University of Rijeka
Faculty of Engineering

CURRICULUM
GRADUATE UNIVERSITY STUDY OF COMPUTING

Rijeka, May 2017

1. CURRICULUM DESCRIPTION

1.1. The list of compulsory and elective courses with the number of active classes required for their performance and ECTS credits

1. semester							
	Subject title	Hours / week					ECTS
		L	aT	lT	dT	L+T	
	Stohastic Mathematics	2	1	1		4	6
	Information Theory and Coding	3	1			4	6
	Elective Subject W [1]					8	12
Subject from elective group Software Engineering:							
	Advanced Algorithms and Data Structures	3	1			4	6
Subject from elective group Computer Systems:							
	Mobile Communications	3		1		4	6
	TOTAL					**20**	**30**

L - lectures, aT – auditory tutorials, lT – laboratory tutorials, dT – design tutorials.
[1] Enroll two elective subjects from the winter semester.

2. semester							
	Subject title	Hours / week					ECTS
		L	aT	lT	dT	L+T	
	Complex Software Systems Engineering	4		2		6	7
	Project I [2]						5
	Professional Practice II						5
	Elective Subject S [3]					4	6
Subject from elective group Software Engineering:							
	Object Oriented Programming	2		2		4	7
Subject from elective group Računalni sustavi:							
	Embedded Systems Programming	2			2	4	7
	TOTAL					**20**	**30**

[2] Enroll one compulsory or elective subject of the curriculum in agreement with the mentor.
[3] Enroll one elective subject from the summer semester.

3. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Advanced Operating Systems	2		2	2	6	8
	Project II [4]						5
	Free Elective Subject I [5]					3	5
	Elective Subject W [6]					8	12
	TOTAL					**17**	**30**

[4] Enroll one compulsory or elective subject of the curriculum in agreement with the mentor.
[5] Enroll one subject in the 3rd semester from other elective groups or from other graduate studies at the Faculty of Engineering University of Rijeka, worth 5 ECTS or more.
[6] Enroll two elective subjects from the winter semester.

4. semester							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Graduate Work						10
	Project Management	2				2	3
	Free Elective Subject II [7]					3	5
	Elective Subject S [8]					8	12
	TOTAL					**20**	**30**

[7] Enroll one subject in the 4th semester from other elective groups or from other graduate studies at the Faculty of Engineering University of Rijeka, worth 5 ECTS or more.
[8] Enroll two elective subjects from the summer semester.

Elective Subject W (winter semester)							
	Subject title	Hours / week					ECTS
		L	aT	IT	dT	L+T	
	Computer and Communication Systems Analysis	2	2			4	6
	Assistive Technology	2			2	4	6
	Mobile Robotics	2	2			4	6
	Location Based Services	2	2			4	6
	Advanced User Interfaces	2		2		4	6
	Advanced Computer Networks	3	1			4	6
	Programming: Scripting Languages	2	2			4	6
	Internet Applications Development	2	2			4	6
	Machine Learning	2		2		4	6

Elective Subject S (summer semester)							
	Subject title	Hours / week					ECTS
		L	aT	lT	dT	L+T	
	Wireless Sensor Networks	2	1		1	4	6
	Digital Image Processing	2	2			4	6
	Software Defined Radio	2	2			4	6
	Cross-platform Programming	2	2			4	6
	Computer Speech and Language Processing	2	2			4	6
	Mobile Applications Development	2		2		4	6

GRADUATE UNIVERSITY STUDY OF COMPUTER ENGINEERING TOTAL	Hours	ECTS
	77	120

Basic description		
Course title	Advanced Algorithms and Data Structures	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

The course topics represent a continuation of basic course in algorithms and data structures. The main objective is to gain a solid understanding of common algorithms and data structures and their application in defining and solving various problems.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Student will be able to: analyse the problem and propose the appropriate algorithms and data structures for its solution; assess how the proposed choice of algorithms and data structures impacts the performance of programs; write programs using the algorithms and data structures covered during the course; solve problems using data algorithm design methods such as dynamic programming, the greedy method, divide and conquer, backtracking.

1.4. Course content

Review of basic data structures and algorithms. Asymptotic analysis. Recursion. Dynamic programming. Greedy approach. Advanced analysis of algorithms. Randomised data structures. Trees. Selected graph algorithms. Complexity theory. Selected problems analysis and solving.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Class attendance and homework.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation	1	Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class attendance, activity, lab exercises, homeworks, tests and written final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Cormen, Thomas H. Introduction to algorithms. MIT press, 2009.

1.11. Optional / additional reading (at the time of proposing study programme)

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1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Cormen, Thomas H. Introduction to algorithms. MIT press, 2009.	1	10-20

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the quality assurance system of the Faculty of Engineering.

Basic description		
Course title	Advanced Computer Networks	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+15+0

1. COURSE DESCRIPTION

1.1. *Course objectives*

The course introduces students to network devices and technologies which enable efficient operation of computer networks, on both local and global scale. Learned theory will be put to practice through real-world computer networks examples.

1.2. *Course enrolment requirements*

There are no formal prerequisites for course enrolment, but basic knowledge of computer networks operation and both OSI and TCP/IP protocol stacks is expected.

1.3. *Expected course learning outcomes*

Upon a completion of the course, students should:

- understand role of network switches
- be familiar with basic technologies employed by network switches, which enable efficient operation of LANs
- be able to apply techniques for IP address space preservation
- understand role of network routers
- be familiar with classes and usage of dynamic routing protocols
- gain basic knowledge of autonomous systems and BGP
- understand basic security threats in computer networks

1.4. *Course content*

Basic concepts of computer networks. Basic features of network switches. Redundant links and switching loops. Virtual local area networks. Routers and routing tables. Dynamic routing protocols. Operation of the global internetwork – Internet. IP address space preservation. Basics of computer networks security. Virtual private networks.

1.5. *Teaching methods*		
	☒ lectures	☒ individual assignment
	☐ seminars and workshops	☐ multimedia and network
	☒ exercises	☒ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☐ other

1.6. *Comments*	Possibility for thesis project

1.7. *Student's obligations*

Class attendance (both lectures and exercises), participation in the student project team (group project assignment).

1.8. *Evaluation of student's work*

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project	1	Sustained knowledge check	1	Report		Practice	1
Portfolio							

1.9. *Assessment and evaluation of student's work during classes and on final exam*

Class attendance (both lectures and exercises), sustained knowledge check, laboratory exercises (individual assignments), and project assignment (participation in a team project).

1.10. *Assigned reading (at the time of the submission of study programme proposal)*

1. Andrew S. Tanenbaum: Computer Networks, 4th Edition, Prentice Hall, 2002.

1.11. *Optional / additional reading (at the time of proposing study programme)*

1. Peterson and Davie: Computer Networks, 4th Edition, Morgan Kaufmann Publishers, 2007.
2. James F. Kurose, Keith W. Ross: Computer Networking, 5th Edition, Addison Wesley, 2009.

1.12. *Number of assigned reading copies with regard to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
Andrew S. Tanenbaum: Computer Networks, 4th Edition, Prentice Hall, 2002.	-	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the institution's quality assurance system.

