COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	University Politehnica of Bucharest
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Electronic Devices, Circuits and Architectures
1.4 Domain of studies	Electronic Engineering, Telecommunications and Informational Technologies
1.5 Cycle of studies	Undergraduate
1.6 Program of studies/Qualification	Tehnologii şi Sisteme de Telecomunicaţii (în limba engleză)

2. Course identification information

2.1 Name of the course				Basic Electronic Circuits			
2.2 Lecturer				Prof.dr.ing. Gabriel DIMA			
2.3 Instructor for practical activities				As.dr.ing. Laurentiu TEODORESCU			
2.4 Year of studies	II	2.5 Semester	4	2.6 Evaluation type	Final examination	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	5	3.2 course	3	3.3 practical activities	2
3.4 Total hours in the curricula, out of which	70	3.5 course	42	3.6 practical activities	28

3.7 Distribution of time	hours
Study according to the manual, course support, bibliography and hand notes	25
Supplemental documentation (library, electronic access resources, in the field, etc)	3
Preparation for practical activities, homework, essays, portfolios, etc.	5
Tutoring	0
Examinations	3
Other activities	0

3.8 Total hours of individual study	36
3.9 Total hours per semester	106
3.10 Number of ECTS credit points	5

4. Prerequisites (if applicable)

4.1 curricular	Fundamentals of Electro-technics, Electronic Devices
4.2 competence-based	Electronic devices, electronic circuit analysis.

5. Requisites (if applicable)

5.1 For running the course	None
5.2 For running of the applications	None

6. Specific competences

6.1 Professional competences	C1. Using of fundamental elements that refer to the electronic devices, circuits and instrumentation
6.2 Transversal competences	None.

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

7.1 General objective of the course	A systematic study of both fundamental analogic circuits - amplifiers, voltage regulators and oscillators - and the building blocks utilized in the design of analog IC's such as: the differential amplifier, the cascode configuration, voltage references, current mirrors, etc.
7.2 Specific objectives	• Operation mode, performances, limits and practical applications of the fundamental analog circuits • The basic feedback theory and the feedback amplifiers topologies • Oscillators: basic principles, oscillation and starting conditions • Voltage regulators: basic principles, electrical parameters, linear and switched operation modes • Methods for analysis and design of the practical schematic of analog fundamental circuits. • Interaction between circuit and devices, the parallel between MOS and bipolar transistor stages and the modern bias techniques used to control the stability of circuit parameters. • Engineering methods for hand calculations of multistage amplifiers, negative feedback amplifiers, voltage regulators AF and RF oscillators.

8. Content

8.1 Lectures	Teaching techniques	Remarks
1. AMPLIFIERS FUNDAMENTALS 1.1. Definition 1.2. Parameters 1.3. Amplifier band 1.4. Distortions. Noise in amplifier 1.5. Operation class 1.6. Classification of amplifiers 1.7 Applications	Teaching is based on Power point slide-show lecture notes. Each slide is explained in detail by means of oral presentation. Lecture slides are available on-line on the course's website (Moodle – http://electronica.curs.pub.ro).	3 Hrs
2. Fundamental amplifiers 2.1. Single transistor amplifier stages 2.2. Cascode and paraphase configurations 2.3. Differential amplifiers 2.4. Ideal operational amplifiers 2.5 Applications		9 Hrs
3. Negative feedback 3.1 Ideal feedback amplifier topology 3.2. Negative feedback properties 3.3 Feedback amplifier configurations 3.4. Shunt-shunt feedback amplifier 3.5. Series-series feedback amplifier 3.6. Shunt-series feedback amplifier 3.7. Series-shunt feedback amplifier 3.8 Applications		9 Hrs

4. Linear voltage regulators 4.1.Definition 4.2.Parameters 4.3.Operation principles 4.4. Classification 4.5. Parametric regulators 4.6. Feedback regulators 4.7. Integrated voltage regulators 4.8 Applications		7 Hrs
5. Switching regulators 5.1.Definition 5.2.Parameters 5.3.Operation principles 5.4. Classification 5.5 Flyback converter 5.6 Forward converter 5.7 Half-bridge converter 5.8 Switching regulators vs. linear voltage regulator comparison 5.9 Applications		12 Hrs
5. Sinusoidal oscillators 5.1. Definition. Parameters 5.2. Classification 5.3. LC oscillators 5.4. RC Oscillators 5.5 Applications		9 Hrs

References

1. A. Rusu, G. Dima, *Fundamental Electronic Circuits*, Ed. Politehnica Press, 2009.
2. G. Brezeanu, F. Drăghici, *Circuite electronice fundamentale,* Ed. Niculescu, Bucureşti, 2013.
3. G. Brezeanu, *Circuite electronice*, Ed. Albastră, Cluj-Napoca, 1999.
4. P. R. Gray, P. J. Hurst, S. H. Lewis, R. G. Meyer, *Analysis and Design of Analog IC's*, ediţia a IV-a, J. Whiley & Sons, 2001.
5. K. R. Laker,W. M. C. Sansen, *Design of Analog IC's and Systems,* McGrawHill, 1994.
6. B. Razavi, *Design of Analog CMOS Integrated Circuits,* McGrawHill, 2001.
7. A. Sedra, K. C. Smith, *Microelectronic Circuits,* ediţia a V-a,Oxford University Press, 2004
8. Course entry on the Moodle eLearning platform: http://electronica.curs.pub.ro

