COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	Politehnica University of Bucharest
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Dept. of Devices, Circuits and Electronic Architectures
1.4 Domain of studies	Electronic Engineering, Telecommunications and Informational Technologies
1.5 Cycle of studies	Licence (engineering)
1.6 Program of studies/Qualification	Technologies and Systems of Telecommunications (TSTeng)

2. Course identification information

2.1 Name of the course		Electronic Circuits (CE) - Laboratory					
2.2 Lecturer		None					
2.3 Instructor for practical activities		Teaching Assistant Teodorescu Laurenţiu, Ph. D.					
2.4 Year of studies	II	2.5 Semester	4	2.6 Evaluation type	Verification	2.7 Course choice type	Mandatory

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week, out of which	2	3.2 course	0	3.3 practical activities	2
3.4 Total hours in the curricula, out of which	28	3.5 course	0	3.6 practical activities	28

Distribution of time	hours
Study according to the manual, course support, bibliography and hand notes	6
Supplemental documentation (library, electronic access resources, in the field, etc)	4
Preparation for practical activities, homeworks, essays, portfolios, etc.	8
Tutoring	0
Examinations	2
Other activities	0

3.7 Total hours of individual study	24
3.9 Total hours per semester	52
3. 10 Number of ECTS credit points	2

4. Prerequisites (if applicable)

4.1 curricular	The completion of the following lectures: - Electro-technical Fundamentals; - Electronic Devices; - Materials and Electronic Devices- Laboratory; - Electronics Measurements- Laboratory
4.2 competence-based	Utilization of: digital oscilloscope, multimeter, signal generator, voltage sources. Knowledge regarding general engineering techniques for measuring electric and electronic quantities.

5. Requisites (if applicable)

5.1 for running the course	Not applicable, according to current PUB regulations.
5.2 for running of the applications	Compulsory presence at laboratory classes, according to current PUB regulations.

6. Specific competences

Professional	C1. The use of the fundamental knowledge for devices, circuits,

competences	systems, instrumentation and electronic technology. C1.2 The analysis of the small / medium complexity electronic circuits in order to design and measure them C1.4 The use of electronic tools and specific methods to characterize and evaluate the performance of the electronic circuits and systems
Transversal competences	CT1. The methodical analysis of the daily issues, identifying the problems for which well-known solutions are already available, thus accomplishing the professional tasks

7. Course objectives (as implied by the grid of specific competences)

7.1 General objective of the course	The discipline familiarizes students with the following: - the presentation and the characterization of the following fundamental circuits: negative feedback amplifiers, audio-frequency oscillators, differential and operational amplifiers. - the presentation and the usage of the measurement methods and techniques for the main electrical parameters which define the negative feedback amplifier in the following configurations: series-shunt (both open and closed loop) and shunt-shunt in open loop. - the presentation and the usage of the measurement methods and techniques for the main electrical parameters which define the Wien bridge audio-frequency oscillator (oscillation frequency, output level, estimating the change of the output amplitude when the load impedance varies). - the presentation and the usage of the measurement methods and techniques for the main electrical parameters which define the operational amplifier. - the usage of PSPICE simulation software for characterizing negative feedback amplifiers, oscillators and linear voltage regulators. - The FPGA implementation of the basic digital circuits (register, memory, programmable logic controller (PLC))
7.2 Specific objectives	Initiating students in an engineering way of thinking. Creating skills to use general knowledge of analog and digital circuitry to measure fundamental parameters of specific circuits, and evaluation of the results of these measurements. Creating some circuits characterization skills, and the ability to redesign low complexity electronic circuits.

8. Content

8.1 Lectures	Teaching techniques	Remarks
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8.2 Practical applications	Teaching techniques	Remarks
1.1 Negative feedback amplifier. Configurations and measurements.	Oral presentation. The students simulate, implement, test and evaluate the proposed applications independently, based on the printed laboratory platforms, using available software and hardware.	2 hours
1.2 Negative feedback amplifier simulations with PSPICE		2 hours
2.1 Introduction to the digital circuits implementation by using the FPGA 2.2 Introduction to the digital circuits implementation (Part II). The Verilog hardware description language.		2 hours
ModelSim simulator. Xilinx synthesis. The multiplexer.		2 hours
3.1 The differential amplifiers		2 hours

3.2 The operation of the linear voltage regulator by using the Pspice simulator		2 hours
4.1 Memory circuits-registers, the counter with the clock signal. 4.2 2 Memory circuits-implementation by using the FPGA		2 hours 2 hours
5.1 Low frequency oscillators 5.2 The simulation of the Wien bridge oscillator		2 hours
6.1 PLC's part I 6.2. PLC's part II		2 hours 2 hours
Final quiz.		4 hours
Total		28 hours

Bibliography:

1. F. Drăghici, I. Rusu, **L. Teodorescu**, *Circuite Electronice* – Îndrumar de laborator, Ed. Hamangiu, 2016, ISBN 978-606-27-0397-4.
2. R. Muller, T. Kamins, *Devices Electronics for Integrated Circuits*, Wiley and Sons, New York, 1988.
3. R. F. Pierret, G. W. Neudeck, *Modular Series on Solid State Devices*, Addison – Wesley, New York, 1990
4. G. Brezeanu, G. Dilimot, F. Mitu, F. Draghici, *Probleme de dispozitive si circuite electronice,* Ed. IT Grup, Bucureşti 2002.
5. P. R. Gray, R. G. Meyer, *Circuite integrate analogice – Analiz`]i proiectare*, Ed. Tehnică, Bucureşti, 1997.
6. A. S. Grove, *Fizica si tehnologia dispozitivelor semiconductoare,* Ed. Tehnică, Bucureşti, 1973.
G. Brezeanu, F. Drăghici, *Circuite Electronice Fundamentale,* Ed. Rosetti Educational, 2013

9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program

The didactic purpose of this discipline is to acquire the necessary skills to recognize, to measure and to characterize the analog electronic circuits which accomplish some fundamental functions: amplification, harmonic signal generation, voltage and current regulation, along with some abilities to implement a fundamental electronic circuit through correct use of measurement instruments and simulation software, in order to ultimately develop their experience in the domain of the complex analog circuit design.

The discipline curriculum is in agreement with the actual development and evolution requirements, subscribing to European service economics in the field of Microelectronics and Nanotechnologies (MON).

The students are provided with adequate competences, responding to actual qualification requirements, as well as a solid scientific background which will enable them to professionally evolve in both the field of analog and digital circuit design. Thus, the discipline subscribes to University Politehnica of Bucharest's policy regarding content, structure and practical ability development.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures			
10.5 Practical applications	- knowledge of the measurement methods and characterization of fundamental analog circuits: amplifiers, oscillators, linear voltage regulators. - knowledge of both analog and digital electronic circuit simulation software.	- evaluations, during the semester, of practical activities. Grading based on the understanding of measurement methods and elaboration of main electrical characteristics of studied electronic circuits. - Final laboratory examination, evaluating both theoretical knowledge (multiple choices test) and practical abilities (implementation and testing of a specific electronic circuit)	50% 50%
10.6 Minimal performance standard			
Acquiring a minimum score of 50% at the final laboratory examination.			

Date　　　　　　　Lecturer　　　　　　　　　　Instructor for practical activities

25.09.2017　　　　　-　　　　　　　　　　Teaching Assistant Laurenţiu Teodorescu, Ph. D.

Date of department approval　　　　　　　　Director of Department,

26.09.2017　　　　　　　　　　　　Prof. Claudius Dan, Ph. D.