Basic description		
Course title	Advanced Operating Systems	
Study programme	Graduate University Study of Computing	
Course status	compulsory	
Year	2.	
ECTS credits and teaching	ECTS student 's workload coefficient	8
	Number of hours (L+E+S)	30+60+0

1. COURSE DESCRIPTION

1.1. Course objectives

This course builds on topics presented in a basic operating systems course. Some important topics of modern operating systems are covered in detail. The main objective is to gain a solid understanding of these topics in order to be immediately productive in installation, configuration, administration and usage of modern operating systems.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Upon a completion of the course, students will be able to:
• understand what is a real-time operating system
• describe typical applications of real-time operating systems
• differentiate between soft and hard real-time system variants
• explain the many benefits of virtualization
• install, configure and administer virtualization software
• create virtual machines and install operating systems into them
• deploy virtual machines from images and create cloned virtual machines
• compare the various filesystems
• describe the various disk and partition types
• explain the underlying concepts behind filesystem management
• explain the underlying concepts behind filesystem security
• explain the underlying concepts behind filesystem encryption
• describe public key infrastructure (PKI) and its basic components
• describe how symmetric and public key encryption works
• define the role of certificates in a PKI
• secure data by using encryption and certificates
• design and apply data encryption policies.

1.4. Course content

Real-time systems: features, implementation, real-time scheduling, examples of real-time operating systems. Virtualization: reasons for virtualization, types of virtualization, virtual machine, usage examples. Modern filesystems: implementation, management and optimization, network filesystems, encrypted filesystems, case-studies of selected filesystems. Computer security: authentication, privacy, public key infrastructure, selected operating system security tools and techniques.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Class attendance, homework, seminar paper, studying.

1.8. Evaluation of student's work

Course attendance	3	Activity/Participation	1	Seminar paper	1	Experimental work	

Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class attendance, activity, midterm exams (sustained knowledge check), optional individual assignment and written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

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1.11. Optional / additional reading (at the time of proposing study programme)

Silberschatz, Galvin, Gagne: Operating System Concepts, Wiley, 7th Ed.
Tanenbaum: Modern Operating Systems, Prentice Hall, 2008.
Stallings: Operating Systems: Internals and Design Principles, Prentice Hall, 6th Ed.
Budin, Golub, Jakobović, Jelenković: Operating Systems (in Croatian)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality insurance system.

Basic description		
Course title	Advanced User Interfaces	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Acquiring fundamental knowledge of the human-computer interaction and the importance of the well-designed user interface, as well as its impact on the efficient interaction model implementation. Introduction to the basic methods for user interface evaluation, and the principles for designing usable interactive systems. Insight into the advanced interfaces implementation, with special emphasis on the universal access concept and multimodal interaction.

1.2. Course enrolment requirements

There are no formal prerequisites for course enrolment, but basic programming skills are expected.

1.3. Expected course learning outcomes

Upon a completion of the course, students will: have both theoretical background and practical experience in the area of design, implementation and evaluation of the interactive systems' user interfaces; be able to use their acquired knowledge within the design process of highly usable interactive systems; be able to apply interface evaluation methods (with or without test users), and to implement procedures for user interface customization and adaptation; be able to analyze special interface and interaction aspects within the domain of mobile devices with small screens.

1.4. Course content

Fundamentals and basic principles of human-computer interaction. Understanding users and user tasks. User oriented interface design. User interface evaluation methods and the usability engineering. Designing and executing HCI experiments. Multimodal user interfaces based on the universal access concept. Mobile devices' specific user interfaces and interaction models.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Class attendance, participation in the student project team (group project assignment), seminar submission.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper	1	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project	1	Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class attendance, midterm exams (sustained knowledge check), seminar submission (individual assignment), and project assignment (participation in a team project).

1.10. Assigned reading (at the time of the submission of study programme proposal)

I. S. MacKenzie: Human-Computer Interaction: An Empirical Research Perspective, Morgan Kaufmann, 2013.

1.11. Optional / additional reading (at the time of proposing study programme)

1. J. Sauro, J. R. Lewis: Quantifying the User Experience, Morgan Kaufmann, 2012.
2. B. Schneiderman, C. Plaisant, M. Cohen and S. Jacobs: Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th Ed., Addison-Wesley, 2009.
3. J. Nielsen: Usability Engineering, Morgan Kaufmann, 1994.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
I. S. MacKenzie: Human-Computer Interaction: An Empirical Research Perspective, Morgan Kaufmann, 2013.	-	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality insurance system.

Basic description		
Course title	Assistive Technology	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Main goal of the course is to gain skills and practical and theoretical knowledge for the development and implementation of assistive technology systems and devices.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Analyze the needs of individuals with disability for assistive technology. Describe user interfaces which are adapted to individuals with disability. Describe voice interactive systems. Analyze the deployment of assistive robotics.

1.4. Course content

Overview of tehnology for individuals with disability. Computer applications and user interfaces for individuals with disability. Voice interactive systems. Home automation. Ambient intelligence. Design for all. Assitive robotics. Mobility of a disabled person.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☐ exercises ☐ long distance education ☒ fieldwork	☒ individual assignment ☒ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Class attendance, tests, and labs.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	1
Project	1	Sustained knowledge check		Report		Practice	1
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Lectures and tutorials attendance, project presentation, and final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

1.11. Optional / additional reading (at the time of proposing study programme)

1. Helal, A. et al. (2008). The Engineering Handbook of Smart Technology for Aging, Disability and Independence, Wiley-Interscience, Hoboken, New Yersey.
2. Scherer, M. (2005). Living in the State of Stuck: How Assistive Technology Impacts the Lives of People with Disabilities. Brookline Books.
3. Mann, C. (2005). Smart Technology for Aging, Disability, and Independence: The State of the Science. Wiley-Interscience.
4. De Jonge, D. et al. (2006). Assistive Technology in the Workplace. Mosby.

5. Burdick, D. et al. (2004). Gerotechnology: Research and Practice in Technology and Aging, Springer.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the quality assurance system of the Faculty of Engineering.

Basic description		
Course title	Complex Software Systems Engineering	
Study programme	Graduate University Study of Computing	
Course status	compulsory	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	60+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding basics of software engineering management, main aspects, principles, techniques, and how to use software measurements for project management and software evolution, from the tactic and strategic organisational aspect.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Understand and differentiate basic principles and techniques used for software engineering management, define problems in concrete areas of software engineering management applying management techniques, planning and control based on the quantitative techniques, analyse and interpret the results. Apply acquired knowledge and skills for software engineering management in verification project in teamwork.

1.4. Course content

Complex software systems. Software engineering and aspects of software engineering management. Software lifecycle, tactic and strategic aspects. Automatization technologies in software engineering management. Cloud computing. Engineering in complex systems evolution management. Quality assurance in testing and assessments of software products. Basic software engineering measurements: basic principles and techniques, assessment and estimation techniques, data analysis. Software project management in complex software systems. Resource and organisation management: coordination mechanisms, main organisational and management principles. Quality management of complex software systems: quality definition and characteristics, control and quality assurance, quality models and metrics. Process management: assessment models and improvements, metrics. Verification and validation.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance, attendance of exercises, preparation for and activity at exercises.

1.8. Evaluation of student's work

Course attendance	3	Activity/Participation	0.5	Seminar paper	0.5	Experimental work	1
Written exam		Oral exam		Essay		Research	
Project	1	Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance, laboratory activities, seminar and homework, active involvement in workshops and laboratory exercises, continuous knowledge testing, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Vliet, H.v.: Software Engineering, Principles and Practice. John Wiley & Sons, Chichester, 2008.

1.11. Optional / additional reading (at the time of proposing study programme)

Kerzner. H: Project Management: A Systems Approach to Planning, Scheduling and Controlling, John Wiley & Sons, Hoboken, 2009.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Vliet, H.v.: Software Engineering, Principles and Practice. John Wiley & Sons, Chichester, 2008.		

