COURSE GUIDE

University year 2019 - 2020

Dean

Prof. dr. ing. Corneliu Ioniță

1. Program info

1.1 Higher education institution	"Gheorghe Asachi" Technical University of Iaşi
1.2 Faculty	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	Applied Electronics, Telecommunications Systems and Technologies, Microelectronics, Optoelectronics and Nanotechnologies

2. Course info

2.1 Course name				FUNDAMENTAL ELECTRONIC CIRCUITS EB iS 209			
2.2 Course organizer (lecturer)				s.l. dr. ing. Arcadie Crăcan			
2.3 Teaching assistant				asist. dr. ing. Gabriel Bonteanu			
2.4 Year of study[1]	2	2.5 Semester[2]	4	2.6 Assessement[3]	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	3.3a sem.	0	3.3 laboratory	2	3.3c project	1
3.4 Total number of hours in curricula[4]	84	3.5 lecture	42	3.6a sem.	0	3.6b laboratory	28	3.6c project	14

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

3.7 Total individual study hours	60
3.8 Total hours per semester	144
3.9 Number of credit points	6

4. Prerequisites (where applicable)

4.1 curricula type[5]	•
4.2 competence type	•

5. Infrestructure (where applicable)

5.1 for lectures	• Blackboard, videoprojector
5.2 for laboratories/project[6]	• Workplaces with oscilloscope, signal generator, DC regulated power supply, multimeter, probes, electronic components, prototyping boards, computers with Pspice software (student version)

6. Specific competences[7]

		Number of credits allocated to the discipline [8]:	6	Allocation of credits by competences [9]
Professional competences	CP1	• Understanding the phenomenon of accumulation of electrical charge in electronic devices and their implications for the switching operation mode		
	CP2	• Knowledge of certain categories of electronic circuits such as amplifiers, voltage regulators, oscillators and their frequency range determined operating peculiarities		
	CP3	• Demonstrate the ability to use proper techniques of analysis and design of those electronic circuits respective categories, including concepts such as feedback		
	CP4	• Knowiledge of the parameters that characterize the electronic circuits and of the methods of their experimental investigation		
	CP5	• Acquiring the skills of analysis and design of the electronic circuits and of practical assessment of their performance		
	CP6	• Developing skills for the proper use of the software tools for the electronic circuits simulation		
	CPS1	• Expansion of the capabilities of critical understanding, explaining, design and testing of complex electronic systems or parts thereof		
	CPS2	• Developing communication skills specific to the field of microelectronics and electronics		

Transversal competences	CT1	• Concern for further training as part of lifelong learning and to prepare to work in an international context	
	CT2	• Use of the sources of information and of the communication resources and of the assisted training both in Romanian and in an international language	
	CT3		
	CTS		

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

7.1 Course main target	• Study the theoretical, methodological and practical aspects for the construction, characterization, operation and application of some important classes of electronic circuits
7.2 Course specific targets	• Study the techniques of analysis and design specific to some categories of electronic circuits including aspects related to the operating frequencies and the use of feedback • Presentation of theoretical and practical aspects regarding the evaluation of the electronic circuits performance • • Exemplification of topologies belonging to some fundamental classes of electronic circuits emphasizing and determining the parameters that characterize those classes of circuits

8. Contents

8.1 Lectures [10]	Teaching methods [11]	Notes
1. **Switching operation of the semiconductor devices** - physical processes in the switching of the semiconductor diode, BJT and MOS-FET; defining of switching times; fundamental circuits switched-mode operated; study of the CMOS logic inverter; CMOS logic gates examples, CMOS flip-flop; 2. **Electronic amplifiers** – definitions; steady state parameters and characteristics; High frequency operation of one stage amplifiers; using of the time constants method to approximate determining of the bandwidth limits of amplifiers; 2-stages amplifiers with good high frequency behaviour; multistage amplifiers; differential amplifiers; 3. **Negative feed back amplifiers** – ideal structure and equation; feedback topologies; properties; real feedback amplifiers analysis methods exemplified by means of two-port models; examples of real feedback amplifier analysis; stability and frequency compensation of feedback amplifiers; 4. **Large signal amplifiers** - definitions, characteristics, classes of operation; class B push-pull amplifier with complementary transistors; Class AB amplifier - VBE multiplier, the driver stage, the typical structure of an audio integrated power amplifier; 5. **Types and sources of noise in amplifiers** 6. **Voltage regulators** - definitions, classification, parameters, feedback regulators, examples, static and dynamic parameters determination, protection circuits, switching voltage regulators 7. **Harmonic oscillators** - parameters, types of oscillators, linear theory - general conditions of oscillation, quasi-linear theory - limiting the oscillation amplitude, RC oscillators, oscillator with RLC parallel circuit, 3 point LC oscillators ;	Exposing the theoretical and methodological concepts; Examples of some applications and the projection of demonstration simulations; The explanation 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. The active dialogue with students is stimulated as a mechanism for setting the information submitted in the lecture and for ajusting the teaching to the students level of training.	1 = 4 lectures 2 = 5 lectures 3 = 6 lectures 4 = 1 lecture 5 = 1 lecture 6 = 2 lectures 7 = 2 lectures

