1. Course programs with information in accordance with Article 4 of the Rulebook on the mandatory components that study programs from the second cycle of studies should have ("Official Gazette of the Republic of Macedonia", no. 25/2011 and no. 154/2011)

FIRST YEAR

Serial number: 1

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Methodology of Scientific Research Work**			
2.	Code	23ISE21A010			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / first semester	7.	Number of ECTS credits	6
8.	Name of the professor	Associate prof. dr. Shpetim Rexhepi			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** The aim of this course is to provide students with knowledge and understanding of various scientific theories and methodologies applied in the field of software engineering. After completing the course, students will be able to: thoroughly explain and understand the meaning of basic scientific concepts, effectively search for relevant information and literature, identify, formulate and describe scientific problems, make a careful choice of alternative research approaches, thoroughly describe, compare and explain the advantages and disadvantages of different scientific methods for collecting quantitative and qualitative data, apply basic scientific methods for analyzing quantitative and qualitative data, understand different frameworks for theory building as well as evaluate and review scientific publications.			
11.	**Course Content:** The main goal of this course is to provide students with the basic concepts of scientific research through the use of various methods such as researching epistemological and methodological approaches in the field of technology, finding scientific literature, structuring and writing scientific papers in accordance with international standards. for scientific publishing as well as presentation and discussion of relevant scientific issues in the field of media technology.				
12.	Learning methods: The course will be studied through advanced forms of lectures and exercises, discussions. It will be realized with audiovisual techniques, demonstrations, immediate solving of tasks, critical and creative approach, work and discussions in groups, solving homework, etc.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours	
16.		16.1.	Project tasks	45 hours	

	Other forms of activities	16.2.	Independent tasks	30 hours
		16.3.	Home study - assignments	60 hours
17.	Method of assessment			
	17.1.	Tests	70 points	
	17.2.	Individual work/project (presentation: written and oral)	20 points	
	17.3.	Activity and participation	10 points	
18.	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)	
		from 51 to 60 points	6 (six) (E)	
		from 61 to 70 points	7 (seven) (D)	
		from 71 to 80 points	8 (eight) (C)	
		from 81 to 90 points	9 (nine) (B)	
		from 91 to 100 points	10 (ten) (A)	
19.	Requirement for signature and passing the final exam	Attendance 80% of the teaching Submitted individual works and Completed duties of exercises		
20.	Language of instruction	Albanian, Macedonian and English language		
21.	A method of monitoring the quality of teaching	Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students		

22. Literature

22.1. Required reading

No.	Author	Title	Publisher	Year
1.	Lazar, J., Feng, J. H., and Hochheiser H.	Research Methods in Human Computer Interaction	John Wiley & Sons Ltd	2010
2.				
3.				

22.2. Additional literature

No.	Author	Title	Publisher	Year
1.	Wilhelm Hasselbring / Simon Giesecke (Hrsg.)	Research Methods in Software Engineering	Trustworthy Software Systems	2006
2.				
3.				

Serial number: 2

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Applied Software Engineering**			
2.	Code	23ISE21A020			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / first semester	7.	Number of ECTS credits	6
8.	Name of the professor	Prof. dr. Bekim Fetaji			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** Acquisition of theoretical knowledge of applied software engineering and software processes. Understanding of the basic models of software processes and the ability to use them practically on specific projects. Training for monitoring and participating in the activities during the development of software requirements and specification, development, testing and evolution of software. Familiarity with SASE technologies and tools used as support in software processes. Gaining practical experience of working with various software tools.				
11.	**Course Content:** Analysis of applied software engineering and software processes. A model of comparing software projects. Software process models: error and fix model, waterfall model, evolutionary development model. Software process models: incremental development model, off-the-shelf component usage model, spiral model, extreme programming model. Fundamentals of Requirements Engineering. Basics of creating system specifications. Modeling of systems. Basics of the UML language. Design of software systems. Methods and techniques of software implementation. Software Verification. Software validation. Expertise and safety. Conditional engineering. Safety Engineering. Project management. Project planning. Quality management.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours	
16.	Other forms of activities	16.1.	Project tasks	45 hours	
		16.2.	Independent tasks	30 hours	
		16.3.	Home study - assignments	60 hours	
17.	Method of assessment				
	17.1.	Tests		70 points	
	17.2.	Individual work/project (presentation: written and oral)		20 points	
	17.3.	Activity and participation		10 points	

