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-E12.00, EA-E12.00

2. Data about the subject

2.1	Subject name	Electronic devices									
2.2	Subject area	Electronic devices and circuits									
2.3	Course responsible/lecturer	Prof. Gabriel Oltean, PhD									
2.4	Teachers in charge of applications	Assist. Prof. Emilia Șipoș, PhD									
2.5	Year of study	I	2.6	Semester	2	2.7	Assessment	Exam	2.8	Subject category	DD/ DI

3. Estimated total time

Year/ Sem.	Subject name	No. of weeks	Course	Applications			Course	Applications			Indiv. study	TOTAL	Credits
			[hours/week]				[hours/sem.]						
				S	L	P		S	L	P			
I / 2	Electronic devices	14	2		2		28		28		69	125	5

3.1	Number of hours per week	4	3.2	of which, course	2	3.3	applications	2
3.4	Total hours in the teaching plan	56	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	22
Supplementary study in the library, online and in the field	-
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	41
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	Amphitheatre, Cluj-Napoca
5.2	For the applications	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	Theoretical knowledge (what the student must know):	The operating principle of electronic devices: diode, operational amplifier, MOS and bipolar transistors; Equivalent models of electronic devices: switching diode and permanent conduction diode, comparator and amplifier regimes for operational amplifier, switching and permanent conduction regimes for MOS and bipolar transistors; Analysis of basic circuits with electronic devices; Description of the operating regimes of electronic devices and basic electronic circuits using transfer characteristics, time representations of the input and output signals and transfer functions.
	Acquired skills (what the student is able to do):	After completing the discipline, the students will be able to: - use electronic devices in different operating regimes: switching regime, permanent conduction regime (or as amplifier); - determine the operating regime of electronic devices; - characterize the behavior of an electronic device in its quiescent point; - determine the performances of simple electronic circuits; - use the basic applications of electronic devices; - (re)design basic circuits with electronic devices; - analyze and experimentally determine the parameters of electronic devices and the performance of basic electronic circuits.
	Acquired abilities: (what type of equipment the student is able to handle)	After completing the discipline, the students will be able to: - use the lab instrumentation (power supply, oscilloscope, function generator, multimeter) for the experimental study of simple electronic circuits - use the experimental boards - connect the lab instrumentation with the experimental boards, in order to experimentally study electronic devices and basic electronic circuits - gather and analyze the numerical data obtained through the explorations
	In accordance with Grila1 and Grila2 RNCIS	C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology 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. C5. To select, install, configure and exploit fixed and mobile telecommunications equipment. To equip a site with common telecommunications networks.

Cross competences (Grila1 and Grila2 RNCIS)	N.A.

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, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2	Diodes. Models for switching diode. Switching DR circuits.		
3	Switching DC circuits. Single-phase rectifiers with capacitive filter.		
4	Diode in permanent conduction. Exponential model. DR circuit analysis. Small-signal parameters. Zener diode. Use of Zener diode. LEDs.		
5	Operational amplifiers (OpAmps). OpAmp operation. Ideal OpAmp. Modes of use. Simple op-amp comparators. Inverting and noninverting comparators. Voltage transfer characteristic. Waveforms		
6	Positive feedback op-amp comparators. Inverting and noninverting comparators. Voltage transfer characteristic. Waveforms		
7	Electronic amplifiers: definition, power supply, voltage transfer characteristic, modeling, performance evaluation.		
8	Negative feedback op-amp amplifiers. Non-inverting amplifier: voltage transfer characteristic, waveforms, gain, input and output resistances. Voltage follower.		
9	Inverting amplifier: performance evaluation: gain, input and output resistances, voltage transfer characteristics, waveforms. Voltage follower. Summing amplifiers. Differential amplifiers.		
10	Transistors. Types. Operating principle and operating regions. Use in circuits. Transfer characteristics.		
11	MOS transistors: symbol, physical structure, operating principle and equations, static characteristics, operating regions.		
12	Switching MOS transistor: analog switch, CMOS inverter. Noise margins.		
13	Bipolar junction transistors: symbol, internal structure, operating principle and equations, transistor characteristics, operating regions. Bipolar junction transistor saturation. Switching bipolar transistor: RTL logic circuits, standard TTL gate.		
14	Recapitulation. Preparation for the final exam.		
8.2. Applications (lab)		Teaching methods	Notes

1	Introduction. Labour protection. Fundamentals.	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, magnetic board
2	Lab instrumentation		
3	DR switching circuits, two-port and multi-port networks		
4	DC switching two-port network		
5	Single phase rectifiers with capacitive filter		
6	Semiconductor diodes		
7	Voltage comparator with op-amp - simple comparators		
8	Voltage comparator with op-amp - hysteresis comparators		
9	Basic amplifiers with OpAmp		
10	Circuits with OpAmp		
11	CMOS transmission gate circuits		
12	Laboratory test		
13	Logic circuits with BJT		
14	Lab recovery and finalization of laboratory activity		

Bibliography

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.

On-line references

1. Oltean, G. Electronic devices (course slides, laboratories, problem examples, exam subjects), http://www.bel.utcluj.ro/dce/didactic/ed/ed.htm

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, 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
Course		The level of acquired theoretical knowledge and practical skills		- 3 formative evaluation tests (problem solving) - Summative evaluation written exam (theory and problems)		- T, max 10 pts. 20% - E, max 10 pts. 60%
Applications		The level of acquired abilities		- Continuous formative evaluation - practical lab test		- L, max. 10 pts. 20%
10.4 Minimum standard of performance						
$L \geq 5$ and $E \geq 4$, $0,6E+0,2L+0,2T \geq 4.5$						

Date of filling in 1.10.2018

Course responsible
Prof. Gabriel Oltean, PhD

Teachers in charge of applications
Assist. Prof. Emilia Șipoș, PhD.