8.2 Seminar	Teaching techniques	Remarks
Seminar 1 – High impedance single transistor stages.	Oral exposition. The teaching method used is problem-solving. Direct involvement of students in this process is stimulated. The main seminar materials are lecture notes and the *"Dispozitive şi Circuite Electronice – Probleme" şi "Circuite electronice fundamentale- Probleme"* exercises books.	2 Hrs
Seminar 2 – Small signal amplifiers: bias points, ac analysis techniques for multiple stages amplifier		2 Hrs
Seminar 3 – Cascode configuration. CMOS inverter.		2 Hrs
Seminar 4 – Differential and paraphase amplifiers.		2 Hrs
Seminar 5 – Frequency behavior of amplifiers stages. Miller effect. Comparison between cascode – CE/CS, respectively CB/CG		2 Hrs
Seminar 6 – Negative feedback amplifier. Analysis techniques. Shunt – shunt configuration.		2 Hrs

Seminar 7 – series-shunt negative feedback amplifiers		2 Hrs
Seminar 8 – Shunt-series and series-series negative feedback amplifiers		2 Hrs
Seminar 9 – Parametric and feedback voltage regulators.		2 Hrs
Seminar 10 – Integrated voltage regulators		2 Hrs
Seminar 11 – DC-DC converters.		2 Hrs
Seminar 12 – Sinusoidal Oscillators. Analysis techniques. RC oscillators.		2 Hrs
Seminar 13 – Wien oscillators		2 Hrs
Seminar 14 – LC Oscillators.		2 Hrs

References

1. G. Brezeanu, F. Drăghici, F. Mitu, G. Dilimoţ, *Circuite electronice fundamentale - probleme*, Editura Rosetti Educaţional, Bucureşti, ediţia a II-a, 2008.
2. G. Brezeanu, G. Dilimoţ, F. Mitu, F. Drăghici, *Probleme de dispozitive şi circuite electronice,* Ed. IT Grup, Bucureşti, 2006.
3. P. R. Gray, P. J. Hurst, S. H. Lewis, R. G. Meyer, *Analysis and Design of Analog IC's*, ediţia a IV-a, J. Whiley&Sons, 2001.
4. D. Dascălu et all, *Dispozitive şi Circuite Electronice – Probleme*, Ed. Didactica şi Pedagogică, 1982.
5. Site-ul cursului pe platforma eLearning Moodle: http://electronica.curs.pub.ro

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

Fundamental Electronic Circuits studies the basic blocks of analogic circuits, typical products of microelectronics. This field has known explosive advancements, especially after the year 2000, following bold and spectacular developments of CMOS nanometer technologies. The microelectronics has a near encyclopedic trait, by the multifunctional circuits and systems it has come to incorporate, offering a wide horizon of applications in many domains for students and specialists alike. Multinational microelectronics companies, well-known producers of integrated circuits (Infineon, Microchip, ON Semiconductor), with strong branches in Romania, have considerably increased the demand for qualified engineers, with solid knowledge and competences in the field of analog and mixed signal. The course familiarizes the students with the fundamental concepts of modelling and design in microelectronics, including original ideas and methods of the specialized Romanian school. Based on the MOS and bipolar models, analysis and design techniques for basic analog circuits – amplifiers, regulators, oscillators – are studied and exemplified. The operation, performances, limitations and typical applications of these circuits are demonstrated through numerical data and comments. Thus, the policy of promoting subjects strongly correlated with the requirements of present top industry such as electronics, is followed.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures	1. Knowledge of fundamental theoretical concepts; 2. Knowledge of using theory to solve specific problems; 3. Understanding the operation, performances and applications of single and multiple transistor amplifiers, negative feedback amplifiers, voltage regulators and sinusoidal oscillators.	A written midterm test, which covers 50% of the lecture, focusing both on theoretical knowledge evaluation and solving problems that illustrate parameters and operation of fundamental multi-stage and feedback amplifier topologies.	40%
		Final examination, with the possibility of retaking the midterm test. This exam is focused both on theoretical knowledge evaluation and solving problems that illustrate parameters and operation of fundamental voltage regulator and sinusoidal oscillator topologies.	40%
10.5 Seminar	Analysis, by numerical data, of specific circuits representing multi-stage amplifiers, negative feedback amplifiers, voltage regulators and sinusoidal oscillators.	Two written tests of equal weight, at dates fixed at the beginning of the semester; test topics are based on problems with numerical data on amplifier, voltage regulator and sinusoidal oscillator circuits.	20%
10.6 Minimal performance standard			
• Acquiring a minimum score of 50% of the points allocated for the activities seminar/course. • Acquiring a minimum score of 50% for the midterm test and a minimum of 50% for the final examination.			

Date, 11.09.2017

Lecturer, Prof.dr.ing Gabriel DIMA

Instructor for practical activities, As.dr.ing. Laurentiu TEODORESCU

Date of department approval, 18.09.2017

Head of Department, Prof.dr.ing. Claudius DAN