References

1. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits-Fifth Edition, Oxford University Press, New York Oxford, 2004
2. Paul R. Gray, Paul J. Hurst, Stephen H Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits-Fifth Edition, John Wiley & Sons Inc., New York, 2009
3. Allan R Humbley, Electronics, PRENTICE HALL, New Jersey , 2000
4. Course web page: http://dce.etc.tuiasi.ro

8.2a Seminar	Teaching methods [12]	Notes

8.2b Laboratory	Teaching methods [13]	Notes
Problems refresher Multi stage amplifiers BJT switcing – applications Low frequencies behavior of the CE amplifier High frequencies behavior of the CE-CB cascode Parallel-parallel feedback Voltage amplifier with feedback Test on the way Frequency compensation of feedback amplifiers Differential amplifiers Large signal amplifiers Voltage regulators RC oscillators Homework evaluation	Experimental tests Simulations using Orcad Pspice Exercises Discussions	

8.2c Project	Teaching methods [14]	Notes
The general theme: the design of voltage stabilizers; students receive individual design themes; **Steps:** 1. Getting refresher - simulation of electronic circuits in Pspice environment; 2. Principles of biasing the BJT. Collector current variation sources. Solutions for reducing the variation of the collector current due to the temperature variation and technological spread. Method of obtaining the design parameters using the simulator for a given model. 3. Design of an elementary amplification stage to meet different specifications such as: dynamic range, temperature range, maximum variation of collector current. 4. Choosing the V_{CE} and the collector resistor R_C. Design for maximum amplification versus design for optimum dynamic range. 5. Choosing the supply voltage. General configuration of the amplifier. The coupling between amplifier stages. Step by step design of a two stages amplifier in order to meet different specifications such as: voltage amplification, dynamic range, bandwidth, bias current. 6. Negative feedback amplifiers. Input Resistance. 7. Individual work - performance evaluation by simulation	Individual students documenting guided by the teacher Case studies Exercises Discussions Simulations using Pspice environment	7 steps

References

1. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits-Fifth Edition, Oxford University Press, New York Oxford, 2004
2. Paul R. Gray, Paul J. Hurst, Stephen H Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits-Fifth Edition, John Wiley & Sons Inc., New York, 2009
3. Allan R Humbley, Electronics, PRENTICE HALL, New Jersey , 2000
4. Course web page: http://dce.etc.tuiasi.ro; http://edu.etti.tuiasi.ro/course/view.php?id=145

9. Course contents corroboration with the expectations of the epistemic community representatives, professional associations and relevant employers in the field of the program [15]

- Objectives are in good agreement with the curricula of the study program Telecommunications Technologies and Systems. On one side, this course requires a series of knowledge introduced in some previous courses like Fundamentals of electrical engineering , Electronic Devices, Signals circuits and systems or Computer-Aided Analysis of Electronic Circuits and, on the other side, it contributes to the understanding of subjects from other courses, such as Digital integrated circuits or Analog integrated circuits
- It was intended to correlate the lectures content 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	10.2 Assessment methods		10.3 Percentage of final grade
10.4 Lectures	• Theoretical knowledge acquired (quantity, correctness, accuracy)	On going tests: one written test in the 8-th week (one subject theory and 3 problems	28%	70% (minimum 5)
		Final assessment: exam - written (2 theoretical subjects and 4 problems);	72%	
10.5a Seminar	•	•		%
10.5b Laboratory	• Knowledge of the equipment and how to use specific tools; assessment of some tools or achievements, processing and interpretation of results	• Oral Answer • Laboratory notebook (experimental works, essays) • Practical demonstration (individual final test)		10% (minimum 5)
10.5c Project	• Quality of the project done, accuracy of project documentation, justification of chosen solutions (project theme presents mandatory requirements for grade 5, grade 8 and grade 10)	• Presentation of the project		20% (minimum 5)
10.5d Other [16]	•	•		
10.6 Minimum performance standard [17]				
• Knowledge of the fundamentals of theory (answers evaluated min. 5 for topics chosen from the short list) • Solving more than 50% of the 2-nd problem (analysis of an amplifier with negative feedback)				

Completion date, September 16th 2019

Course organizer signature, ...s.l. dr. ing. Arcadie Crăcan

Teaching assistant signature, asist. dr. ing Gabriel Bonteanu

Department approval date, ...

Department director signature, ... prof. dr. ing. Victor Grigoraş...