COURSE GUIDE

2019 - 2020

Prof. dr. ing. Daniela Tărniceriu

1. Program info

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

2. Course info

2.1 Course name **Analog Integrated Circuits** Code: EDiD 301							
2.2 Course organizer (lecturer)	S.l. dr. ing. Cojan Nicolae						
2.3 Teaching assistants	S.l. dr. ing. Cracan Arcadie; S.l. dr. ing. Cojan Nicolae;						
2.4 Year of study	3	2.5 Semester	5	2.6 Assessement	Continuous Exam	2.7 Category	DID

3. Estimated total time (hours per semester for teaching activities)

3.1 Number of hours per week	6	3.2 lecture	3	3.3 seminar/laboratory/project	3
3.4 Total number of hours in curricula	84	3.5 lecture	42	3.6 seminar/laboratory/project	42

Time distribution	hours
Textbook, course support, references and course notes study	21
Library, electronic platforms and on site documentation	7
Seminar/laboratory/project preparation, homework, reports, portfolios and essays	21
Tutoring	7
Assessment	4
Other activities	10

3.7 Total individual study hours	70
3.9 Total hours per semester	154
3. 10 Number of credit points	7

4. Prerequisites (where applicable)

4.1 curricula type	
4.2 competence type	

5. Infrastructure (where applicable)

5.1. for lectures	Blackboard, videoprojector, computer.
5.2. for laboratories	Workplaces with oscilloscope, signal generator, DC regulated power supply, multimeter, probes, electronic components, prototyping boards, computers with

	license Mentor Grafix software

6. Specific competences

Professional competences	• To know the terminology used in the Analog Integrated Circuits; • To know the basic properties of linear analog integrated circuits; • To achieve the performances of the ideal fundamental specific structures to the field of Analog Integrated Circuits; • To achieve the performances of the real fundamental specific structures to the Analog Integrated Circuits; • To acquire skills for understanding, analyzing and evaluating the performance of elementary applications with elementary analog integrated circuits; • To learn the basic principles of some simple applications with complex analog integrated circuits; • Demonstrate the basic understanding of complex analogue circuits; • Develop skills for proper use of laboratory instruments in analogue circuits; • Demonstrate skills for identifying and evaluating the performance of fundamental analog integrated circuits; • Apply the design principles of analog integrated circuits;
Transversal competences	• Getting teamwork and understanding its necessity and advantages along with the responsibilities and constrain involved as a member of a team • Concern for further training as part of lifelong learning and to prepare to work in an international context • To efficiently use the information and communication sources and training resources, • To develop an efficient and accurate technical communication capacity.

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

7.1 Course main target	Knowledge and understanding of the parameters, principles and methods of using in the application of elementary structures in the field of analog integrated circuits; their practical experimentation by realizing and measuring fundamental analog integrated circuits; acquiring specific design techniques for complex analog integrated circuits; learning how to use the soft tools specific to the analog integrated circuits.
7.2 Course specific targets	• The student is able to demonstrate that he has gained understanding of elementary notions specific to the field and that he has used them in applications; • - The student is able to understand critically, to explain qualitatively and quantitatively the performances of simple analog circuits; • - Student is able to interpret correctly and understand the implementation of complex analog circuits; • - The student can correctly apply the basic methods and principles assimilated in the understanding of more complex analogic applications; • The student can make applications with analog integrated circuits, understand them at the principle level and measure their fundamental parameters; • The student can design simple applications with analog integrated circuits, determine their parameters and measure them in the laboratory;

8. Contents

8. 1 Lectures	**Teaching methods**	**Notes Hours**

1.Fast transfer calculation through non-reactive circuits with bipolar transistors and MOS transistors. Approximate calculation of increment in elementary floors. **2.Fundamental Amplifiers: AO, OTA, AdC, CC (Polarization for Linear Operation, Analysis, Transistor Implementation for Typical Structure)** **3.Elementary applications with fundamental amplifiers (Amplif inversor, noninvert, repeater, differential, integrator, derivative with AO, OTA, AdC, CC).** **4.Instrumentation Amplifiers** **5.Comparators.** **6.Current sources. Parameters, Implementation.** **7.Voltage references. Band gap gap. Autopolarizarea.** **8.Families of linear stabilizers. Protection in stabilizers.** **9.Signal generators: rectangular, triangular.** **10.Harmonic signal generators. Amplitude limitation. Principles and implementation.** **11.Controled Oscillators. Circuits, Functioning, Applications.** **12.Rectifiers.** **13 Nonlinear circuits.**	Teaching the course is done by exposing the theoretical concepts accompanied by examples and applications and the projection of demonstration simulation or of materials available to students via the website. It seeks to initially understand the phenomena on an intuitive basis, supplemented by rigorous justification and demonstration of the key issues, highlighting the relevant issues in the engineering practice. During the lecture, an active dialogue with students is stimulated as a mechanism for setting the information submitted in the lecture.	1 = 6 hours lecture 2 = 4 hours lecture 3 =4 hours lecture 4 =2 hours lecture 5 = 3 hours lecture 6 = 3hours lecture 7 = 4hours lecture 8 = 2hours lecture 9 =3 hours lecture 10=3hours lecture 11=3hours lecture 12=2hours lecture 13=3hours lecture

