

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-E34.00, EA-E34.00

2. Data about the subject

2.1	Subject name	Optoelectronics										
2.2	Subject area	Optoelectronics and Photonics										
2.3	Course responsible/lecturer	Prof. Emil Voiculescu, PhD										
2.4	Teachers in charge of applications	Assist. Prof. Lorant Szolga, PhD										
2.5	Year of study	III	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			Applications			Indiv. study	TOTAL	Credits		
			[hours/week]			[hours/sem.]							
			S	L	P	S	L	P					
III / 1	Optoelectronics	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									28
Supplementary study in the library, online and in the field									14
Preparation for seminars/laboratory works, homework, reports, portfolios, essays									26
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	N.A

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):	After completing the discipline, students will learn: Fundamentals of optics. Photometry and radiometry. LED. LED display. Photosensitive devices. Optocouplers. Barriers infrared. Transmission of analog signals with optical separation - insulating amplifiers. Data Transmission on wires with optical separation. Devices controlled by light. Industrial applications of the devices controlled by light. Injection laser diodes. Optical fiber drives. Fiber optic components.
	Acquired skills (what the student is able to do):	After completing the discipline, students will be able to: To know how to identify LEDs, photodiodes, laser diodes, optical fiber. To know the meaning of LED parameters To know how to use the applications catalog and to give the interpretation of LED parameters, photodiodes To know the functioning and role optocouplers To know the functioning of lasers and laser diodes To know how to analyze and design some simple circuits with optical components To know the characteristics of optical fibers
	Acquired abilities: (what type of equipment the student is able to handle)	After completing the discipline, students will be able to: Use laboratory equipment (power supplies, spectrum analyzers, digital oscilloscopes, meters measuring voltage, current, temperature, etc.) to study and testing the optoelectronic components Use specific hardware and software tools; To know how to measure quantities that characterizes optoelectronic components: LEDs, photodiodes, phototransistors, photoresist, optocouplers. To design simple circuits with optical components after data catalog. To simulate in PSpice simple circuits with optoelectronic components.
	In accordance with Grila1 and Grila2 RNCIS	C1. To use the fundamental elements regarding electronic devices, circuits, systems, instrumentation and technology 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 optoelectronic circuits.
7.2	Specific objectives	<ol style="list-style-type: none"> 1. Recognizing and understanding basic concepts specific to fundamental optoelectronic circuits. 2. Developing skills and abilities necessary for the use of fundamental optoelectronic circuits. 3. Developing skills and abilities for the analysis and (re)design of fundamental optoelectronic circuits.

8. Contents

8.1. Lecture (syllabus)		Teaching methods	Notes
1	Optoelectronics today : subject presentation, course references, literature. Recap of the main optical notions. Images, phenomena, experiments.	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2	Advanced optics. Reflection, refraction, wave interference, diffraction, other properties of wave optics.		
3	Photonic sources. LEDs, applications – lighting, displays, car lighting, headlights etc.		
4	LED Drivers. Basic concepts on lasers. Semiconductor lasers. Modelling, operation, oscillation modes.		
5	Lasers – industrial and telecom applications. Characteristics, performances, technology. Pulsed lasers and drivers.		
6	Photodetectors. Photodiodes, APD – Avalanche photodiodes, phototransistors, voltaic cells, solar pannels, solar vehicules.		
7	Transmission media : Optical Fibers. Fundamentals, numerical aperture, guiding light, propagation modes, manufacturing fiber optics. Special fibers : PCF – photonic crystal fibers, bend-resistant fibers, manufacture. Characterization. FO Cables. Industrial and telecom applications.		
8	Transmission media: Optical Waveguides: slabs and stripes. Structure, propagation modes, aperture, typical applications.		
9	Optocouplers : generic presentation, industrial and telecom applications.		
10	Isolation amplifiers and applications.		
11	Nanotechnologies. Optoelectronic sensors. Fundamentals, operation, implementation examples, applications.		
12	Distributed optoelectronic sensors.		
13	Other optoelectronic components : couplers, isolators, circulators, multiplexers, de-multiplexers, modulators, optical switches, semiconductor optical amplifiers – SOAs.		
14	LED and LCD flat screen displays, including portable AMOLED displays. Recapitulation. Preparation for the final exam.		
8.2. Applications (lab)		Teaching methods	Notes
1	Introduction-labour protection laws. Basic optical concepts.	Didactic and experimental proof, didactic exercise, team work	Use of laboratory instrumentation, experimental boards, computers, white/magnetic board
2	LEDs – Light emitting diodes.		
3	The visible spectrum. The white (RGB) LED.		
4	Semiconductor laser diodes.		
5	The photo-resistance response to various wavelengths.		
6	Voltage and current response of the photodiode and phototransistor to		

	various IR light.		
7	Measuring the characteristic of directivity for photosensitive devices.		
8	The optical fiber. Application: fiber optic splicing.		
9	Study of the index-profiles of rectangular optical waveguides and fiber optics.		
10	Photo-interrupters and isolation amplifiers.		
11	Optoelectronic components. Application : unguided transmission system for an AF signal, the same on optical fiber.		
12	LED drivers. Linear drivers and switch-mode to strobe the displays.		
13	Bar-graph displays.		
14	Lab recovery and finalization of laboratory activity. Assessing students.		

Bibliography

1. Emil Voiculescu, Tiberiu Marita - *Optoelectronica*, Editura Albastra, 2001, ISBN 973-9443-96-6
2. Lorant A. Szolga, Ramona Gălătuș, Emil Voiculescu : “Optoelectronică – Îndrumător de laborator”, Editura UTPRESS, 2013, ISBN 978-973-662-858-6.
3. Safa O Kasap - *Optoelectronics Devices and Photonics: Principles and Practices*.
4. Prentice Hall ISBN 0-201-61087-6, Kasap Book Images.
5. Stefan Nilsson-Gistvik – *Optical Fiber Theory for Communication Networks*, EN/LZT 199210/R1, Ericsson 2002.
6. Bahaa E A Saleh, Malvin Carl Teich – *Fundamentals of Photonics*, Wiley, ISBN : 0471213748 (Electronic), 0471839655 (Print).
7. Harry J R Dutton - *Understanding Optical Communications*, IBM <http://www.redbooks.ibm.com>.
8. Catalog Thorlabs, vol 21. Titlu : V21_Catalog_web Site : http://www.thorlabs.com/images/Catalog/V21/V21_Catalog_web.pdf

Electronic material

1. Voiculescu E. – fișiere prezentari, format PPT, pentru curs
2. Voiculescu E – fișiere audio cu Talk-ul cursurilor, înregistrate live la predare (narrated slide-shows).
3. VPIPhotonics – User Guide
4. Liekki – User Guide.

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		- after 7 courses, preliminary exam (problem solving) - Summative evaluation written exam (theory and problems)		- T, max 10 pts. 35% - E, max 10 pts. 60%
Applications		The level of acquired abilities		- Continuous formative evaluation - practical lab test		- L, max. 10 pts. 15%

10.4 Minimum standard of performance

The presence of the course is considered activity and chronic absenteeism requires further verification of material lost. Presence in all laboratories, obtaining a minimum of 4.5 notes in laboratory activities, and partly written exam.

$$L \geq 4.5 \text{ and } E \geq 4.5 \text{ and } 0,6E+0,15L+0,35T \geq 4.5$$

Date of filling in

1.10.2018

Course responsible

Prof. Emil Voiculescu, PhD

Teachers in charge of applications

Assist. Prof. Lorant Szolga, PhD