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Computer and Communication Systems Analysis	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Obtaining theoretical knowledge in computing and communication systems analysis and synthesis. Students will acquire the methodological knowledge and modelling procedures and system simulation techniques based on mathematical modelling techniques and computational simulation methods.

1.2. Course enrolment requirements

Information Theory and Coding.

1.3. Expected course learning outcomes

Analyse computing and communication systems using mathematical modelling and computer based simulation methods. Apply acquired knowledge in design and testing process of computing and communication systems.

1.4. Course content

Processes in telecommunication network. Communication protocol model, analysis and synthesis methods and procedures, finite automata model, Petri nets, and process algebra.
Information network structure,. Modelling information flow processes in communicating networks. Introduction into queuing theory, queuing networks and models. Waiting time, probability of failure. Reservation systems, priorities,. Simulation analysis methods for information networks.

1.5. Teaching methods		
	☒ lectures	☒ individual assignment
	☐ seminars and workshops	☐ multimedia and network
	☒ exercises	☒ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☐ other

1.6. Comments

1.7. Student's obligations

Course attendance, laboratory activities, preparation and active involvement in laboratory exercises.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation	0.5	Seminar paper		Experimental work	1.5
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance, laboratory activities, active involvement laboratory exercises, continuous knowledge testing, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Models of Telecommunication Process –Theory and Application of Petri Nets, I. Lovrek, Školska knjiga, 1997. (in Croatian)
Information Networks, V. Sinković, Školska knjiga,1994. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Design and Validation of Computer Protocols G. J. Holzmann Prentice - Hall (on line) 1
Wireless and Mobile Network Architectures Y. B. Lin, I. Chlamtac John Wiley & Sons, 2001

The SPIN Model Checker: Primer and Reference Manual G. J. Holzmann Addison Wesley, 2003 Queueing Systems. Volume 2: Computer Applications; L. Kleinrock;1976;John Wiley & Sons Performance of Computer Communication Systems : A Model - Based Approach; B.R. Haverkort;1998;John Wiley & Sons

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Models of Telecommunication Process –Theory and Application of Petri Nets, I. Lovrek, Školska knjiga, 1997. (in Croatian)	-	-
Information Networks, V. Sinković, Školska knjiga,1994. (in Croatian)	-	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Computer Speech and Language Processing	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Introduce to students state of the art methods and procedures in speech recognition and understandig systems.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

The students will understand how to implement and develop speech recognition and understanding computer systems.

1.4. Course content

Introduction to speech recognition and understanding systems. Speech coding, sampling and processing procedures. Speech signal features. Short time spectral analysis of speech signals. Homomorphic signal analysis, cepstrum. Fundamental speech frequency estimation. Acoustic modeling using hidden Markov Models. Language resources, corpus, lexicons, speech databases. Language modeling. Speech recognition methods. Morphologic language analysis. Speech taggers. Parsing methods. Semantic analysis. Spoken dialog systems. Dialog modeling. Speech synthesis.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☒ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Students have to attend to all course activities and work on projects.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	2
Written exam		Oral exam		Essay		Research	
Project	2	Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

The presence to all course activities and work on projects will be evaluated.

1.10. Assigned reading (at the time of the submission of study programme proposal)

1. Huang, X. D., A. Acero and H. W. Hon (2000). Spoken Language Processing: A Guide to theory, Algorithm and System Development, Prentice Hall, New Jersey, USA.
2. Nikola Pavešić: Pattern Recognition, Založba FE in FRI Ljubljana, 2000, ISBN 961-6210-81-5. (in Slovenian)

1.11. Optional / additional reading (at the time of proposing study programme)

3. Gyergyek L., Pavešić N., Ribarić S.: Uvod u raspoznavanje uzoraka, Tehnička knjiga Zagreb, 1988.
4. Jurafsky, D., and J. Martin (2000). Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition. Upper Saddle River, New Jersey: Prentice

Hall.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Huang, X. D., A. Acero and H. W. Hon (2000). Spoken Language Processing: A Guide to theory, Algorithm and System Development, Prentice Hall, New Jersey, USA	-	-
Nikola Pavešić: Pattern Recognition, Založba FE in FRI Ljubljana, 2000, ISBN 961-6210-81-5. (in Slovenian)	-	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Cross-platform Programming	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. *Course objectives*

The course trains students to develop cross-platform applications. Students are taught benefits of the approach, and technologies which enable or facilitate the development. Theoretical considerations will be put to practice by programming simple cross-platform applications.

1.2. *Course enrolment requirements*

Object Oriented Programming.

1.3. *Expected course learning outcomes*

Upon a completion of the course, students should:

1. understand benefits, challenges and disadvantages of cross-platform application development
2. be competent to analyse and select technology for cross-platform application development
3. be able to develop cross-platform applications using technologies considered in the course

1.4. *Course content*

Definition and classification of platforms. Benefits of cross-platform programming. Overview of various approaches and technologies. Challenges of cross-platform programming. Real world applications success stories. Selection of technology and programming language. Shell applications development. Cross-platform GUI. Integrated development environments. Development of cross-platform applications with graphical user interface.

1.5. *Teaching methods*		
	☒ lectures	☒ individual assignment
	☐ seminars and workshops	☐ multimedia and network
	☒ exercises	☒ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☐ other

1.6. *Comments*	Possibility for thesis project

1.7. *Student's obligations*

Class attendance (both lectures and exercises), participation in the student project team (group project assignment).

1.8. *Evaluation of student's work*

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project	1	Sustained knowledge check	1	Report		Practice	1
Portfolio							

1.9. *Assessment and evaluation of student's work during classes and on final exam*

Class attendance (both lectures and exercises), sustained knowledge check, laboratory exercises (individual assignments), and project assignment (participation in a team project).

1.10. *Assigned reading (at the time of the submission of study programme proposal)*

J. Blanchette, M. Summerfield: C++ GUI Programming with Qt 4, 2nd Edition, Prentice Hall, 2008.

1.11. *Optional / additional reading (at the time of proposing study programme)*

3. M. Summerfield: Rapid GUI Programming with Python and Qt, Prentice Hall, 2007.
4. A. Krause: Foundations of GTK+ Development, Apress, 2007.
5. J. Thelin: Foundations of Qt Development, Apress, 2007.
6. J. Smart, K. Hock, S. Csomor: Cross-Platform GUI Programming with wxWidgets, Prentice Hall, 2005.
7. B. Hook: Write Portable Code, 1st Edition, No Starch Press, 2005.

1.12. *Number of assigned reading copies with regard to the number of students currently attending the course*

Title	*Number of copies*	*Number of students*
J. Blanchette, M. Summerfield: C++ GUI Programming with Qt 4, 2nd Edition, Prentice Hall, 2008.	-	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the institution's quality assurance system.

Basic description		
Course title	Digital Image Processing	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Main goal of the course is to gain skills and practical and theoretical knowledge for image processing by using the concept of a digital two-dimensional signal.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Apply the image analysis and processing methods. Apply basic methods of two-dimensional filtering. Describe image enhancement and restoration methods, image feature extraction, image segmentation and compression.

