Study Programme Description

Title of the study programme	National code
Software Engineering	612I30001

Official name of the awarding institution	Language(s) of instruction
Vilnius University, Faculty of Mathematics and Informatics, Department of Software Engineering	Lithuanian

Kind of study	Cycle of studies	Level of qualification according to LQF (LKS)
University studies	1st cycle	VI

Mode of study and length of the programme in years)	Length of the degree programme in ECTS credits	Total student's workload in hours	Contact hours	Self-study hours
Full-time, 4 years	240	6400	2717	3683

Study area	Major study field (branch) of the programme	Minor study field (branch) of the programme (if applicable)
Physical Sciences	Software Engineering	-

Degree and/or qualification awarded
Bachelor of Software Engineering

Head of the study programme	Contact information of the head of the programme
assoc. prof. dr. Saulius Ragaišis	Vilnius University, Faculty of Mathematics and Informatics, Department of Software Engineering, Didlaukio St. 47, Vilnius, Lithuania e-mail: saulius.ragaisis@mif.vu.lt; tel. +370 5 219 50 40

Accreditation organization	The Programme accredited until
Center for Quality Assessment in Higher Education	31-12-2014

Purpose of the programme
The objective of the programme is preparation of highly qualified IT specialists that match the needs of the economy of Lithuania, are capable to export software products and services, and could successfully compete for IT workplaces in the European Union and other foreign countries.

Degree profile characteristics		
Content of the study programme: groups of modules	**General/specialist focus, orientation**	**Distinctive features of the study programme**
Modules of Study Field (165 credits) can be distributed into the following groups: • Mathematics: 15 credits. • Discrete Mathematics: 10 credits. • Computing Fundamentals: 40 credits. • Software Engineering: 60 credits. • English Language: 10 credits.	Academic – applied.	Study programme combines the theoretical knowledge with its practical application, focuses on teamwork and task execution on time. Professors – researchers, experts in their fields with extensive experience in software systems development for Lithuanian and

• Professional practice: 15 credits. • Bachelor Thesis: 15 credits. Modules of General University Studies: 15 credits. Other modules (60 credits)[1] can be distributed into the following groups: • Compulsory modules (Mathematical Logic, Object Oriented Programming II, Professionalism and Ethics): 15 credits. • Elective Mathematics modules: 10 credits. • Elective Sciences modules: 10 credits. • Elective Computing modules: 20 credits. • FMI elective module: 5 credits.		foreign customers. Programme satisfies criteria for accrediting Software Engineering study programmes in Europe and USA. A wide list of elective modules and flexible choice of options enable specialization. Those, wishing find a job according to their specialty, easily do this still during study period.

Admission requirements	Specific arrangements for recognition of prior learning
At least a twelve-year secondary or its equivalent education is required. The general criterion for admission is competition grade which is composed from results of maturity exams/yearly grades of subjects important for study programme (including information technologies) according the procedures established by Ministry of Education and Science and/or Vilnius University (the list of subjects and their weights in the competition grade).	In accordance with procedures established at Vilnius University.

Access to further studies
Studies can be continued in Master's degree programmes of Software Engineering, Informatics, Informatics engineering and other close fields in Lithuania or abroad.

Employability
Graduates of Software Engineering study programme are ready to work as system analysts, designer, programmers in large projects based on advanced technologies and virtual enterprises and after gathering some more experience as project managers for private or public Lithuanian and foreign enterprises. They are able to establish private IT enterprise, to lead small teams, to learn independently new methods and technologies and apply them in practice.

Learning and teaching approaches	Assessment methods
Lectures, problem-oriented teaching, case analysis, team projects, seminars, discussions, laboratory works, self-studies, individual coaching, research work, preparation of final work.	Student's knowledge and general performance are evaluated using grading scale from 1 (very poor) to 10 (excellent). Usually accumulative grades are applied as well. Matters evaluated: home and laboratory work assignments, their defense, oral and written presentations, projects and their defense, research work and its defense. Final assessment of modules – examination (open, semi-open and closed-ended questions and tasks). Course works, project works, BA thesis, team projects and results of professional practice are defended in front of a commission.