18.	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Requirement for signature and passing the final exam	Attendance 80% of the teaching Submitted individual works and Completed duties of exercises	
20.	Language of instruction	Albanian, Macedonian and English language	
21.	A method of monitoring the quality of teaching	Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students	

22. Literature

22.1. Required reading

No.	Author	Title	Publisher	Year
1.	Ian Sommerville	Software Engineering, 10th Ed.	Addison Wesley	2015
2.	S.R. Schach	Object Oriented & Classical Software Engineering, 7-th Ed.	McGraw Hill	2006
3.				

22.2. Additional literature

No.	Author	Title	Publisher	Year
1.	R. S. Pressman	Software Engineering: A Practiontionner Approach	McGraw-Hill	2008
2.				
3.				

Serial number: 3

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Advanced Algorithms and Data Structures**			
2.	Code	23ISE21A030			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / first semester	7.	Number of ECTS credits	6
8.	Name of the professor	Prof. dr. Aleksandar Dimovski			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** This course builds on previous knowledge of algorithms and data structures. The aim of this course is to introduce students to advanced efficient algorithms and appropriate data structures used for organization, query and optimization of data. Theoretical efficiency of algorithms and its practical determination are also considered in order to be able to compare different algorithms. During the course, students will be introduced to several well-known algorithms, especially for search and optimization in complex nonlinear structures, such as trees and graphs.				
11.	**Course Content:** The program includes the following topics: analysis of recursive algorithms and random techniques, sorting algorithms and complexity comparison (counting, radix, heapsort, quicksort, linear sorting), methods of algorithm conception (divide and rule, dynamic programming, greedy algorithms) , data structures (heap, sets and balanced trees), augmenting existing structures, hash methods and functions, graphs and algorithms for depth and breadth search, heuristic search, algorithms for finding the shortest path, optimization and linear programming, maximum flow in a network, etc.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours	
16.	Other forms of activities	16.1.	Project tasks	45 hours	
		16.2.	Independent tasks	30 hours	
		16.3.	Home study - assignments	60 hours	
17.	Method of assessment				
	17.1.	Tests		70 points	
	17.2.	Individual work/project (presentation: written and oral)		20 points	
	17.3.	Activity and participation		10 points	
18.	Assessment criteria (points/grade)		up to 50 points	5 (five) (F)	

			from 51 to 60 points		6 (six) (E)
			from 61 to 70 points		7 (seven) (D)
			from 71 to 80 points		8 (eight) (C)
			from 81 to 90 points		9 (nine) (B)
			from 91 to 100 points		10 (ten) (A)
19.	Requirement for signature and passing the final exam		Attendance 80% of the teaching Submitted individual works and Completed duties of exercises		
20.	Language of instruction		Albanian, Macedonian and English language		
21.	A method of monitoring the quality of teaching		Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students		
22.	Literature				
	22.1.	Required reading			
		No.	Author	Title	Publisher	Year
		1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	Introduction to Algorithms, Second Edition	The MIT Press	2001
		2.				
		3.				
	22.2.	Additional literature			
		No.	Author	Title	Publisher	Year
		1.	Algorithms. by S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani	Algorithms	McGraw-Hill	2006
		2.				
		3.				