1.4. Course content

Sampling, reconstruction and image quantization. Computer- based representation of a digital image. 2-D discrete convolution. 2-D discrete transformations. 2-D filters. Basics of a human visual system. Feature extraction. Image segmentation. Edge detection. Morphological image processing. Application of the wavelet transform in the field of image processing. Image compression.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☒ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Class attendance, tests, project work and labs.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation	1	Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project	2	Sustained knowledge check		Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Lectures and labs attendance, project presentation, and final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Gonzalez, R. et al. Digital Image Processing. Prentice Hall, 2007.

1.11. Optional / additional reading (at the time of proposing study programme)

Russ, J. The Image Processing Handbook. CRC Press, 2006.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Gonzalez, R. et al. Digital Image Processing. Prentice Hall, 2007.		

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the quality assurance system of the Faculty of Engineering.		

Basic description		
Course title	Embedded Systems Programming	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Acquire skills and knowledge required to reason about embedded computing architectures, platforms and applications and to select between them when making systems design decisions. To be able to customize operating systems for embedded systems applications and to know and understand how embedded systems vary from their traditional counterparts. To understand the device drivers development process.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Upon a completion of the course, students will be able to:
• understand what the embedded systems are and why they are different
• describe typical application and their wide spread scope
• explain the characteristics of and constraints for the embedded systems
• identify and quantify the main requirements for a given application in terms of resources (memory, computational power, I/O …), architecture and selection of the appropriate peripheral units
• code, compile, link, download, debug and execute programs for embedded systems
• customize current general purpose operating systems and development tools and apply them in some embedded systems applications
• understand various communication interface standards
• setup communication between PC and embedded system
• understand communication protocols commonly used in industry
• follow the trends in embedded systems field

1.4. Course content

Embedded systems features and application fields. Review of current systems and their architectures. Operating systems for embedded systems. Communication interfaces and protocols. Customization of general purpose operating systems and development tools for embedded systems applications. Review of programming techniques in C language: pointers, mixing assembly code with C programs, memory allocation. Cross-compilation and development. Coding, compiling, linking, downloading, debugging and execution of programs for embedded systems with limited resources. Device drivers development. Remote debugging.

1.5. Teaching methods		
	☒ lectures	☒ individual assignment
	☒ seminars and workshops	☐ multimedia and network
	☒ exercises	☐ laboratories
	☐ long distance education	☒ mentorship
	☐ fieldwork	☐ other

1.6. Comments

1.7. Student's obligations

Class attendance, homework, seminar paper, studying.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation	1	Seminar paper	1	Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class attendance, activity, midterm exams (sustained knowledge check), optional individual assignment and written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Corbet, Rubini, Kroah-Hartman - Linux Device Drivers, 3rd edition

1.11. Optional / additional reading (at the time of proposing study programme)

Michael Barr, Programming Embedded Systems in C and C++
Gene Sally, Pro Linux Embedded Systems

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Corbet, Rubini, Kroah-Hartman - Linux Device Drivers, 3rd edition	freely available	

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality insurance system.

Basic description		
Course title	Graduate Work	
Study programme	Graduate University Study of Computing	
Course status	compulsory	
Year	2.	
ECTS credits and teaching	ECTS student 's workload coefficient	10
	Number of hours (L+E+S)	-

1. COURSE DESCRIPTION

1.1. Course objectives

Graduate work is an individual assignment and verification of student expertises, which should show the appropriate level of engineering skills for individually solving specific professional task.

1.2. Course enrolment requirements

Enrolled course from which the Graduate Work is selected.

1.3. Expected course learning outcomes

Apply acquired knowledge, expertises and skills of the content of Graduate Work associated course. Solve practical task. Acquire competence for individually solving specific professional task.

1.4. Course content

The content of the Graduate Work is based on the application of acquired knowledge from educational programs at the graduate university studies. Final thesis can be specified from a particular course specific professional content and exceptionally from course that belongs to the group of shared content, when it represents a broader entity with a particular course specific content of the studies. Student enrollers the Graduate Work by enrolling the last semester. Thesis of the Graduate Work is establishes by Commission for Graduate Works, based on suggestion of teacher who will mentor the Graduate Work.

1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Attending the consultation, individually solving task and writing the Graduate Work report.

1.8. Evaluation of student's work

Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check		Report		Practice	
Portfolio		Individual task solving	8	Final work in written form	2		

1.9. Assessment and evaluation of student's work during classes and on final exam

Assesses and evaluates the accuracy and completeness of a given task solving process, the Graduate Work written report, and its oral presentation

1.10. Assigned reading (at the time of the submission of study programme proposal)

1.11. Optional / additional reading (at the time of proposing study programme)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course		
Title	*Number of copies*	*Number of students*
1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		

Basic description		
Course title	Information Theory and Coding	
Study programme	Graduate University Study of Computing	
Course status	compulsory	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

Acquiring the basics of information theory and its applications.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After successful completion of the course students will have required theoretical and practical knowledge and skill for collection, processing, storage and transfer of information. They will understand, be able to analyse and plan the solution to communication problem and data storage problem. Students will understand and be able to apply data processing based on information entropy concept..

1.4. Course content

Introduction and historical outline. Preliminary knowledge: permutations, probability, conditional probability, Bayes heorem, distributions, Booulean algebra. What is information? Shannon's contribution to information theory, information entropy, measures of information. Information theory in communications, model of communication system, communication channel coding of information, parity control, secure coding. Application of information theory to 2-D data: pictures, graphics and storage media. Compression of information: reversible, lossless (without information loss), ireversible, lossy (approximative). Algorithms and programs for compression with practical applications: compression of binary data, text compression, soud compression, picture compression. Information theory in data processing. Maximum entropy method.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Mastering of course material, activity, midterm exams, homework.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation	0.5	Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report	0.5	Practice	
Portfolio		Homework					

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance, activity, homework, continuous knowledge testing, presentation, written final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Pandzic, I.S. et all, Introduction to Information Theory and Coding, Element, 2007 (in Croatian)
Gray, "Entropy and Information Theory", Springer, Revised 2009, http://ee.stanford.edu/~gray/it.html

1.11. Optional / additional reading (at the time of proposing study programme)

Press, W.H. et.all. "Numerical Recipes in C", 3rd Ed, Cambridge University Press, 2007		
1.12. Number of assigned reading copies with regard to the number of students currently attending the course		
Title	*Number of copies*	*Number of students*
Pandzic, I.S. et all, Introduction to Information Theory and Coding, Element, 2007 (in Croatian)	-	-
Gray, "Entropy and Information Theory", Springer, Revised 2009, http://ee.stanford.edu/~gray/it.html	free access	-
1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		

Basic description		
Course title	Internet Applications Development	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

This course gets students familiar with the process of distributed internet applications design, development and implementation. Introduction to the internet-domain complex programming architectures, where appropriate implementation procedures go beyond the standard design of typical front-end Web applications. Insight into new services, protocols and appropriate APIs for high-quality interactive network solutions development, within the distributed internet domain.

1.2. Course enrolment requirements

There are no formal prerequisites for course enrollment, but basic programming skills are expected.

1.3. Expected course learning outcomes

Upon a completion of the course, students will: be able to understand both the challenges and technical requirements in the process of distributed internet applications development; be familiar with protocols and methods for distributed internet solutions implementation, and competent in the selection of appropriate programming procedures; be able to proactively participate in the internet application development process, regardless of the particular project scope; get the insight into the possibility of mashup application development (typical for Web 2.0), as well as into the specific features of the data-driven internet applications; get the insight into the cloud computing paradigm and architecture, as well as into the peer-to-peer based applications and protocols.

