfolios and essays					40
Tutoring					3
Exams and tests					3
Other activities:					

3.7 Total hours of individual study	69
3.8 Total hours per semester	125
3.9 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 Curriculum	
4.2 Competence	Electrical signals, connection of passive components, relations and theorems for electric circuits, time and frequency behavior of capacitors and inductors, frequency response representation.

5. Requirements (where appropriate)

5.1. For the course	Amphitheater, Cluj-Napoca
5.2. For the laboratories	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology C4. To design and use low complexity hardware and software applications, specific to applied electronics C5. To apply knowledge, concepts and basic methods from power electronics, automated systems, electric energy management, electromagnetic compatibility Other skills: - knowledge of using electronic devices in different operating regimes: switching regime, permanent conduction regime (or as amplifier); - characterization of the behavior of an electronic device in its quiescent point; - determine the performances of simple electronic circuits; - knowledge of basic applications of electronic devices; - using the lab instrumentation (power supply, oscilloscope, function generator, multimeter) for the experimental study of simple electronic circuits - collecting and analyzing the numerical data obtained through the explorations - experimental determination of the voltage transfer characteristic of several circuits (DR, op-amp comparators, op-amp amplifiers) - experimental determination of the parameters of several circuits (gain, input resistance, pass band)
Cross-competences	CT1: Methodical analysis of the problems encountered in the activity, identifying the elements for which there are established solutions, thus ensuring the fulfilment of professional tasks

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

7.1 General objectives	Developing the competences regarding the use of electronic devices.
7.2 Specific objectives	1. Recognizing and understanding basic concepts specific to electronic devices. 2. Developing skills and abilities necessary for the use of electronic devices in simple electronic circuits 3. Developing skills and abilities for the analysis and (re)design of electronic circuits.

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Presentation of course structure. Review: electrical signals, relations and theorems for electric circuits, RC circuits, frequency response representation	Presentation, euristic conversation, exemplification,	.Use of .ppt presentation, projector, blackboard
2. Diodes. Models for switching diode. DR circuits.		

3. DR switching circuits. Switching DC circuits. Single-phase rectifiers with capacitive filter.	problem presentation, teaching exercise, case study, formative evaluation	
4. Full-wave DR rectifiers. DC swicthcing circuits. DRC rectifiers. LEDs.		
5. Zeener diodes. Operational amplifiers (OpAmps). OpAmp operation. Ideal OpAmp. Modes of use.		
6. Simple op-amp comparators. Inverting and noninverting comparators. Voltage transfer characteristic. Waveforms.		
7. Positive feedback OpAmp comparators. Inverting and noninverting comparators. Voltage transfer characteristic. Waveforms.		
8. Electronic amplifiers: definition, power supply, voltage transfer characteristic, modeling, performance evaluation. Negative feedback op-amp amplifiers. Non-inverting and inverting amplifier.		
9. Summing amplifiers. Differential amplifiers.		
10. Aplications with OpAmp: voltage domain conversion circuits, capacitively coupled amplifiers, amplifiers operated from a single power supply, integrators and differentiators.		
11. Transistors. Types. Operating principle and operating regions. Use in circuits. Transfer characteristics. BJTs: symbol, internal structure		
12. BJTs operating principle and equations, transistor characteristics, operating regions, saturation. Switching MOS transistor: analog switch, CMOS inverter. Noise margins.		
13. MOS transistors: symbol, physical structure, operating principle and equations, static characteristics, operating regions.		
14. Recapitulation. Preparation for the final exam.		
8.2 Laboratory	Teaching methods	Notes
1. Introduction. Workplace safety.	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, smart board
2. Lab instrumentation. Voltage divider.		
3. Semiconductor diodes		
4. DR switching circuits, two-port and multi-port networks		
5. DC switching two-port network		
6. Single phase rectifiers with capacitive filter		
7. Circuits with Zener diodes and LEDs.		
8. Voltage comparator with op-amp - simple comparators		
9. Optical indicator for voltage level with OpAmp		
10. Voltage comparator with op-amp - hysteresis comparators		
11. Basic amplifiers with OpAmp		
12. Rail-to-rail OpAmp amplifier with unipolar supply		
13. Laboratory test		
14. Lab do-overs and finalization of lab activity		
Bibliography ***On-line references***		

1. Ivanciu, Laura-Nicoleta. Electronic devices (course slides, laboratories, problem examples, exam subjects), http://www.bel.utcluj.ro/dce/didactic/ed/ed.htm
2. Sipos, Emilia, Ivanciu, Laura, Dispozitive Electronice. Probleme rezolvate, 2016

Offline references

1. Oltean, G., Electronic Devices, Editura U.T. Pres, Cluj-Napoca, ISBN 973-662-220-7, 2006; 317 pag.
2. Oltean, G., Sipos, Emilia, Miron, C., Ivanciu, Laura, Laboratory Manual for Electronic Devices, Editura UTPRESS, Cluj Napoca, 2010, ISBN 978-973-662-542-8, 90 pag.

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

The discipline content and the acquired skills are in agreement with the expectations of the professional organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job (in the field of Electronics), and the expectations of the national organization for quality assurance (ARACIS).

10. Evaluations

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	The level of acquired theoretical knowledge and practical skills	- 10 homework activities - optional (problem solving) - Summative evaluation written exam (problem solving)	- H, max 10 pts, 10% - E, max 10 pts 70%
10.5 Applications	The level of aquired abilities	- Continuous formative evaluation - Laboratory test (practical evaluation)	- L, max. 10 pts, 30%
10.6 Minimum standard of performance			

Quality level:

Minimum knowledge:

- ✓ Recognizing and understanding basic concepts specific to electronic devices.
- ✓ Analyzing and (re)designing electronic circuits.

Minimum competences:

- ✓ To recognize and understand basic concepts specific to electronic devices.
- ✓ To develop skills and abilities necessary for the use of electronic devices in simple electronic circuits
- ✓ To analyze and (re)design electronic circuits.

Quantitative level:

- ✓ Full laboratory attendance
- ✓ Final grade computed as: min(10, 0,7E+0,3L+0,1H)≥ 4.5, where L ≥ 5 and E ≥ 4.

Date of filling in:	Responsible	Title Surname NAME	Signature
29.09.2019	Course	Assist.prof. Laura-Nicoleta IVANCIU, PhD eng.	
	Applications	Assist.prof. Laura-Nicoleta IVANCIU, PhD eng.	
		Assist.prof. Emilia ȘIPOȘ, PhD eng.	

Date of approval in the Department of Bases of Electronics _____	Head of Bases of Electronics Department Prof. Sorin HINTEA, PhD Eng.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology _____	Dean Prof. Gabriel OLTEAN, PhD Eng.