

FISA DISCIPLINEI

Denumirea disciplinei	OPTOELECTRONICS
Domeniul de studiu	Electronic Engineering and Telecommunications – Undergraduate level
Specializarea	Applied Electronics and Telecommunications Technologies and Systems
Codul disciplinei	51383407
Titularul disciplinei	Prof.dr.ing. Emil Voiculescu, emil.voiculescu@bel.utcluj.ro
Colaboratori	Ramona Galatus, ramona.galatus@bel.utcluj.ro, Gabor Csipkes Gabor.Csipkes@bel.utcluj.ro
Catedra	Basic Electronics
Facultatea	Electronics, Telecommunications and Information Technology

Sem.	Tipul disciplinei	Curs			Aplicații			Stud. Ind.	TOTAL	Credit	Forma de verificare		
		[ore/săpt.]			[ore/sem.]								
		S	L	P	S	L	P						
9	Ing. din domeniu	2	-	2	-	28	-	14	-	78	120	4	Exam

Competențe dobândite:
Cunoștințe teoretice, (Ce trebuie sa cunoască)
Fundamentals. Photometry and radiometry. LEDs. LED displays. Photosensitive devices. Optocouplers. IR light barriers. Signal isolation in data transmission, isolation amplifiers. UTP/STP transmission using optocouplers as isolators. Light-activated devices in industrial applications. Semiconductor laser diodes. Fiber optics. Fiber optic devices.
Deprinderi dobândite: (Ce știe să facă)
Course skills obtained: <ul style="list-style-type: none"> – Fundamentals of photometry and radiometry – LEDs , fotodiodes, lasers, optical fibres operations – LEDs parameters significance – How to choose, in application design, LEDs and photodiodes using catalog parameters – Optocouplers working – lasers and laser diodes working – design and analysis of simple electronic circuits, using optical components – modern optical fibres characteristics and – complex optical system design
Abilități dobândite: (Ce echipamente, instrumente știe să mănuiască)
– After the course study, the students will be able to design and study the behaviors of optic components and circuits with optoelectronic devices using Optical Banc devices and also Simulation Tools (Pspice, Spice, LightTools, Zemax, particular applications implemented in VBasic) - in correlation with data sheet catalogs.

Prerequisite
Basic knowledge of optic.

A. Curs (titlul cursurilor + programa analitica)	
1	Short history. Frequency/Wavelength ranges. The refractive index. Recap of the main wave properties of the light. The light as electro-magnetical wave vs. quantum theory.
2	Photonic sources. LEDs: operation, characteristics, control, protection.
3	Lasers. Semiconductors lasers. Characteristics. Structures.
4	PIN Photodiodes, APD Avalanche Photodiodes. Optical detectors.
5	Analog and Digital Optocouplers. Characterization, properties, types of optocouplers. Industrial applications.
6	Isolation amplifiers. Transfer Characteristic Linearization.
7	Data transmission on twisted pairs – UTP/ STP cables optically isolated.
8	Optical fibres. Short history, characteristics, materials, types of fibres, numerical aperture, acceptance cone, propagation modes, index profiles.
9	Coupling light into the fiber. Trajectories. Tunneling depth. DWDM multiplexing, the virtual fiber. Fiber optic cables.
10	Fiber optic devices: couplers, multiplexors, demultiplexors.
11	Fiber optic active devices.
12	Optoelectronic integrated devices: 2D light waveguides/slabs, stripe waveguides, waveguiding devices.
13	Prism couplers for coupling the light in and out the waveguide. Diffraction gratings. Micro-lenses: geodesic,

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	Lunenburg, Fresnel.
14	Optical functional circuits. Examples, applications.

B1. Aplicații – LUCRARI (lista lucrări, teme de seminar, conținutul proiectului de an)	
1.	Introduction. Laboratory organization. Fundamentals of optics (<i>review</i>).
2.	Directivity characteristics of photosensitive devices - <i>circuit</i>
3.	Study of LEDs geometrical characteristics and parameters, and their influences on directivity characteristics - <i>circuit and theoretical study</i> using dedicated optoelectronics simulation environment
4.	2D waveguides <i>study</i> (VBasic environment)
5.	Waveguides coupling <i>study</i> (VBasic environment) - Couplers
6.	IR light barriers - <i>circuit</i>
7.	Dot/Bar Display Driver (10 steps) - <i>circuit</i>
8.	The photo detectors response dependent on variable incident wavelength - <i>circuit</i>
9.	Infrared proximity detector using an IR photo detector - <i>circuit</i>
10.	Different laser type characteristics. Comparison. – <i>study</i> with VPI Player (VPI Photonics software)
11.	Interferometers (Zemax tutorial) - <i>study</i>
12.	Using splicer - <i>device</i>
13.	Communication-link design and simulation using optical devices – <i>study</i> .
14.	Test exam