1.4. Course content

Characteristics and features of the distributed internet applications. PHP programming language. Development of the Web services oriented applications: programming architectures based on remote procedure calls, service-oriented architectures. Hybrid Web applications (mashups). Data-driven internet applications. Cloud computing model. Peer-to-peer based protocols and applications.

1.5. Teaching methods		
	☒ lectures	☒ individual assignment
	☐ seminars and workshops	☐ multimedia and network
	☒ exercises	☐ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☐ other

1.6. Comments

1.7. Student's obligations

Class attendance, participation in the student project team (group project assignment).

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project	1	Sustained knowledge check	1	Report		Practice	1
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class attendance, midterm exams (continuous knowledge examination), laboratory exercises (individual assignments), and project assignment (participation in a team project).

1.10. Assigned reading (at the time of the submission of study programme proposal)

M. Papazoglou: Web Services: Principles and Technology, Prentice Hall, 2007.

1.11. Optional / additional reading (at the time of proposing study programme)

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1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
M. Papazoglou: Web Services: Principles and Technology, Prentice Hall, 2007.	-	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the institution's quality assurance system.

Basic description		
Course title	Location Based Services	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Basic goal of the course is to acquire theoretical knowledge in the field of telecommunication services based on location, procedures and systems for determining the position of mobile users, in geo-spatial data and public mobile networks. The course has a goal of mastering the knowledge and skills required for development, implementation and support of location based services.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Students will be able to: describe and understand the concept of location based services and supporting network architecture, define elements of telecommunication network which supports location based services and understand their usage, understand and apply network protocols which support location based services, differentiate between methods for determining the location of mobile user, describe and understand structures and methods in using geo-spatial data, describe and understand location in public mobile network data management, understand business enviroment for establishing location based services, and application of acquired knowledge i practical projects.

1.4. Course content

Basic concepts (status, location, mobility). Determining location: net based procedures, satellite based methods (GPS, GNSS, DGPS), other procedures for location determination. Geo-spatial reference system. Geo-spatial data. Public mobile networks. Management of location data in public mobile networks. Achitecture of system supporting location based services. Network protocols for location based services. Business environment for location based services. New generation services. Practical work in programming platforms Octave, QGIS, Java, Android.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☒ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance, activity, laboratory, exercises, homework, seminar work.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper	1	Experimental work	
Written exam	1	Oral exam	1	Essay		Research	
Project		Sustained knowledge check		Report		Practice	1
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance, activity, homework, continuous knowledge testing (three mid-term exams), written and oral exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Steiniger, S, M Neun, A Edwardes. (2006). Foundations of Location Based Services. University of Zuerich, Switzerland. Accessible at: http://bit.ly/ccG7b6.

Quantum GIS Development Team. (2010). Quantum GIS User Guide (Version 1.4.0 'Enceladus'). Accessible at: http://bit.ly/9kauvw.

1.11. Optional / additional reading (at the time of proposing study programme)

Filjar, R, G Jezic, M Matijasevic. (2008). Location-Based Services: A Road Towards Situation Awareness. J of Navigation, 61, 573-589. Cambridge University Press.
Kuepper, A. (2005). Location-Based Services: Fundamentals and Operation. John Wiley & Sons. Chichester, UK.
Munoz, D, F Bouchereau, C Vargas, R Enriquez-Caldera. (2009). Position Location Techniques and Applications. Academic Press (an imprint of Elsevier). Burlington, MA.
Van Diggelen, F. (2009). A-GPS: Assisted GPS, GNSS and SBAS. Artceh House. Norwood, MA.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Steiniger, S, M Neun, A Edwardes. (2006). Foundations of Location Based Services. University of Zuerich, Switzerland. http://bit.ly/ccG7b6	Free access	-
Quantum GIS Development Team. (2010). Quantum GIS User Guide (Version 1.4.0 'Enceladus'). http://bit.ly/9kauvw	Free access	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Machine Learning	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Understanding the concept of generalization from data. Applying basic procedures for building machine learning models. Understanding and applying inference procedures based on evidence. Interpreting the results. Understanding and applying machine learning experiments and result evaluation. Developing problem-solving abilities.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Explain the concept of generalizing from the data. Use a variety of machine learning algorithms and different knowledge representation models. Explain the difference between machine learning algorithms. Explain the difference between knowledge representation models. Define the choice of algorithm/model based on data type. Use evidence and inference procedures on different models of knowledge representation. Define the experiment based on machine learning algorithm and data used. Explain experimental results.

1.4. Course content

Fundamentals. Probability distributions. Supervised, unsupervised and semi-supervised learning. Selection of relevant features. Handling missing data. Models of knowledge representation and learning algorithms (linear methods, decision trees, neural networks, support vector machines, graphical models). Ensemble learning. Setting up the experiment. Evaluation methodology and evaluation metrics. Statistical evaluation of the results. Inference based on evidence.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Class attendance, tests, and labs.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	1
Written exam	0.5	Oral exam	0.5	Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Lectures, tutorials and labs attendance, written exams, written and oral final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Hastie, Tibshirani: The Elements Of Statistical Learning: Data Mining, Inference And Prediction, 3rd ed., 2009

1.11. Optional / additional reading (at the time of proposing study programme)

Bishop: Pattern Recognition and Machine Learning, 2007
Duda, Hart, Stork: Pattern classification, 2nd ed., 2001

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Hastie, Tibshirani: The Elements Of Statistical Learning: Data Mining, Inference And Prediction, 3rd ed., 2009	freely available	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the quality assurance system of the Faculty of Engineering.

Basic description		
Course title	Mobile Applications Development	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

This course prepares students to work in the area of mobile software development by teaching them relevant technologies and skills in the design and development of mobile applications using up-to-date software development tools and APIs.

1.2. Course enrolment requirements

There are no formal prerequisites for course enrollment, but basic programming skills are expected.

1.3. Expected course learning outcomes

Upon a completion of the course, students will be: able to discuss technical challenges involved with modern mobile devices, as well as their constraints in the context of mobile software development; competent in the evaluation and selection of software tools and APIs for mobile applications development and aware of their scope and limitations; able to develop real-world mobile applications for contemporary platforms.

1.4. Course content

Characteristics and features of the present-day mobile devices, and challenges of developing mobile device applications. Mobile services. Platforms and APIs for mobile application development. Integrated development environments and corresponding emulator platforms. Specific aspects of mobile applications development: graphics and interfaces, data entry, data persistence, networking, multimedia, sensor usage, optional programming interfaces.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments	Possibility of thesis project.	

1.7. Student's obligations

Class attendance, participation in the student project team (group project assignment).

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project	1	Sustained knowledge check	1	Report		Practice	1
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class attendance, midterm exams (continuous knowledge examination), laboratory exercises (individual assignments), and project assignment (participation in a team project).

1.10. Assigned reading (at the time of the submission of study programme proposal)

B. Phillips, B.Hardy: Android Programming, Big Nerd Ranch Inc., 2013.

1.11. Optional / additional reading (at the time of proposing study programme)

E. Hellman: Android Programming: Pushing the Limits, Wiley, 2014.
G. Nudelman: Android Design Patterns, Wiley, 2013.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
B. Phillips, B.Hardy: Android Programming, Big Nerd Ranch Inc., 2013.	-	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the institution's quality assurance system.

Basic description		
Course title	Mobile Communications	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	45+15+0

1. COURSE DESCRIPTION

1.1. Course objectives

The goal of this course is to teach students the principles and techniques of modern mobile communication systems, from the wireless transmission basics and methods of information processing, to the systems for information transmission in mobile conditions.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describe principles of wave propagation. Describe and analyze the modulation techniques. Describe the spread spectrum techniques. Describe methods of multiplexing and multi-user access. Describe terrestrial and satellite communication systems. Describe short-range broadband wireless networks. Describe network and transport layer of mobile network.

