

SYLLABUS 2016/2017

Level of study	Master's Course
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Course title in Ukraine	Аналогова обробка інформації оптичними системами		
Course title in English	Analog processing of the information by the optical systems		
Course code		ECTS credits	3
Lecturer(s)	Ph.D. Tatyana Bochkova Email address: fttkaf@i.ua ;		

Course objectives (learning outcomes)	The aim of this course to get acquainted with the phenomena of the transformations of spatially modulated optical signals in analog optical and optoelectronic systems. The students will be mastered theoretical basis and practical methods of analog processing of the optical information.
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Prerequisites:

Knowledge	Knowledge of mathematics and physics on the level of bachelor of physics or applied physics
Skills	Mathematical and physical skills on the level of bachelor of physics or applied physics
Courses completed	The bachelor of physics or applied physics.

Learning effects:

	Learning effects of the course	Relation of the learning effects to the specialization
Knowledge	W01 A student has a basic knowledge in the Fourier transformations of two-dimensional functions. W02 A student understands foundations of spatial optical filtering. W03 A student comprehends physical principles of holography and spatial-time modulation of the light. W04 A student knows the structural schemes of the optical systems for processing of signals and images.	W01 – W10

	Learning effects of the course	Relation of the learning effects to the specialization
Skills	U01 A student is able to use mathematical tools of Fourier transformations, operators of convolution and correlation of the functions. U02 A student is able to perform a description of the holography storage of the information, to classify holograms according to various criteria. U03 A student understands foundations of spatial-frequency filtering of images with the help of the optical convolution processors.. A student can use the amplitude, phase and amplitude-phase filters for image processing. U04 A student is able to use optoelectronic devices for entering the data into the optical systems, processing and readout of the information.	U01 – U07

Social skills	Learning effects of the course	Relation of the learning effects to the specialization
	K01. A student has the creativity and the ability to conceptual thinking. K02 A student is able to present and justify the personal point of view. K03 A student is able to use the information technologies for the communication with the scientific community. K04 A student is aimed to expand personal knowledge and skills. K05 A student has the legal erudition. K06 A student concerned about the environmental safety of physical experiment.	K01 – K06

Course organization:

Form of classes	Lecture (W)	Group-exercises							
		A (large group)	K (small group)	L (Lab)	S (Seminar)	P (Project)	T. (Test)		
Contact hours	13		13				1		
Semester	2								
Language	English, Ukrainian, Russian								

Teaching methods:

Classes will be performed in tutorial system on a weekly basis using multimedia presentation and internet in a form of the lectures open for discussion and questions.
 In-class exercises are designed to probe knowledge developed through this process, with emphasis on how well students have understood the underlying mathematical and physical ideas.
 The students will prepare one individual presentation.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	assignment (essay)	Oral exam	Written exam	Test
W01						x		x					x
W02						x		x					x
W03						x		x					x
W04						x		x	x				x
U01							x	x					x
U02							x	x					x
U03							x	x					x

U04							x	x					x
K01						x		x	x				x
K02							x	x					x
K03							x	x	x				x
K04						x	x	x					x
K05													x
K06													x

Assessment criteria:

Grades	<p>The grading scale will be as follows:</p> <p>90 – 100 % - A including A- excellent (eq. in Ukraine: відмінно (very good))</p> <p>82–89 % : B including B – very good (eq. in Ukraine: добре (good))</p> <p>74–81 %: C including C – good (eq. in Ukraine: добре (good))</p> <p>64–73 %: D including D – satisfactory (eq. in Ukraine: задовільно (satisfactory))</p> <p>60–63 %: E including E – acceptable (eq. in Ukraine: задовільно (satisfactory))</p> <p>< 59 %: F failed (eq. in Ukraine: незадовільно (unsatisfactory))</p>
Criteria	<p>A. A student knows all terms and concepts mentioned in W1-W4, U1- U4 and K1-K4. A student can work without any assistances, his/her knowledge's are creative and easily applied to decision of specific problem.</p> <p>B. A student knows all terms and concepts mentioned in W1-W4, U1- U4 and K1-K4, yet needs a little help when decision of specific problem.</p> <p>C. A student knows all terms and concepts mentioned in W1-W4, U1- U4 and K1-K4, however needs a help when decision of specific problem.</p> <p>D. A student knows the most of terms and concepts mentioned in W1-W4, U1- U4 and K1-K4 and has difficulty in decision of specific problem.</p> <p>E. A student knows only several terms and concepts mentioned in W1-W4, U1- U4 and K1-K4 and can solve only a simple problem.</p> <p>F. A student does not know most of terms and concepts mentioned in W1-W4, he/she did not reach the satisfactory level of knowledge this course.</p>

Course content (topic list):

Topics	<p>1. Mathematical foundations of the information processing by the optical systems.</p> <p>W1. Properties of Fourier transformations of two-dimensional functions.</p> <p>W2. Generalized functions. Convolution. Correlation.</p> <p>2. Scalar theory of the light diffraction.</p> <p>W3. Fresnel diffraction. Fraunhofer diffraction.</p> <p>W4. Optical systems performing Fourier transformation.</p> <p>3. Optical holography.</p> <p>W5. Physical principles of holography.</p> <p>W6. Classification of the holograms.</p> <p>W7. Fourier holograms.</p> <p>4. Implementation of the principles of analog processing of the information in the analog optical systems.</p> <p>W8. Spatial-frequency filtering images.</p> <p>W9. The spatial correlator Vander-Lyuhta. The optical recording scheme and principle of the action.</p> <p>W10. Optical multiplication of a vector by a matrix.</p> <p>5. Optoelectronic analog methods of information processing.</p> <p>W11. Spatial-time light modulators.</p> <p>W12. Operations on optical signals in the optoelectronic systems.</p>
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Literature:

Compulsory reading	1.Стюард, И.Г. Введение в Фурье-оптику[Текст] /И.Г.Стюард - 1985.- 186 с. 2.Акаев, А.А. Оптические методы обработки информации. [Текст] /А.А.Акаев, С.А.Майоров - М.: Высшая школа, 1988. - 237 с. 3.Дмитриев, А.Л. Оптические методы обработки информации. Учебное пособие[Текст] /А.Л.Дмитриев - С-Пб.:СПбГУИТМО, 2005.-46с. 4.Тарлыков Е.А. Когерентная оптика. Учебное пособие. [Текст] /Е.А.Тарлыков - С-Пб.:СПбГУИТМО, 2011.-168 с.
Recommended reading	5.Кольер, Р. Оптическая голография. Пер. с англ.[Текст] /Р. Кольер, К. Беркхарт, Л. Лиин.- М.: 1973.-672 с.

Estimation of the total working time of students:

Contact hours	Lectures	26
	Seminars	
	Other (consultation, meetings)	14
Students' work hours (without the lecturer)	Reading books and preparation for the lectures	10
	Preparation to the seminar	5
	Preparation of an individual presentation	5
	Preparation to the test	15
Total works' hours		75
ECTS credits 1 ECTS = 25 h		3