Serial number: 4

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Discrete Mathematics and its Application in Programming**			
2.	Code	23ISE21A040			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / first semester	7.	Number of ECTS credits	6
8.	Name of the professor	Assistant prof. dr. Egzona Iseni Rexhepi			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** Students get to know the methods of discrete mathematics and structures, solve problems and apply them in solving different problems in programming.				
11.	**Course Content:** Finite sets. Variations, permutations, combinations. Counting subsets of a set – combinations, r-combinations with allowed repetition, Pascal's formula and Binomial theorem. Principle of inclusion and exclusion. Sequences, Mathematical Induction, and Recursion. Explicit Formulas for Sequences, Sequences in Computer Programming. Principles of mathematical induction and its application in correctness of algorithms. Defining recurrent sequences and solving them, structural induction. Latin Squares and Application. Theory of sets. Relations and properties of relations. Functions. Binary operations. Modular Arithmetic. Numerical systems. Amounts. Divisibility.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours	
16.	Other forms of activities	16.1.	Project tasks	45 hours	
		16.2.	Independent tasks	30 hours	
		16.3.	Home study - assignments	60 hours	
17.	Method of assessment				
	17.1.	Tests		70 points	
	17.2.	Individual work/project (presentation: written and oral)		20 points	
	17.3.	Activity and participation		10 points	
18.	Assessment criteria (points/grade)	up to 50 points		5 (five) (F)	
		from 51 to 60 points		6 (six) (E)	

			from 61 to 70 points	7 (seven) (D)	
			from 71 to 80 points	8 (eight) (C)	
			from 81 to 90 points	9 (nine) (B)	
			from 91 to 100 points	10 (ten) (A)	
19.	Requirement for signature and passing the final exam		Attendance 80% of the teaching Submitted individual works and Completed duties of exercises		
20.	Language of instruction		Albanian, Macedonian and English language		
21.	A method of monitoring the quality of teaching		Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students		
22.	Literature				
	22.1.	Required reading			
		No.	Author	Title	Publisher	Year
		1.	S.Lipschucz	Theory and problems of finite mathematics	McGraw-Hill	1996
		2.	Kenneth H. Rosen	Discrete Mathematics and its applications, 6th edition.	The Mc Graw-Hill Companies	2007
		3.	Susanna S. Epp	Discrete Mathematics with application, 4th edition	Brooks/Cole Cengage Learning	2011
	22.2.	Additional literature			
		No.	Author	Title	Publisher	Year
		1.	Rowan Garnier, John Taylor	Discrete Mathematics for New Technology Second Edition	Op Publishing Ltd	2002
		2.				
		3.				

Serial number: 5

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Object Oriented Design**			
2.	Code	23ISE21B050			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / first semester	7.	Number of ECTS credits	6
8.	Name of the professor	Associate prof. dr. Mirlinda Ebibi			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** Getting to know the techniques for analysis, design and modeling of object-oriented systems. Training for practical analysis of user requirements and creation of effective OO models as the initial phase of the implementation of the OO system.				
11.	**Course Content:** An introduction to the object-oriented model of the real world, and its application in software engineering. Code reuse, standardization. Basic properties of the object-oriented paradigm. Classes and objects and notation. OO software development. Modularity, hierarchy, aggregation and generalization. Basic concepts of UML. Basic class diagrams. Associations between classes. Limitations and Qualifiers. Interfaces. User scenario diagrams. Inclusion and extension functions. Activity diagrams. State diagrams. Sequence diagrams. Collaboration diagrams. Interaction with other systems. Defining interfaces to other systems using UML. Component diagrams. Development diagrams for implementation in UML. Real world models. Using the UML notation.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours	
16.	Other forms of activities	16.1.	Project tasks	45 hours	
		16.2.	Independent tasks	30 hours	
		16.3.	Home study - assignments	60 hours	
17.	Method of assessment				
	17.1.	Tests		70 points	
	17.2.	Individual work/project (presentation: written and oral)		20 points	
	17.3.	Activity and participation		10 points	
18.	Assessment criteria (points/grade)	up to 50 points		5 (five) (F)	
		from 51 to 60 points		6 (six) (E)	
		from 61 to 70 points		7 (seven) (D)	

		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Requirement for signature and passing the final exam	Attendance 80% of the teaching Submitted individual works and Completed duties of exercises	
20.	Language of instruction	Albanian, Macedonian and English language	
21.	A method of monitoring the quality of teaching	Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students	