Generic competences		Programme learning outcomes	
1.	Communication and collaboration	**1.1.**	An ability to present, information, ideas, problems, and suggested solutions convincingly in official and second (foreign) language for specialists and non-specialists in written and verbal form.
		1.2.	An ability to function effectively on multidisciplinary teams to accomplish a common goal.
		1.3	An ability to organise their own work independently.
2.	Life-long learning	**2.1.**	Recognition of the need for, and engagement in life-long learning.

[1] Instead of these modules student could select Minor studies - *Organizational arrangements for Minor studies* approved by Vilnius University Senate Committee resolution No. SK-2012-12-12 of 21 June 2012. Internet access: http://www.vu.lt/lt/studijos/studiju-procesas/gretutines-studijos/45-studijos/studijos/2581-gretutiniu-studiju-organizavimo-tvarka [Accessed: 30-05-2013].

		2.2.	An ability to undertake literature searches and analysis, and to use data bases and other sources of information.
		2.3.	An ability independently to acquire new knowledge, methodologies, and tools and to apply them in practice.
3.	Social responsibility	**3.1.**	An understanding of professional and ethical responsibility.
		3.2.	An ability to analyse the economic, social, ethical, and legal impact of engineering solutions on individuals, organizations, and society.
Subject-specific competences		**Programme learning outcomes**	
4.	Knowledge and skills of underlying conceptual basis	**4.1.**	Knowledge and understanding of the key aspects and concepts of software engineering, including some at the forefront of the discipline, insight into possible application fields, and an awareness of the wider spectrum of the discipline.
		4.2.	An ability to apply mathematical foundations, knowledge of science and engineering, computer science theory, and algorithmic principles in software systems development.
		4.3.	An ability to reason at abstract level, to use formal notation, to prove the correctness, and to apply formalisation and specification for real-world problems.
5.	Software development knowledge and skills	**5.1.**	An ability to become familiar with new software engineering applications, to appreciate the extent of domain knowledge, to evaluate the complexity of the problems and the feasibility of their solution.
		5.2.	An ability to analyse a problem, identify needs and define the computing requirements appropriate to its solution.
		5.3.	An ability to design, implement, and evaluate a computer-based system, process, component, or service to meet desired needs.
		5.4.	An ability to select the software life cycle suitable for building new, and maintaining and commissioning existing, software systems.
6.	Technological and methodological knowledge and skills, professional competence	**6.1.**	An ability to combine theory and practice to complete software engineering tasks from different application areas while taking into account the existing technical, economical and social context.
		6.2.	An ability to select and use appropriate current techniques, models, solution patterns, skills, and tools necessary for software engineering practice involving emerging application areas.
		6.3.	An ability to use existing hardware, software and application systems, to identify, understand and apply the promising technologies.
		6.4.	An ability to plan, design and conduct experiments and other appropriate practical investigations (e.g. of system performance), as well as to analyse and interpret data.
		6.5.	An ability to formulate acceptable, cost-effective and time-efficient problem solutions using essential knowledge and methods of estimating and measuring cost and productivity.
		6.6.	Awareness of project management, quality assurance, and process improvement practices and abilities to apply them.

These competences and learning outcomes have been formulated based on the long experience of Informatics (more than 30 years) and Software Engineering (12 years) studies in Vilnius University; bachelor study programmes of Software Engineering at universities in other countries; research on Software Engineering studies and projects on study programs definition [1,2]; demands of IT companies [3] and analysis of prerequisites for IT products and services export; recommendations of world leading professional organizations ACM/IEEE [4,5]; and criteria for accrediting Software Engineering study programmes in Europe [6] and USA [7, 8].

1. A. Mitašiūnas and other. Informatics studies description, Vilnius, 2012. /in Lithuanian/ Internet access: <http://www.mii.lt/files/informatikos_ska_galutinis_2012_03_10.pdf> [Accessed: 30-05-2013].
2. L. Bukauskas and other. Methodology for competences development in Informatics studies. Vilnius University, Vilnius, 2011, ISBN 978-9955-526-78-0. /in Lithuanian/ Internet access: <http://www.ects.cr.vu.lt/Files/File/ECTS_informatika.pdf> [Accessed: 30-05-2013].
3. A. Poviliūnas and other. Results of Informatics professional field research: guidelines for study programmes updating. Vilnius, 2010. /in Lithuanian/ Internet access: <http://www.ects.cr.vu.lt/Files/File/Informatikos%20technine%20ataskaita.pdf> [Accessed: 30-05-2013].

