

SYLLABUS 2019/2020

Level of study	Master's Course		
Course title in Ukraine	Активні діелектрики		
Course title in English	Active dielectrics		
Course code		ECTS credits	5
Lecturer(s)	Prof. Trubitsyn M.P. Email address: trubitsyn_m@ua.fm		

Course objectives (learning outcomes)	<p>This course covers all major issues, and the most pressing matters in the physics of dielectrics, shows the relationship of physics and engineering, which allows for seamless connection of this course with previous courses.</p> <p>In the process of studying this discipline a student is obliged to: learn the basic phenomenological theory of various phenomena in dielectrics, be able analyze the physical nature of the phenomena observed, learn and know the application principles of dielectrics in functional and integrated electronics.</p>
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Prerequisites:

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

Learning effects:

	Learning effects of the course	Relation of the learning effects to the specialization
Knowledge	<p>W01 Basic phenomenological theory of ferroelectrics.</p> <p>W02 Pyroelectric, piezoelectric and other effects in dielectrics.</p> <p>W03 Thermodynamic properties of dielectrics.</p> <p>W04 Optical properties: electrooptical, elasto-optical, photorefractive, nonlinear optical.</p> <p>W05 Principles of polar dielectrics application in storage devices and displays, laser modulators.</p>	W01 –W10

	Learning effects of the course	Relation of the learning effects to the specialization
Skills	<p>U01 Ability to analyze the physical nature of electric and optical phenomena.</p> <p>U02 Ability to choose the best material for use as functional ones.</p>	U01 –U07

	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)	Exam		
Contact hours	18		16				1		
Semester	1								
Language	English, Ukrainian								

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 with emphasis on how well students have understood the underlying topics of course.
 The students will prepare two of individual presentation.

Assessment methods:

	E – learning	Didactic games	Classes in schools	Field classes	Laboratory tasks	Individual project	Group project	Discussion participation	Student's presentation	written assignment (essay)	Oral exam	Written exam	Test
W01								x				x	x
W02								x	x			x	x
W03								x				x	x
W04								x	x			x	x
W05								x	x			x	x
U01							x	x				x	x
U02							x	x				x	x

K01								X	X			X	X
K02							X	X				X	X
K03							X	X	X			X	X
K04							X	X				X	X
K05							X	X				X	X
K06							X	X				X	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-K6. 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-K6, 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-K6, 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-K6 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-K6 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. Introduction to the physics of dielectrics.</p> <p>W1. General concepts and definitions of physics of dielectrics.</p> <p>W2. The classification of dielectrics.</p> <p>2. Polarization of dielectrics.</p> <p>W3. General definitions of polarization.</p> <p>W4. Types of polarization.</p> <p>W5. Polarization of dielectrics in various phase states.</p> <p>W6. The polarization of polar material without conductivity in a DC field.</p> <p>3. Electrical conductivity of dielectrics</p> <p>W7. Basic concepts of electrical conductivity of dielectrics.</p> <p>W8. Electrical conductivity of gaseous and liquid dielectrics</p> <p>W9. Electrical conductivity of solid and polymeric dielectrics.</p> <p>4. Specific conditions and types of dielectrics</p> <p>W10. Electrets.</p> <p>W11. Piezoelectrics.</p> <p>W12. Pyroelectrics.</p> <p>W13. Methods of preparation of dielectric materials.</p> <p>5. Electrical aging of dielectrics</p> <p>W14. Electric breakdown.</p>
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Literature:

Compulsory reading	1. Poplavko Yu.M. Physics of Dielectrics, 1980. 2. Zheludev I.S. Physics of crystalline dielectrics, 1968. 3. Scanavi G.I. Physics of dielectrics, vol. 1, 2. 4. Oreshkin P.T. Physics of Semiconductors and Dielectrics, 1977. 5. Barfut J. Introduction to the physics of ferroelectric phenomena, 1970. 6. Lines M., Glass A. Ferroelectrics and Related Materials, 1981. 7. Brown V. Dielectrics, 1961.
Recommended reading	1. Matveev A.N. Electricity and Magnetism, 1961. 2. Smolensky G.A., Bokov V.A., Isupov V.A., Krainik N.N., Pasinkov R.E. Ferroelectrics and anti-ferroelectrics, 1971.

Estimation of the total working time of students:

Contact hours	Lectures	34
	Seminars	
	Other (consultation, meetings)	26
Students' work hours (without the lecturer)	Reading books and preparation for the lectures	25
	Preparation for quizzes and exercises	10
	Preparation of an individual presentation	10
	Preparation to the exam	20
Total works' hours		125
ECTS credits 1 ECTS = 25 h		5