References

1. **P. E. Gray şi C. L. Searle, Fundamentals of Modern Electronics, vol.I**
2. **P. R. Gray şi R. G. Meyer,Analog Integratd Circuits Analysis and Design;**
3. **A. Sedra, K. Smith, Microelectronic Circuits 5-th edition (Oxford Universitz Press, 2004)**
4. **Anca Manolescu, Anton Manolescu, Analog Integrated Circuits, Editura Electronica 2000, 2011.**
5. **Sergio Franco, Design_with_operational_amplifiers_and_analog_integrated_circuits, Mc Grow Hill New York, 2002**
6. **Gray, Hurst, Lewis and Meier, Analysis and Design of Integrated Circuits, John Wilei&Sons Inc.**
7. **Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2001**
8. **David A. Johns, Ken Martin, Analog Integrated Circuit Design, John Wilei&Sons Inc., 1996**
9.

8. 2 Laboratory	Teaching methods	Notes/hours
1. Presentation of SSM and PSI norms. Presentation of	Experimental tests Exercises	1=1 hour 2=1hour

the laboratory. 2. The CIA Catalog. Connection to pins. Parameters AO 3. Offset voltage. Polarization currents and input gap. Measurements. 4. Open Loop Amplification, Step Response, Slew Rate, CMRR, PSRR, Measurements. . 5. Reverse Amplifier with AO. Measurements. 6. A non-invasive amplifier. Measurements. 7. Integrator and derivative with AO. 8. Current difference amplifier. Polarization. Fundamental connections 9. Comparators: inverter, non-inversor; the transfer feature; thresholds. 10. Still with AO. Performance control. 11. Linear and rectangular signal generator with integrator and comparator 12. Linear and rectangular signal generator with integrator and voltage controlled comparator	Discussions	3=2 hours 4=4 hours 5=2 hours 6=2 hours 7=4 hours 8=2 hours 9=2 hours 10=4 hours 11=4 hours 12= hours
8. 3 Seminar Solving problems with the content focused on the main chapters of the course aimed at strengthening and creative use of knowledge taught Course **8.4 Project** Harmonic signal generators with negativ feedbach loop for amplitude control.	Exercises Discussions	1 hour on week

References

1. CIA course notes
2. Specific CIA applications
3. Anca Manolescu, Anton Manolescu, Analog Integrated Circuits, Editura Electronica 2000, 2011.
4. Sergio Franco, Design_with_operational_amplifiers_and_analog_integrated_circuits, Mc Grow Hill New York, 2002

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

- On one side, this course requires a series of knowledge introduced in some previous courses like CEF, Materials and passive components and circuits, Fundamentals of electrical engineering or Signals circuits and systems and, on the other side, it contributes to the understanding of subjects from other courses, such as Computer-aided analysis of electronic circuits, Digital integrated circuits or VLSI Analog integrated circuits.
- It was intended to correlate the CIA discipline with that of similar disciplines taught in prestigious universities in the country and abroad and with expectations of the main employers in Romania, with which we collaborate constantly.

10. Assessment

Activity type	10.1 Assessment criteria		10.3 Percentage of final grade
10.4 Lectures	Theoretical knowledge acquired (quantity, correctness, accuracy)		20% (minimum 5)
	applications of the circuits presented in the course, problems (partial examination during the course)		60% (minimum 5)
10.5 Seminar/laboratory	Project Frequency / relevance of interventions, answers and solving homework steps		10%
	Laboratory Knowledge of the equipment and how to use specific tools; assessment of some tools or achievements, processing and interpretation of results		10% (minimum 5)
10.6 Minimum performance standard			
• • Knowledge of the fundamentals circuits and applications (answers evaluated min. 5 for topics chosen from the short list)			

Completion date
September 4, 2019

Course organizer signature,
S.l. dr. ing. Cojan Nicolae

Teaching assistant signature,
S.l. ing Cracan Arcadie,

S.l. dr. Ing Nicolae Cojan

Department approval date

04.09.2019

Department director signature

Prof.dr.ing. Victor Grigoraș