4. Guide to the Software Engineering Body of Knowledge (Eds.: A. Abran, J.W. Moore), IEEE Computer Society, 2004. Internet access: <http://www.computer.org/portal/web/swebok/htmlformat> [Accessed: 30-05-2013].
5. Computing Curricula 2005. The Overview Report. The Joint Task Force for Computing Curricula 2005. A cooperative project of The Association for Computing Machinery (ACM), The Association for Information Systems (AIS), The Computer Society (IEEE-CS). ACM and IEEE. 2006. Internet access: <http://www.acm.org/education/education/curric_vols/CC2005-March06Final.pdf> [Accessed: 30-05-2013].
6. Euro-Inf Framework Standards and Accreditation Criteria. EQANIE, 2011. Internet access: <http://www.eqanie.eu/media/Quality%20Label/Euro-Inf%20Framework%20Standards%20and%20Accreditation%20Criteria%20V2011-06-29.pdf > [Accessed: 30-05-2013].
7. Criteria for Accrediting Computing Programs 2013 - 2014 Accreditation Cycle. ABET Computing Accreditation Commission, 2012. Internet access: <http://www.abet.org/uploadedFiles/Accreditation/Accreditation_Step_by_Step/Accreditation_Documents/Current/2013_-_2014/cac-criteria-2013-2014.pdf> [Accessed: 30-05-2013].
8. Criteria for Accrediting Engineering Programs 2013 - 2014. ABET Engineering Accreditation Commission, 2012. Internet access: <http://www.abet.org/uploadedFiles/Accreditation/Accreditation_Step_by_Step/Accreditation_Documents/Current/2013_-_2014/eac-criteria-2013-2014.pdf> [Accessed: 30-05-2013].

The quality of the study programme is ensured by the programme Committee which estimates specific means for observation of the study programme quality and development. At the end of every semester the study programme Committee arranges a students' opinion survey which is meant to estimate the quality of the study programme to foresee the means of the programme development. The study Committee includes at least one social partner which represents the business sector. The Committee of the study programme also includes a students' representative, with observer's rights, which is proposed by the Students' Representation. The study programme Committee regularly meets with the most important employers of the study programme graduates; possible ways of developing the study programme are discussed during the meetings, and the statistical data about the study programme graduates' placement is collected as well.

The Department of Software Engineering is responsible for implementation of the study programme. The activity of the study programme Committee is regularly (once a year) considered by the Council of the Faculty Mathematics and Informatics.

THE PLAN OF THE STUDY PROGRAMME (full-time studies)
(CORRELATION BETWEEN THE MODULES, COMPETENCES, AND THE LEARNING OUTCOMES)

Code	Study modules according to groups	Credits	Total student's workload	Contact work	Self-study work	Study programme competences																				
						Generic competences								Subject-specific competences												
						1			2			3		4			5			6						
						Main learning outcomes																				
						1	2	3	1	2	3	1	2	1	2	3	1	2	3	4	1	2	3	4	5	6
YEAR I		**60**	**1600**	**837**	**763**																					
SEMESTER 1		**30**	**800**	**428**	**372**																					
Compulsory modules		**30**	**800**	**428**	**372**																					
*[2]	Mathematics for Software Engineering I	5	132	72	60						X				X	X										
*	Discrete Mathematics	5	132	72	60										X	X										
*	Computer Architecture	5	142	68	74			X	X		X				X	X							X			
*	Procedural Programming	5	134	68	66			X	X		X	X			X	X							X			X
*	IT and Communication Skills	5	130	84	46	X	X	X	X	X	X	X	X								X	X	X	X	X	
*	English Language I/II	5	130	64	66	X	X	X	X	X	X	X				X								X		
SEMESTER 2		**30**	**800**	**409**	**391**																					
Compulsory modules		**25**	**670**	**345**	**325**																					
*	Mathematics for Software Engineering II	5	136	72	64			X							X	X										
*	Algorithm Theory	5	132	71	61						X				X	X										
*	Algorithms and Data Structures	5	132	68	64		X	X			X				X	X							X			X
*	Object Oriented Programming	5	140	70	70			X			X				X		X	X	X				X			
*	English Language II/II	5	130	64	66	X	X	X	X	X	X	X				X								X		
Optional modules		**5**	**130**	**64**	**66**																					
	GUS[3]	5	130	64	66																					
YEAR II		**60**	**1600**	**738**	**862**																					
SEMESTER 3		**30**	**800**	**368**	**432**																					
Compulsory modules		**25**	**670**	**304**	**366**																					
*	Software Engineering I	10	270	100	170	X							X	X	X			X	X	X	X	X				
*	Database Management Systems	5	134	68	66	X		X			X				X	X			X				X			