22. Literature

22.1. Required reading

No.	Author	Title	Publisher	Year
1.	G. Booch, J. Rumbaugh, I. Jacobson	The Unified Modeling Language User Guide (2nd Edition)	Addison Wesley Professional	2005
2.	Binder, R.V.	Testing object - oriented systems: Models, Patterns and Tools	The Mc Graw-Hill Companies	2007
3.	Susanna S. Epp	Systems Analysis and Design with UML	Wiley	2007

22.2. Additional literature

No.	Author	Title	Publisher	Year
1.	M. Fowler	UML Distilled: A Brief Guide to the Standard Object Modeling	Addison-Wesley	2003
2.				
3.				

Serial number: 5

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Multimedia Technologies**			
2.	Code	23ISE21B060			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / first semester	7.	Number of ECTS credits	6
8.	Name of the professor	Prof. dr. Andrej Cvetkovski			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** Students to acquire theoretical and practical knowledge of how to create, reproduce, digitize, process, transmit and deliver different types of multimedia products and applications, as well as practical knowledge of multimedia processing programs.				
11.	**Course Content:** Introduction to Multimedia. Elements of multimedia, image, video, sound, movement, text and typography, interactivity. Projecting multimedia. Challenges in multimedia content acquisition, processing and transmission systems. Images: digitization, sampling, quantization. Colors, color patterns in images and video. Raster and vector graphics, image compression algorithms, formats. Basic concepts of video, compression and coding algorithms, video standards, formats and delivery. Animation. Fundamentals of audio signals, digitization, processing, speech and music compression algorithms, delivery. Production and synthesis of sound and music. MIDI interface. Multimedia architecture of the Internet. Search and filter multimedia data.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours	
16.	Other forms of activities	16.1.	Project tasks	45 hours	
		16.2.	Independent tasks	30 hours	
		16.3.	Home study - assignments	60 hours	
17.	Method of assessment				
	17.1.	Tests		70 points	
	17.2.	Individual work/project (presentation: written and oral)		20 points	
	17.3.	Activity and participation		10 points	
18.	Assessment criteria (points/grade)	up to 50 points		5 (five) (F)	
		from 51 to 60 points		6 (six) (E)	

		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Requirement for signature and passing the final exam	Attendance 80% of the teaching Submitted individual works and Completed duties of exercises	
20.	Language of instruction	Albanian, Macedonian and English language	
21.	A method of monitoring the quality of teaching	Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students	

22. Literature

Required reading

No.	Author	Title	Publisher	Year
1.	Tay Vaughan	Multimedia: Making It Work	McGraw-Hill	2014
2.	Binder, R.V.	Testing object - oriented systems: Models, Patterns and Tools	The Mc Graw-Hill Companies	2007
3.	Susanna S. Epp	Systems Analysis and Design with UML	Wiley	2007

22.1.

Additional literature

No.	Author	Title	Publisher	Year
1.	Vic Costello	Multimedia Foundations: Core Concepts for Digital Design, 2nd edition	Rutledge	2016
2.				
3.				

22.2.

Serial number: 6

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Advanced Databases**			
2.	Code	23ISE22A010			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / second semester	7.	Number of ECTS credits	6
8.	Name of the professor	Assistant prof. dr. Majlinda Axhiu			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** Acquaintance of students with the advanced concepts of relational databases, necessary for the creation, management and maintenance of databases, as well as for the development of data-oriented systems. In this way, they will acquire deep theoretical and practical knowledge in the field of databases. Also, students will be familiar with the modern trends of development and expansion of traditional database management systems, in order to respond to current challenges in information theory and practice.				
11.	**Course Content:** Advanced data modeling – standards and models; Architecture of database management systems; Protection and security, database recovery. Evaluation and optimization of questionnaires, indexing, partitioning, clustering of data; Distributed databases, database clusters, replication; Transactional and analytical databases.; Object-oriented and object-databases, object-relational mapping; Web-oriented and mobile systems and databases; Practical implementation of advanced modeling techniques and tools; Administration and performance tuning of database management systems; Recovery and replication tools for the same systems; Advanced SQL; Programming in databases. Query planning and optimization, transaction processing and concurrency control, ACID rules, OLTP, large scale management, data warehousing and online analytical processing (OLAP), database theory. Special purpose databases: temporal, spatial, and multimedia databases.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours	
16.	Other forms of activities	16.1.	Project tasks	45 hours	
		16.2.	Independent tasks	30 hours	
		16.3.	Home study - assignments	60 hours	
17.	Method of assessment				
	17.1.	Tests		70 points	
	17.2.	Individual work/project (presentation: written and oral)		20 points	

