MODULE DESCRIPTION

Module title	Module code
Coding Theory	

Lecturer(s)	Department where the module is delivered
Coordinator: dr. Gintaras Skersys **Other lecturers:**	Department of Computer Science Faculty of Mathematics and Informatics Vilnius University

Cycle	Type of the module
First	Optional

Mode of delivery	Semester or period when the module is delivered	Language of instruction
Face-to-face	5, 7 semester	Lithuanian

Prerequisites
Prerequisites: Mathematics for Software Engineering I

Number of credits allocated	Student's workload	Contact hours	Self-study hours
5	130	68	62

Purpose of the module: programme competences to be developed

Purpose of the module – to introduce to the basic concepts of coding theory, bounds for codes, principal classes of codes as well as encoding and decoding algorithms, to develop the ability to apply principal coding theory methods in solving problems.

Generic competences:

- Communication and collaboration *(GK1).*
- Life-long learning *(GK2).*

Specific competences:

- Knowledge and skills of underlying conceptual basis *(SK4).*
- Software development knowledge and skills *(SK5).*

Learning outcomes of the module: students will be able to	Teaching and learning methods	Assessment methods
Define principal coding theory concepts, to illustrate them by examples.	Lecture Laboratory work Case study Individual reading Problem solving	Assessment of laboratory work Exam (written)
Formulate and prove principal coding theory statements.		
Apply principal coding theory methods in solving problems.		
Independently analyse, design and implement encoding and decoding algorithms.		

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Practice	Laboratory work (LW)	*Tutorial during LW*	**Contact hours**	**Self-study hours**	**Assignments**
1. The essentials of coding theory: definitions, basic assumptions, weight and distance, maximum likelihood decoding, error-detecting codes, error-correcting codes, some bounds for codes.	8				4	*3*	**12**	**10**	Individual reading Problem solving Analysis, design and implementation of error-correcting codes
2. Linear codes: definitions, generating matrices, encoding, parity-check matrices, dual codes, equivalent codes, cosets, decoding, standard decoding array.	10				6		**16**	**14**	
3. Some families of codes: Hamming codes, extended codes, Golay codes, Reed-Muller codes.	6				12	*3*	**18**	**21**	
4. Cyclic codes: definitions, generator polynomials, encoding, decoding, construction, dual cyclic codes.	6				8	*3*	**14**	**12**	
5. Convolutional codes: definitions, encoding, decoding, examples.	2				2		**4**	**5**	
Exam		2					**4**		2 hours for tutorial, 2 hours for exam
Total	**32**	**2**			**32**	*9*	**68**	**62**	

Assessment strategy	Weight %	Deadline	Assessment criteria
Assessment of laboratory work	50%	During the semester	In laboratory works students must implement the simulation of error-correcting codes: coding, noisy channel, decoding. The evaluation is following: 5 - if all required functions are implemented and works correctly, 4 - if there are some non-essential omissions, 3 - if there are some serious errors, some functions do not work correctly, 2 - if only a part of required functions is implemented, 1 - if only some most basic functions are implemented, 0 - if no laboratory work is done.
Exam (written)	50%	Exam session	Exam consists of theory questions and exercises (of diverse difficulty). Each question or exercise is assessed as follows: 100% – excellent knowledge and abilities; 75% – strong knowledge and abilities; 50% – mediocre knowledge and abilities; 25% – minimal knowledge and abilities; 0% – minimal requirements are not satisfied.

Author	Publishing year	Title	Number or volume	Publisher or URL
Required reading				
D.G. Hoffman, D.A. Leonard, C.C. Lindner, K.T. Phelps, C.A.Rodger, J.R.Wall	1991	Coding Theory: The Essentials		Marcel Dekker, Inc.
G. Skersys	2008	Theory of codes repairing errors (in Lithuanian)		http://www.mif.vu.lt/~skersys/11r/ktkt/konsp.htm

Recommended reading				
V. Stakėnas	2007	Codes and ciphers (in Lithuanian)		TEV
P. Sweeney	2002	Error Control Coding: From Theory to Practice		John Wiley & Sons, Inc.
S. Roman	1992	Coding and Information Theory		Springer Verlag