1.4. Course content

Fundamentals of wireless communications: frequency bands, antennas, signal propagation. Digital modulations. Spread spectrum techniques. Multiplexing and multi-user access schemes. Basics of GSM and UMTS system. DECT. TETRA. Satellite systems. WLAN, IEEE 802.11. ZigBee. Bluetooth. Mobile ad-hoc networks. LTE.

1.5. Teaching methods		
	☒ lectures	☒ individual assignment
	☐ seminars and workshops	☐ multimedia and network
	☒ exercises	☐ laboratories
	☐ long distance education	☐ mentorship
	☐ fieldwork	☐ other

1.6. Comments

1.7. Student's obligations

Class attendance, activity in class, midterms.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation	2	Seminar paper	0.5	Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Evaluation is performed based on a few midterms and a seminar paper. Exam questions are such as: What types of multiplex are you familiar with, what is common to all of them and how is that provided in each type of multiplex?

1.10. Assigned reading (at the time of the submission of study programme proposal)

J. Schiller, *Mobile Communications*, 2nd ed, Wiley, 2005.

1.11. Optional / additional reading (at the time of proposing study programme)

A.F. Molisch, *Wireless Communications*, Wiley-IEEE Press, 2005.
D. Tse and P. Viswanath, *Fundamentals of Wireless Communications*, Cambridge University Press, 2005.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

J. Schiller, *Mobile Communications*, 2nd ed, Wiley, 2005.	-	30

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Mobile Robotics	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Acquiring theoretical and practical knowledge for designing mobile robotic systems.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After successful completion of the course the students will be able to: identify types of mobile robotic systems and model them correctly; design and implement basic algorithms for the control of mobile robots, such as localization and path planning.

1.4. Course content

Types of robot locomotion and their characteristics. Mobile robot kinematics and control. Sensors and perception of environment. Localization and map building. Path planning and navigation. Autonomous flying vehicles and autonomous cars.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Mastering course material, homeworks and mid-term exams, class activity.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	1
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Class activity, presentations, mid-term exams, final exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

R. Siegwart, I.R. Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2004

1.11. Optional / additional reading (at the time of proposing study programme)

1. Thrun, Burgard, Fox, Probabilistic Robotics, MIT Press, 2005;
2. I. Petrović, Mobilna robotika – predavanja, FER - Zavod za APR, 2010

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
R. Siegwart, I.R. Nourbakhsh, Introduction to Autonomous Mobile	0	-

Robots, MIT Press, 2004		

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences
Through the Institution's quality assurance system.

Basic description		
Course title	Object Oriented Programming	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	7
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Basic knowledge and skills for object oriented programming.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Explain class and object, understand how to manage objects during the program execution, understand meaning of implementation hiding, reusing of classes, and polymorphism, inheritance, interface, inner classes, understand to to manage program faults and exceptions, threading, application of object oriented programming in context of distributed computing.

1.4. Course content

Introduction to objects. Everything is an object. Managing program execution. Initialization and memory cleaning. Implementation hiding. Reusing of classes. Polymorphism. Interfaces and inner classes. Fault management and exceptions. Type identification during program execution. Threading. Distributed computing.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance, activity, studying, exercising.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper	2	Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio		Final exam	1				

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance, laboratory practice, homework, seminar, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

B. Eckel, Thinking in C++, 2nd Edition

1.11. Optional / additional reading (at the time of proposing study programme)

A. Alexandrescu, Modern C++ Design, Addison – Wesley Int., 2001.
S. Meyers, Effective C++, Addison – Wesley Professional, 2005.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

Eckel, Thinking in C++, 3rd Edition, available online	Free access	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Professional Practice II	
Study programme	Graduate University Study of Computing	
Course status	compulsory	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	-

1. COURSE DESCRIPTION

1.1. Course objectives

Student verifies and complements his own expertise, along with a comprehensive view of the work process.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Apply acquired knowledge and skills from studied courses professional content. Gain working process experience. Develop and further improve competence for solving specific professional engineering problems.

1.4. Course content

Industrial practice within Graduate University Study of Naval Architecture is carried out individually in work organization that is engaged in the student's field of study, and with activities in accordance with the Industrial Practice Rules and Study Program curriculum. Within such practice, student is familiarized with the corresponding jobs that are studied through programs of education, with the task of verifying and complementing their own expertise, along with a comprehensive view of the work process.

1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☒ fieldwork	☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Conducting professional practice in duration of 15 working days, or 120 hours, and writing the corresponding report.

1.8. Evaluation of student's work

Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Sustained knowledge check		Report	1	Practice	4
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Assesses and evaluates student work and dedication, and written report.

1.10. Assigned reading (at the time of the submission of study programme proposal)

1.11. Optional / additional reading (at the time of proposing study programme)

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		

Basic description		
Course title	Programming: Scripting Languages	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

The aim of this course is familiarization with the concept of scripting languages, their historical development, initial use (command interpreters, shells, report generation) and evolution into their current state.
Along with the application of programming language concepts in the domain of scripting (i.e. declaring variables), this course references capabilities rarely present in classical programming languages. A series of short programming assignments familiarizes students with the capabilities of various scripting languages and teaches them flexibility in approaches to learning new computer languages.
Course contents include the most relevant scripting languages in various areas of application: extending OS capabilities through Unix and Windows shell scripts, server-side web scripting, scripts for scientific computing and data processing.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Classifiy computer languages into programming and scripting languages, understand their advantages and disadvantages. Analyze different real-world programming challenges and: devise an optimum solution path, apply scripting languages to create the solution, analyze and substantiate the applicability and quality of the solution. Use scripting languages to create: web applications, computer process automation scripts, data processing, scientific computing. Aalyze and explain the advantages and disadvantages of particular scripting languages in different areas of application.

1.4. Course content

Scripting languages: historical development, similarities and differences regarding programming languages, areas of application. Data management: regular expressions, string interpolation (Python). Web programming: web applications, PHP, database connectivity (MySQL), Ruby on Rails, CGI services. Computer process automation ("pasting"): Windows Script Engine – Jscript; Bash; Windows PowerShell; Scientific computing: Python. Overview of other languages: Perl, Ruby, VBScript, Javascript, Actionscript.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☒ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance (lectures, exercises), activity, homework, remote coursework, formal written exam, independent studying.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation	1	Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	2	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance (lectures, exercises), activity, independent programming of scripting solutions, homework, continual knowledge testing (mid-term), final exam

1.10. Assigned reading (at the time of the submission of study programme proposal)

Pilgrim Mark: Dive Into Python 3, Apress, New York, SAD, 2009. –available at http://diveintopython3.org/ (downloaded 16.4.10.)
Cooper, Mendel: Advanced Bash-Scripting Guide, 2009. available at http://tldp.org/LDP/abs/html/ (downloaded 16.4.10.)
Getting Started With Windows PowerShell, available at http://technet.microsoft.com/hr-hr/library/ee177003%28en-us%29.aspx (http://bit.ly/avxQqJ) (downloaded 16.4.10.)
Getting Started with Rails, available at http://guides.rubyonrails.org/getting_started.html (downloaded 16.4.10.)
PHP 101: PHP For the Absolute Beginner, available at http://devzone.zend.com/article/627 (downloaded 16.4.10.)
Beginner's Introduction to Perl, available at http://www.perl.com/pub/a/2000/10/begperl1.html (downloaded 16.4.10.)

