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-E22.00, EA-E22.00

2. Data about the subject

2.1	Subject name					Fundamental electronic circuits					
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 Sipos, PhD					
2.5	Year of study	II	2.6	Semester	1	2.7	Assessment	Exam	2.8	Subject category	DID/DOB

3. Estimated total time

Year / Sem.	Subject name	No. of weeks	Course [hours/week]	Applications [hours/week]			Course [hours/sem.]	Applications [hours/sem.]			Indiv. study	TOTAL	Credits
				S	L	P		S	L	P			
II / 1	Fundamental electronic circuits	14	2		2		28		28		74	130	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 curriculum	56	3.5	of which, course	28	3.6	applications	28

Individual study	Hours
Manual, lecture material and notes, bibliography	40
Supplementary study in the library, online and in the field	-
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	28
Tutoring	3
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	74
3.8	Total hours per semester	130
3.9	Number of credit points	5

4. Pre-requisites (where appropriate)

4.1	Curriculum	N / A
4.2	Competence	Relations and theorems for electric circuits, frequency response representation; operating principles for electronic devices: diode, operational amplifier, MOSFET and BJT transistors; use of electronic devices in electronic circuits; analysis methods for electronic circuits; voltage transfer characteristics; transfer function

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):	Transistor biasing circuits for transistor amplifiers;Small signal models for transistors and amplifiers with transistors (MOS, BJT); Feedback circuits structure, type of feedback, the fundamental equation of the negative feedback; Configuration, operating principle and analysis and (re)design methods for fundamental electronic circuits: amplifiers with one transistor, current sources and mirrors, linear voltage regulators, sinusoidal and non-sinusoidal oscillators, power amplifiers, other circuits with operational amplifiers.
	Acquired skills (what the student is able to do):	After completing the discipline, the students will be able to: - analytically compute the quiescent point of transistors; - determine the small signal parameters of transistors; - analyze and determine the performance of fundamental electronic circuits; - describe the operation of fundamental electronic circuits using analytical equations, transfer characteristics and waveforms in different points of the circuits; - (re)design fundamental electronic circuits; - use dedicated integrated circuits for various applications; - analyze and experimentally determine the performance of fundamental 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 electronic circuits - use the experimental boards - connect the lab instrumentation with the experimental boards, in order to experimentally study electronic circuits - use the computer to the numerical data obtained through the explorations - store 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 C2. To apply basic methods for signal acquisition and processing 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, analysis and (re)design of fundamental electronic circuits.
7.2	Specific objectives	1. Recognizing and understanding basic concepts specific to fundamental electronic circuits. 2. Developing skills and abilities necessary for the use of fundamental electronic circuits. 3. Developing skills and abilities for the analysis and (re)design of fundamental electronic circuits.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Course description. Biasing circuits for transistors in the active region: the need for biasing, biasing circuits, quiescent point evaluation.	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2	Parameters and small signal models of transistors; connections of basic amplifiers with one transistor.		
3	Basic amplifiers with one transistor: small signal equivalent circuits, performance evaluation.		
4	Frequency response of basic amplifiers with one transistor. CS and CE connections. Current sources and current mirrors with MOSFET and BJT.		
5	Feedback circuits. Positive feedback and negative feedback. Equations of the ideal feedback. Feedback topologies. Analysis of the negative feedback amplifier. Negative feedback effects on amplifiers.		
6	DC voltage regulators. Parametric regulators. Linear voltage regulators with op amp. Increasing the output current. Over - current and short - circuit protection. Output characteristic.		
7	Integrated voltage regulators. The 723 voltage regulator. Three – terminal fixed regulator. Switching voltage regulators. Step – down and step –down/step – up converters.		
8	Sinusoidal oscillators. Oscillation criterion. RC oscillators. OpAmp and Wien bridge oscillators. Automatic control of the amplitude. OpAmp and RC ladder network oscillator.		
9	LC oscillators. Nonsinusoidal oscillators. Astable multivibrators. Astable multivibrator with one OpAmp, astable multivibrator with an integrator and a comparator with OpAmp. Clock generator. LM555 timer.		
10	Power amplifiers. Amplifier classes. Class A amplifiers. Operating principle, VTC, waveforms, powers, efficiency.		
11	Class B amplifiers. Operating principle, VTC, crossover distortions, waveforms, powers, efficiency. Class AB amplifiers. Biasing using diodes. Biasing using VBE multiplier. Overcurrent protection. Use of compound transistors with higher current gain.		
12	Class D amplifiers. Operating principle. PWM generator. Power stage. Low – pass filter.		
13	OpAmp applications: OpAmp amplifiers operated from a single power supply; integrator and differentiator – active filters; current sources using op - amp and T; voltage domain conversion circuits; precision rectifier.		
14	Recapitulation. Preparation for the final exam.		

8.2. Applications (lab)		Teaching methods	Notes
1	Introduction. Labour protection	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, white/magnetic board
2	Collecting experimental data using the computer		
3	Transistor amplifiers		
4	Single-stage BJT amplifiers		
5	Negative feedback effects on amplifiers		
6	LM7805 voltage regulator		
7	DC – DC converter		
8	Sinusoidal oscillator		
9	Function generator		
10	Multivibrator circuits using the 555 timer		
11	Class B amplifiers		
12	Rail – to – rail op-amp amplifier		
13	Laboratory test		
14	Lab recovery and finalization of laboratory activity		

Bibliography

1. Oltean, G., Circuite electronice, UT Pres, Cluj-Napoca, 2007, ISBN 978-973-662-300-4, 203 pag
2. Oltean, G., Electronic Devices, Editura U.T. Pres, Cluj-Napoca, ISBN 973-662-220-7, 2006; 317 pag.
3. Miron,C., Oltean, G., Gordan, Mihaela, Dispozitive și circuite electronice, Culegere de probleme, Editura Casa Cărții de Ştiință, Cluj-Napoca, 1999
4. Şipoş, Emilia, Oltean, G., Miron, C., Ivanciu, Laura, Gordan, Mihaela, Fundamental Electronic Circuits: Laboratory Manual, Cluj-Napoca, U.T. Press, 2009

On-line references

5. Oltean, G. Fundamental electronic circuits (course slides, laboratories, problem examples, exam subjects), http://www.bel.utcluj.ro/dce/didactic/fec/fec.htm

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

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 $E \geq 4$ and $0,6E+0,2L+0,2T \geq 4.5$						

Date of filling in 19.01.2015 — Course responsible: Prof. Gabriel Oltean, PhD — Teachers in charge of applications: Assist. Prof. Emilia Sipos, PhD

Date of approval in the department 19.01.2015 — Head of department: Prof. Sorin Hintea, PhD