COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
Modeling the Wireless Propagation Channel	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Assoc. prof. Edvardas Kazakevičius	Faculty of physics, Vilnius University

Study cycle	Type of the course unit (module)
The Second	Elective

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Classroom	The first semester (Autumn)	Lithuanian

Requirements for students	
Prerequisites: The students should know the courses of general Physics and Principles of Telecommunications	**Additional requirements (if any):**

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5	140	64	76

Purpose of the course unit (module): programme competences to be developed		
The aim is to provide knowledge about signal fading in a wireless propagation channel and its modeling using a computer with MATLAB computational soft. It develops the ability to analyze signal fading data, generate a signal according to the assigned propagation channel statistics or geometry, calculate the parameters defining the channel and estimate the coverage of the area by wireless propagation. Programming skills are also improved.		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assessment methods**
Will be familiar with the wireless propagation channel key concepts and mechanisms of propagation.	Lectures.	Oral exam.
Will be able to perform temporal signal fading analysis.	Lectures, exercises, independent study	Delivery of completed exercise tasks.
Will be able to geometrically and statistically describe obstacles effects on the signal in the wireless channel (shadowing effect).	Lectures, exercises, independent study	Delivery of completed exercise tasks.
Will be able to estimate the quality of coverage of a certain area by wireless channel.	Lectures, exercises, independent study	Delivery of completed exercise tasks.
Will be familiar with the simplest methods of communication between stations.	Lectures, exercises, independent study	Delivery of completed exercise tasks.
Will be able to evaluate the influence of extraneous signals on the useful signal in the wireless channel.	Lectures, exercises, independent study	Delivery of completed exercise tasks.
Will be able to evaluate the effects of signal reflections (multipath fading) and evaluate signal variation due to station movement.	Lectures, exercises, independent study	Delivery of completed exercise tasks.

Content: breakdown of the topics	Contact hours	Self-study work: time and assignments

	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work	Contact hours	Self-study hours	Assignments
1. Introduction to wireless propagation channel. Basic concepts and mechanisms. Methods of analysis of temporal signal variation.	4	4		8			16	19	Studying literature, MATLAB programming tasks
2. Shadowing effect. Fully absorbing screens. Buildings and major obstacles. Terrain effect.	4	4		8			16	19	Studying literature, MATLAB programming tasks
3. Coverage and interference. Coverage quality and models. Auto Correlated signal, multiple correlated signals. Methods of communication between stations. Multiple signal interference.	4	4		8			16	19	Studying literature, MATLAB programming tasks
4. Multipath fading. Geometric trajectories of varying complexity. Doppler effect. Spatial standing wave. Stationary station. The case of a mobile and a base station. Multiple scatter point model.	4	4		8			16	19	Studying literature, MATLAB programming tasks
Total	16	16		32			64	76	

Assessment strategy	Weight,%	Deadline	Assessment criteria
Programming tasks and their presentation	30	During the semester	S1 - completeness of the performed task, presentation of results; S2 - ability to explain the application of program code to achieve the set goals; S3 - ability to explain the obtained results; S = 0.3 x S1 + 0.4 x S2 + 0.3 x S3
Exam	70	During the session	Theoretical question and related programming task. The acquired knowledge and the ability to apply it to the performance of a specific task are assessed: 5-6 points: Lower than average knowledge and skills, incomplete answers to questions, there are errors/ knowledge and skills meet the minimum requirements; 7-8 points: Average knowledge and skills, there are insignificant mistakes/ better than average knowledge and skills; 9-10 points: Strong / excellent, exceptional knowledge and skills, answers are given smoothly.

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsary reading				
F. P. Fontan, P.M Espineira	2008	Modeling the wireless propagation channel		Wiley
J.M. Hernando, F. P. Fontan	1999	An Introduction to Mobile Communications Engineering.		Artech House
Optional reading				
A.Kežionis	2008	Radijo sąsaja judriojo ryšio sistemose, paskaitų medžiaga		
A. Kežionis	2003-2011	Telekomunikacijų pagrindai, paskaitų medžiaga.		