1.11. Optional / additional reading (at the time of proposing study programme)

Scott, Michael: Programming Language Pragmatics, 3rd edition, Morgan Kaufman, San Francisco, USA, 2009.
Model, M. L.: Bioinformatics Programming Using Python, O'Reilly Media, Sebastopol, USA, 2009.
Taylor, Dave: Wicked Cool Shell Scripts, No Starch Press, San Francisco, USA, 2004.
Schwartz, R. L. et. al.: Learning Perl (5th edition), O'Reilly Media, Sebastopol, USA, 2008.
Tate, B. A. et. al.: Ruby on Rails: Up and Running, 1st Edition, Sebastopol , USA, 2006.
Beighley, L. et al.: Head First PHP & MySQL, O'Reilly Media, Sebastopol , USA, 2008.
Wilson, Ed: Microsoft Windows PowerShell Step by Step, Microsoft Press, Redmond, USA 2007.
Langtangen, H.P.: Python Scripting for Computational Science, Springer-Verlag, Berlin, Germany 2004.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Pilgrim Mark: Dive Into Python 3, Apress, New York, SAD, 2009.	freely available	-
Cooper, Mendel: Advanced Bash-Scripting Guide, 2009	freely available	-
Getting Started With Windows PowerShell	freely available	-
Getting Started with Rails	freely available	-
PHP 101: PHP For the Absolute Beginner	freely available	-
Beginner's Introduction to Perl	freely available	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Project I	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	0+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Application of acquired knowledge and skills to solve practical problems in the field of associated course from which the Project I is elected.

1.2. Course enrolment requirements

Enrolled course from which the Project I is elected.

1.3. Expected course learning outcomes

Apply the knowledge and skills from professional content of the associated course. Solve practical task. Acquire competence for individually solving specific professional tasks.

1.4. Course content

Chosen chapter of associated course from which the project was elected.

1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Attending the consultation, individually solving task and writing the project report.

1.8. Evaluation of student's work

Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project	2	Sustained knowledge check		Report		Practice	
Portfolio		Individual task solving	3				

1.9. Assessment and evaluation of student's work during classes and on final exam

Assesses and evaluates the accuracy and completeness of the project task solution and its presentation.

1.10. Assigned reading (at the time of the submission of study programme proposal)

References listed for the associated course from which the Project I is elected.

1.11. Optional / additional reading (at the time of proposing study programme)

References listed for the associated course from which the Project I is elected.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		

Basic description		
Course title	Project II	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	2.	
ECTS credits and teaching	ECTS student 's workload coefficient	5
	Number of hours (L+E+S)	0+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Application of acquired knowledge and skills to solve practical problems in the field of associated course from which the Project II is elected.

1.2. Course enrolment requirements

Enrolled course from which the Project II is elected.

1.3. Expected course learning outcomes

Apply the knowledge and skills from professional content of the associated course. Solve practical task. Acquire competence for individually solving specific professional tasks.

1.4. Course content

Chosen chapter of associated course from which the project was elected.

1.5. Teaching methods	☐ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☒ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Attending the consultation, individually solving task and writing the project report.

1.8. Evaluation of student's work

Course attendance		Activity/Participation		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project	2	Sustained knowledge check		Report		Practice	
Portfolio		Individual task solving	3				

1.9. Assessment and evaluation of student's work during classes and on final exam

Assesses and evaluates the accuracy and completeness of the project task solution and its presentation.

1.10. Assigned reading (at the time of the submission of study programme proposal)

References listed for the associated course from which the Project II is elected.

1.11. Optional / additional reading (at the time of proposing study programme)

References listed for the associated course from which the Project II is elected.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		

Basic description		
Course title	Project Management	
Study programme	Graduate University Study of Computing	
Course status	compulsory	
Year	2.	
ECTS credits and teaching	ECTS student 's workload coefficient	3
	Number of hours (L+E+S)	30+0+0

1. COURSE DESCRIPTION

1.1. Course objectives

Knowledge of the principles of project management. Understanding the methods of planning projects. Knowledge of project management software.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Explain the basic concepts of project management. Compare the vision, strategy and goals when creating the project. Explain what are project management, business project managers, project teams' work, and the relationship between project management and organizational structure. Know the models of project management. Explain the basic organizational structure of the project organization. Describe the organization of projects. Distinguish methods for project planning time and / or capacity - Gantt, network planning techniques - PERT, CPM. Project planning computer. Knowledge of one project management software. MS Project.

1.4. Course content

Introduction and basic concepts of project management topics. Projects - vision, strategy, objectives Project Management, Project Managers. Project teams. Project management and organizational structure. Models project management. HBS model. Project phases: definition and project organization, project planning and monitoring and project management. Techniques planning project planning time and / or capacity - Gantt, network planning techniques - PERT, CPM, MPM. Examples. Methods for project planning management costs - Target Costing. Presentation of MS Project software for project management.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☐ exercises ☐ long distance education ☐ fieldwork	☐ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Attendance and class participation, seminar work in a team, independent learning.

1.8. Evaluation of student's work

Course attendance	1	Activity/Participation		Seminar paper		Experimental work	
Written exam	1	Oral exam		Essay		Research	
Project		Sustained knowledge check	1	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Attendance, class participation, seminar work in a team, independent learning.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Ikonić, M., Vuković, A.: *Project Management,* Tehnički fakultet, Rijeka, 2011. (in Croatian)
Veža, I.: Project Management (internal scrypt), Fakultet elektrotehnike, strojarstva i brodogradnje, Split, 1994. (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Kerzner, H.: Project management: A systems approach to planning, scheduling, and controlling, John Wiley & Sons, 2003.
Kliem, R.L.: The project manager's emergency kit, Saint Lucie Press, 2002.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Ikonić, M., Vuković, A.: *Project Management,* Tehnički fakultet, Rijeka, 2011. (in Croatian)	Free access	-
Veža, I.: Project Management (internal scrypt), Fakultet elektrotehnike, strojarstva i brodogradnje, Split, 1994. (in Croatian)	-	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Software Defined Radio	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

This course is aimed to enable the acquisition of theoretical and practical knowledge and skills in the field of development and implementation of the software-defined radio (SDR) systems. Theoretical foundations will be turned into practice during the analysis of the satellite navigation SDR receiver case-study.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

After successful course completion, a student will collect the necessary theoretical knowledge and develop practical engineering skills required for competent solution of problems in the area of SDR development, installation and maintenance.

1.4. Course content

Essential definitions and terms. Software-defined radio. Radio frequency spectrum. SDR architecture. Field Programmable Gate Array (FPGA). Digital signal processing for SDR. Case-study: single-frequency GPS SDR receiver. Satellite navigation fundamentals. Description of the GPS signals. GPS receiver architecture: hardware and software components. GPS SDR receiver performance. Communication protocols between GPS receivers and the other computing devices. Practical work in the Octave environment.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☒ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance, mandatory laboratory work, home works, seminar paper.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper	1	Experimental work	
Written exam	1	Oral exam	1	Essay		Research	
Project		Sustained knowledge check		Report		Practice	1
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance, successful completion of laboratory exams, home works, seminar paper, successful completion of written and oral exams.