[2] * - Modules of Study Field (165 credits)

[3] Module of General University Studies. *Concept of General University Studies in Vilnius University* approved by Vilnius University Senate Committee resolution No. SK-2012-7-3 of 19 April 2012. Internet access: http://www.vu.lt/site_files/SD/Studentams/BUS_VU_koncepcija_galutinis.pdf /in Lithuanian/ [Accessed: 30-05-2013].

	Object Oriented Programming II	5	134	68	66	X		X		X	X				X	X		X	X		X	X	X			
	Mathematical Logic	5	132	68	64										X	X								X		
Optional modules		**5**	**130**	**64**	**66**																					
	GUS	5	130	64	66																					
SEMESTER 4		**30**	**800**	**370**	**430**																					
Compulsory modules		**20**	**540**	**238**	**302**																					
*	Software Engineering II	10	270	100	170	X	X							X	X	X	X	X	X	X	X					
*	Mathematics for Software Engineering III	5	132	70	62										X	X								X		X
*	Computer Networks	5	138	68	70				X	X	X			X	X								X	X		
Optional modules		**10**	**260**	**132**	**128**																					
	Optional module S	5	130	64	66										X								X	X		
	Optional module H	5	130	68	62		X						X													
YEAR III		**60**	**1600**	**710**	**890**																					
SEMESTER 5		**30**	**800**	**408**	**392**																					
Compulsory modules		**20**	**540**	**272**	**268**																					
*	Software Testing	5	136	68	68	X		X			X		X	X						X		X		X		X
*	Internet Technologies	5	132	68	64						X			X	X	X			X		X	X	X			
*	Human Computer Interaction	5	136	68	68		X				X	X			X		X		X			X	X			
*	Software Design	5	136	68	68	X									X				X			X				
Optional modules		**10**	**260**	**136**	**124**																					
	Optional module M	5	130	68	62										X	X										
	Optional module C	5	130	68	62										X											
SEMESTER 6		**30**	**800**	**302**	**498**																					
Compulsory modules		**20**	**540**	**170**	**370**																					
*	Software Development	10	280	82	198	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X		X	X
*	Coursework	5	130	8	122	X		X	X	X	X			X	X		X				X	X	X	X		
	Professionalism and Ethics	5	130	66	64	X	X	X	X		X	X	X								X	X	X	X	X	X
Optional modules		**10**	**260**	**132**	**128**																					
	GUS	5	130	64	66																					
	Optional module C	5	130	68	62										X											
YEAR IV		**60**	**1600**	**432**	**1168**																					
SEMESTER 7		**30**	**800**	**408**	**392**																					
Compulsory modules		**10**	**280**	**140**	**140**																					
*	Software Projects and Quality Management	5	144	72	72					X			X							X		X			X	X
*	Software Process	5	136	68	68	X				X			X	X						X		X				X
Optional modules		**20**	**520**	**268**	**252**																					
	Optional module C	5	130	68	62										X											
	Optional module C	5	130	68	62										X											
	Optional module M	5	130	68	62										X	X										