B2. Sala laborator (Sala/suprafata, adresa) B 204/50 m ² , C 05/50 m ² B-dul Muncii 103-105		
Echipament	Descriere echipament	Anul achizitiei
Calculatoare (2 buc)	Calculator PC- Procesor Pentium 4 – 3GHz, 1G RAM, HDD 80G, Monitor LG LCD	2008
Calculator (1 buc)	Pentium III, 850MHz, 256M RAM, HDD 40G, Monitor Samsung	2000
Calculator (1 buc)	AMD Athlon, 1.47 GHz, 256M RAM, HDD 40G, Monitor LG LCD	2000
Softuri: Windows XP si MS Office	Licenta UTCN	2005
Osciloscop	HAMEG, 35MHz, HM303-06	1989
Generatoare de functii (3buc)	RIGOL, DG 2021A, 25MHz	2007
Osciloscop digital (3 buc)	Tektronix TDS 1002B, 60Mhz, two channel, digital storage	2007
Multimetre digitale (3buc)	PICOTEST M3500A	2007
Splicer (fibra optica)	Siemens S46999-M7-B30	2001
Fiber Optic Tranceiver (2buc)	CentreCOM MX26F	2000
Banc teste lucrari laborator	Fibre optice de diferite tipuri, conectori, lentile, Frequency Programmable Light Chopper, componente optoelectronice, aparate de masura, surse de tensiune stabilizate, Surse de tensiune programabile P6100 (3buc)	1999-2008
Setup HFC – cu racord fibra UPC	Transceivere C-COR, nod optic, demodulator de cablu TV, full-Internet si UPC basic package instalate	2008

C. Studiul individual (tematica studiilor bibliografice, materiale de sinteză, proiecte, aplicații etc.)						
Pregatire laborator pe baza indrumătorului de laborator si a notitelor de curs Si elaborarea unui referat - miniproiect						
Structura studiului individual	Studiu materiale curs	Rezolvări teme, lab., proiecte	Pregătire aplicații	Timp alocat examinărilor	Studiu bibliografic suplimentar	Total ore pregătire individuală
Nr. ore	14	24	30	3	7	78

D. Strategii si metode de predare
SE VA FACE REFERIRE LA: mijloace multimedia, stil de predare interactiv, parteneriat cadru didactic student, cercuri stiintifice, atragere in contracte de cercetare, consultatii, vizite de studii, etc,

Bibliografie (Cursuri, indrumatoare de lucrari, proiect, culegeri de probleme)
<i>In biblioteca UTC-N</i>
1. Emil Voiculescu, Tiberiu Marita - <i>Optoelectronica</i> , Editura Albastra, 2001, ISBN 973-9443-96-6
2. Emil Voiculescu, Lucian Rotaru, ș.a. – <i>Optoelectronica. Indrumător de laborator</i> , U.T. PRES, 2003
3. Desmond Smith - <i>Optoelectronic Devices</i> , Prentice Hall International, London, NewYork, 1995.
4. Niculae N. Puscas – <i>Sisteme de Comunicatii Optice</i> , Editura Matrix, Bucuresti, 2006, ISBN (10) 973-755-

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Materiale didactice virtuale

1. Voiculescu E. – fisiere prezentari, format PPT, pentru curs

2. In alte biblioteci

1. John Power – *An Introduction to Fiber Optic Systems*, McGraw Hill, Second Edition, 2000

2. Harry J.R. Dutton - *Understanding Optical Communications*, IBM RedBook, <http://www.redbooks.ibm.com>

3. Bahaa E.A. Saleh, Malvin Carl Teich – *Fundamentals of Photonics*, 2001.

4. Gerd Keiser - *Optical Communications Essentials* (Telecommunications), 2003

5. Newnes - *Introduction to Fiber Optics*, 2ed – 2001.

6. Govind P. Agrawal- *Nonlinear Fiber Optics*, **2001**

7. S.O. Kasap – *Optoelectronics and Photonics*, Prentice Hall, 2001

8. *Photonics Magazine*

Modul de examinare și atribuire a notei

Examinations	Examenul constă din verificarea cunoștințelor prin rezolvarea de probleme și o parte teorie (intrebări) în scris (2 ore). După cursul 7 se poate susține un examen parțial (1,5 ore). Nota la laborator se stabilește pe baza unui test în ultima ora de laborator.
Score components	Exam (EX score); Laboratory (nota L); Sintesis material/Essay (ES score);
Final score formula	Final score = $0,5EX+0,1L+0,4ES$; Credits acquired if: $EX \geq 4.5$; $L \geq 4.5$; $ES \geq 4.5$

Optoelectronics Chief

Prof.dr.ing. Emil VOICULESCU