1.10. Assigned reading (at the time of the submission of study programme proposal)

Youngblood, G. (2002). A Software-Defined Radio for the Masses, Part 1. QEX; Jul/Aug 2002, 13-21. Available at: http://bit.ly/bK2sjJ.
Youngblood, G. (2002). A Software-Defined Radio for the Masses, Part 2. QEX; Sept/Oct 2002, 10-18. Available at: http://bit.ly/dDvTSw.
Youngblood, G. (2002). A Software-Defined Radio for the Masses, Part 3. QEX; Nov/Dec 2002, 27-36. Available at: http://bit.ly/a8Chce.

Youngblood, G. (2003). A Software-Defined Radio for the Masses, Part 4. QEX; Mar/Apr 2002, 20-31. Available at: http://bit.ly/avtBFo.
IS-GPS-200. (2004). Navstar GPS Space Segment / Navigation User Interfaces (Rev D). Available at: http://bit.ly/dtaROS.

1.11. Optional / additional reading (at the time of proposing study programme)

Borre, K et al. (2006). A Software-Defined GPS and Galileo Receiver: A Single-Frequency Approach. Birkhauser Boston. Boston, MA.
Dillinger, M, K Madani, N Alonistioti. (2003). Software Defined Radio: Architectures, Systems and Functions. John Wiley & Sons. New York, NY.
Farrell, J. (2008). Aided Navigation: GPS with High Rate Sensors. McGraw-Hill.
Mitola III, J. (2000). Software radio architecture: object-oriented approaches to wireless systems engineering. John Wiley & Sons. New York, NY.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Youngblood, G. (2002). A Software-Defined Radio for the Masses, Part 1. *QEX*; Jul/Aug 2002, 13-21. Freely available at: http://bit.ly/bK2sjJ.	freely available	-
Youngblood, G. (2002). A Software-Defined Radio for the Masses, Part 2. *QEX*; Sept/Oct 2002, 10-18. Freely available at: http://bit.ly/dDvTSw.	freely available	-
Youngblood, G. (2002). A Software-Defined Radio for the Masses, Part 3. *QEX*; Nov/Dec 2002, 27-36. Freely available at: http://bit.ly/a8Chce.	freely available	-
Youngblood, G. (2003). A Software-Defined Radio for the Masses, Part 4. *QEX*; Mar/Apr 2002, 20-31. Freely available at: http://bit.ly/avtBFo.	freely available	-
IS-GPS-200. (2004). Navstar GPS Space Segment / Navigation User Interfaces (Rev D). Freely vailable at: http://bit.ly/dtaROS.	freely available	-

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality insurance system.

Basic description		
Course title	Stochastic Mathematics	
Study programme	Graduate University Study of Computing	
Course status	compulsory	
Year	1.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Acquiring basic knowledge and skills in probability and stochastic processes. Recognition of problems in engineering practice that can be solved by using probability or modelled as stochastic process and analysis of such problems.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Define and interpret correctly random variables, interpret correctly and calculate means and variances. Describe some basic probability distributions, interpret correctly their meaning and use them in typical experiments. Define and interpret correctly basic concepts of random vectors. Express and understand the central limit theorem. Define and interpret correctly basic concepts from sampling theory. Explain the general concepts of estimating the parameters. Estimate some parameters of a population or a probability distribution from samples. Express and interpret correctly basic concept about statistical hypotheses tests. Calculate and explain correctly the results of some statistical tests. Define and explain correctly some basic concepts of stochastic processes and Markov chains. Express and understand basic results from Markov chain theory. Apply Markov chains in problem solving. Simulating stochastic processes.

1.4. Course content

Random variable and standard probability distributions. Random vectors. Samples. Estimation of parameters. Confidence intervals. Testing of hypotheses, decisions. Stochastic processes. Markov chains.

1.5. Teaching methods	☒ lectures ☐ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☒ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Class attendance, homework, tests.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation		Seminar paper		Experimental work	
Written exam	0.75	Oral exam	0.75	Essay		Research	
Project		Sustained knowledge check	2.5	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance, tests on computer, mid-term exams, written and oral exam

1.10. Assigned reading (at the time of the submission of study programme proposal)

Elezović, N.: Random variables, Biblioteka Bolonja, Element, Zagreb 2007. (in Croatian)
Elezović, N.: Statistics and processes, Biblioteka Bolonja, Element, Zagreb 2007. (in Croatian)
Črnjarić-Žic, material of course Engineering Statistics, Tehnički fakultet Rijeka (in Croatian)

1.11. Optional / additional reading (at the time of proposing study programme)

Montgomery, D. C., Runger G. C., Applied statistics and probability for engineers, Wiley, 2003.
Winston, L. W., Introduction to probability models, Thomson Brooks/Cole, 2004.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
Elezović, N.: Random variables, Biblioteka Bolonja, Element, Zagreb 2007.		
Elezović, N.: Statistics and processes, Biblioteka Bolonja, Element, Zagreb 2007		
Črnjarić-Žic, N.: material of course Engineering statistics, Tehnički fakultet Rijeka		

1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences

Through the Institution's quality assurance system.

Basic description		
Course title	Wireless Sensor Networks	
Study programme	Graduate University Study of Computing	
Course status	optional	
Year	1. or 2.	
ECTS credits and teaching	ECTS student 's workload coefficient	6
	Number of hours (L+E+S)	30+30+0

1. COURSE DESCRIPTION

1.1. Course objectives

Introduction to key elements and concepts in wireless sensor networks. Acquiring the knowledge required to describe and analyze main network components, its architecture, protocols, and distributed algorithms used to control, localize, and synchronize the network nodes.

1.2. Course enrolment requirements

None.

1.3. Expected course learning outcomes

Describe network components and analyse network architecture. Describe MAC protocol. Analyse links. Describe and analyse address allocation and assignment, localization and positioning, network topologies, routing protocols, and signal propagation. Describe transport layer. Design and analysis of distributed algorithms.

1.4. Course content

Network components and architecture. MAC protocol. Links. Address allocation. Synchronization and localization. Topology control. Routing protocols. Distributed algorithms.

1.5. Teaching methods	☒ lectures ☒ seminars and workshops ☒ exercises ☐ long distance education ☐ fieldwork	☒ individual assignment ☐ multimedia and network ☐ laboratories ☐ mentorship ☐ other
1.6. Comments		

1.7. Student's obligations

Course attendance, activity, exams, seminars.

1.8. Evaluation of student's work

Course attendance	2	Activity/Participation	1	Seminar paper	1	Experimental work	
Written exam	0.5	Oral exam		Essay		Research	
Project		Sustained knowledge check	1.5	Report		Practice	
Portfolio							

1.9. Assessment and evaluation of student's work during classes and on final exam

Course attendance, activity, continuous knowledge testing, seminars, written exam.

1.10. Assigned reading (at the time of the submission of study programme proposal)

H. Karl and A. Willig, Protocols and Architectures for Wireless Sensor Networks, Wiley-Interscience, 2007.

1.11. Optional / additional reading (at the time of proposing study programme)

N. Santoro, Design and Analysis of Distributed Algorithms, Wiley-Interscience, 2006.
P. Santi, Topology Control in Wireless Ad Hoc and Sensor Networks, Wiley, 2005.

1.12. Number of assigned reading copies with regard to the number of students currently attending the course

Title	*Number of copies*	*Number of students*
H. Karl and A. Willig, Protocols and Architectures for Wireless Sensor Networks,	-	-

Wiley-Interscience, 2007.		
1.13. Quality monitoring methods which ensure acquirement of output knowledge, skills and competences		
Through the Institution's quality assurance system.		