



COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Applied electrodynamic	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: associated prof. Dr. Mindaugas Žilinskas Other(s):	Physics Faculty of Vilnius University, Institute of electrodynamics and telecommunications

Study cycle	Type of the course unit (module)
second	obligatory

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
auditorium	Second term (autumn term)	Lithuanian

Requirements for students	
Prerequisites: no	Additional requirements (if any):

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	140	48	92

Purpose of the course unit (module): programme competences to be developed		
<p>The aim is to give knowledges on frequency management in Lithuania and on international level as well. To provide an evidence of the advantage of frequency harmonization and to show its impact on proliferation of a new technologies. To give knowledges on radio wave propagation in free space, methodology of free space losses calculations, losses due to impact of atmosphere, to provide various radio waves propagation models. By using and experimental results of radio waves propagations from ITU recommendations to learn the methodology of calculation service area of radio and television stations for analogue and for digital signals including multifrequency networks and single frequency networks. To give knowledges on the basis of antennas technics, to analyse the simplest types of antennas analytically, to analyse linear antennas array, to show its scanning possibility. To give knowledges on the methods of calculation of radio relay systems.</p>		
Learning outcomes of the course unit (module)	Teaching and learning methods	Assessment methods
To provide a knowledges on frequency management and its impact on the proliferation of new technics.	Lessons	exam
To give knowledges on the method of calculations of radio wave propagation in free space, methodology of free space losses calculations, losses due to impact of atmosphere, to provide various radio waves propagation models for various frequency ranges including radio waves propagation in troposphere, ionosphere. To give knowledge on the evaluation of atmosphere's impact on the rotation of radio waves polarization in ionosphere, to give knowledge on radio wave propagation in giro tropical material. To give knowledge of refractivity features of atmosphere.	Lessons	exam
To give knowledge on the calculations of service	Lessons and laboratory	Reports on laboratories, exam

areas of radio and televisions stations taking into account disturbances from other stations for analogue and digitals signals. To give knowledge on analysis of radio and TV synchronized and not synchronized networks.		
To give knowledges on the basis of antennas technics, to analyse the simplest types of antennas (short dipole, loop, long thin antenna, antennas linear array, traveling wave thin antenna) analytically, to analyse antennas array, to show its scanning possibility, to define the main characteristics such like resistance, antenna gain, directivity, radiation pattern. To give knowledge on atmospheric noise impact on antenna's characteristics.	Lessons	exam

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	Contact hours	Self-study hours	Assignments
1. To provide a knowledges on frequency management and its impact on the proliferation of new technics.	2						2	5	To analyse corresponding literature
2. Characteristics of short electric dipole (electromagnetic fields, radiation's resistance, directivity)	3						3	6	To analyse corresponding literature
3. Characteristics of small loop antennas (electromagnetic fields, radiation's resistance, directivity).	1						1	5	To analyse corresponding literature
4. Characteristics of thin long antenna's (electromagnetic fields, radiation's resistance, directivity).	2						2	5	To analyse corresponding literature
5. Characteristics of uniform traveling wave antenna's	1						1	3	To analyse corresponding literature
6. Dipole systems, array antennas, radiation patterns of array antenna's.	2						2	6	To analyse corresponding literature
7. Antenna's noise, atmospheric noise	2				1		3	5	To analyse corresponding literature
8. Radio wave propagation in free space. Friis	3				1		4	6	To analyse

transmission's formulas. Fresnel zones.									corresponding literature
9. Earth surface impact on radio wave propagation in homogenous atmosphere	2				1		3	6	To analyse corresponding literature
10. Calculations of radio wave propagation losses in direct visibility zones.	2						2	6	To analyse corresponding literature
11. Earth curvature and earth irregularity impact on radio wave propagation's.	1						1	5	To analyse corresponding literature
12. The main characteristics of atmosphere. The electric permeability and conductivity of troposphere and ionosphere.	3						3	6	To analyse corresponding literature
13. Trajectory of radio wave propagation in troposphere, refractivity, effective earth radius.	3				3		6	8	To analyse corresponding literature
14. Electromagnetics' waves propagation in giro tropical materials.	3				3		6	8	To analyse corresponding literature
15. Calculation of service areas of radio and televisions stations, including interference coming from other stations, planning of synchronized networks.	2				4		6	10	
Total	32				16		48	92	

Assessment strategy	Weight, %	Deadline	Assessment criteria
exam in written form	40	Half semester	To give answer into two questions. To show knowledges how to derive electromagnetic fields and potentials equations, to show knowledge on relations between the other main characteristics.
exam	40	session	To provide answer into two questions on radio wave propagations.
Reports of labours work	20	During semester	To explain the main results

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsary reading				
John D. Kraus	2001	Antennas	The 3 edition	McGraw-Hill Higher Education
Roger L. Freeman	1997	Radio system design for telecommunications		John Wiley & Sons Inc.
Erik Dahlman, Stefan Parkvall, Johan Skold	2011	4G; LTE/LTE-Advanced for Mobile Broadband		Academic Press, Elsevier
K. Paulauskas	1985	Antenos ir mikrobangu įtaisai		Mokslas
Optional reading				
Н.И. Листопадов, В.М. Козел, К. Л.	2009	Системы и сети цифровой радиосвязи		Гревцова. Минск

Горбачев, К. А. Ковалев				
В.В.Никольский. Т.И. Никольская.	1989.	Электродинамика и распространение радиоволн.		Наука. М.
ITU-R, ITU-P, ITU-S	2018	Recommendations		International telecommunication Union. Geneva
William C.Y. Lee	1995	Mobile cellular telecommunications		John Wiley & Sons Inc