	FMI elective module[4]	5	130	64	66																				
SEMESTER 8		**30**	**800**	**24**	**776**																				
Compulsory modules		**30**	**800**	**24**	**776**																				
*	Professional practice (group project)	15	400	10	390	X	X	X	X		X	X	X		X			X	X	X	X		X		X	X
*	Bachelor Thesis	15	400	14	386	X		X	X	X	X			X	X	X	X					X	X	X	X	
Sem.	***Optional modules S***																									
4	Physical Fundamentals of Electronics	5	130	72	58										X								X	X		
4	Physics for Informatics	5	130	60	70	X									X								X	X		
Sem.	***Optional modules H***																									
4	Basics of Management	5	130	65	65	X	X				X		X			X		X								X
4	Accounting	5	130	68	62		X	X				X	X		X		X				X				X	
4	Informatics Law	5	130	68	62	X	X	X		X		X	X								X					
Sem.	***Optional modules M***																									
5,7	Mathematical Analysis	5	130	70	60	X		X		X	X				X	X										
5,7	Statistical Data Analysis	5	130	68	62	X	X	X	X	X	X				X	X						X	X	X		
5,7	Combinatorics and Graph Theory	5	130	72	58										X	X										
5,7	Optimization Methods	5	130	68	62			X			X				X	X					X	X				
5,7	Numerical Analysis	5	130	68	62	X									X	X										
5,7	Differential Equations	5	130	68	62	X					X			X	X	X	X									
5,7	Coding Theory	5	130	68	62			X			X				X	X			X							
7	Mathematical Modeling	5	130	68	62	X			X						X	X										
Sem.	***Optional modules C***																									
5	Computer Networks II	5	130	66	64	X					X				X						X		X			
5,7	Bioinformatics	5	130	66	64	X		X		X	X			X	X	X	X	X			X	X	X	X		
5,7	Logic Programming	5	130	68	62			X			X				X	X	X									
5,7	Computer Graphics	5	130	68	62	X					X	X	X		X			X			X	X				
5,7	Compiling Methods	5	130	68	62		X	X	X		X				X	X							X			
5,7	IT Governance in Organization	5	130	68	62							X	X	X	X		X	X	X	X	X	X			X	X
5,7	Knowledge Representation	5	130	68	62	X				X	X	X	X	X	X	X	X	X			X	X	X	X	X	
5,7	Video Game Design and Development	5	130	58	72	X	X				X				X			X	X			X	X			
5,7	Programming Windows API	5	130	66	64	X					X			X	X						X					
5,7	Functional Programming	5	130	66	64			X		X	X			X	X	X			X			X				
5,7	Parallel Programming	5	130	68	62					X	X			X	X	X	X	X			X		X	X		
5,7	Agile Development with Ruby	5	130	68	62					X	X			X								X				
5,7	Software development for mobile devices and autonomous systems	5	130	68	62			X		X	X				X			X	X			X	X		X	

[4] Student could select any elective module provided by VU Faculty of Mathematics and Informatics.

5,7	Introduction to Business Process Management	5	130	66	64	X			X	X	X					X	X	X			X			X		X
5,6,7	Artificial Intelligence	5	130	69	61	X				X	X	X	X	X	X	X	X	X			X	X	X	X	X	
5,6,7	Financial Intelligence	5	130	66	64	X		X			X				X		X				X					
5,6,7	Foundations of Electronic Commerce	5	130	68	62	X				X			X		X		X		X	X	X		X	X	X	
5,6,7	Oracle PL/SQL Programming	5	130	66	64						X				X			X	X		X	X	X			
6	Operating Systems	5	130	68	62		X	X	X		X				X	X							X			
6	Computer Technology	5	130	72	58		X		X						X			X	X		X		X			
6	Geographic Information Systems	5	130	68	62					X	X	X		X	X		X	X	X			X		X		
6	Advanced Topics in Database Management Systems	5	130	68	62	X		X			X				X	X			X				X			
6	Computer Networks for Professionals I	5	130	66	64	X			X		X				X						X		X			
6	Programming in Python	5	130	66	64					X	X			X	X						X					
6,7	Computational Intelligence and Decision Making	5	130	68	62	X					X				X		X				X					
7	Information Systems	5	130	69	61	X	X				X		X		X		X	X					X			
7	CASE Method	5	130	66	64						X				X			X	X		X	X	X			
7	Computer Networks for Professionals II	5	130	66	64	X			X		X				X						X		X			
7	Project Work	5	130	10	120	X		X	X	X	X			X	X	X	X				X	X	X	X	X	