	17.3.	Activity and participation			10 points
18.	Assessment criteria (points/grade)		up to 50 points		5 (five) (F)
			from 51 to 60 points		6 (six) (E)
			from 61 to 70 points		7 (seven) (D)
			from 71 to 80 points		8 (eight) (C)
			from 81 to 90 points		9 (nine) (B)
			from 91 to 100 points		10 (ten) (A)
19.	Requirement for signature and passing the final exam		Attendance 80% of the teaching Submitted individual works and Completed duties of exercises		
20.	Language of instruction		Albanian, Macedonian and English language		
21.	A method of monitoring the quality of teaching		Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students		
22.	Literature				
	22.1.	Required reading			
		No.	Author	Title	Publisher	Year
		1.	Hoffer et al.	Modern Database Management, 13th edition	Pearson Education Limited	2018
		2.	Hector Garcia Molina, Jeffrey Ullman and Jennifer Widom	Database Systems: The Complete Book	Prentice Hall	2002
		3.				
	22.2.	Additional literature				
		No.	Author	Title	Publisher	Year
		1.	Avi Silberschatz, Henry Korth, S. Sudarshan	Database System Concepts	McGraw Hill	2010
		2.	Thomas M. Connolly and Carolyn E. Begg	Database Systems: A Practical Approach to Design, Implementation and Management	Addison Wesley (5th Edition)	2009
		3.				

Serial number: 7

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Software Testing**			
2.	Code	23ISE22A020			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / second semester	7.	Number of ECTS credits	6
8.	Name of the professor	Prof. dr. Aleksandar Dimovski			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** Acquaintance of students with the need for software testing, the different techniques of software modeling and the use of those models for testing, as well as practical work on testing, validation and verification of software Definitions and measures of reliability and reliability. Reliability and availability modeling. Error detection and error correction codes. Reliable system design: Transient versus permanent hardware errors. Sources of errors in software, Fault tolerance techniques, Reliability in VLSI devices, air control systems, telecommunication systems, industrial control applications. Trusted transaction processing systems. Software approaches and software reliability. Software reliability models. Software Reliability Methods. Reliability in operating systems and data structures. Reliability in databases and distributed systems. Design of tests. Test Generation Methods. Automatic Test Pattern Generation (ATPG).				
11.	**Course Content:** System level tests and diagnosis. Software testing. Test specifications. Black box testing. White box testing. Random tests. Test coverage. Maintenance. Analysis of risks and hazard exposures, risk reduction strategies. Inevitability of maintenance of certain systems. Maintenance behavior patterns – hardware, software, communications. Nature of maintenance: defect removal, upgrade, improvement. Configuration management and version control in engineering systems. Tool support. Building expertise, its later reuse, problems, balances, opportunities. Software validation and verification, V&V terminology and fundamentals. V&V objectives and limitations, V&V planning and documentation, metrics and measures, process participants, Types of testing, static analysis and dynamic testing, functional and non-functional testing. Software modeling with graphs. Modeling logical expressions Partitioning of input space. Syntactic modeling. Testing object-oriented applications. Testing of web applications and web services. Contemporary trends in testing.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours	

16.	Other forms of activities	16.1.	Project tasks	45 hours
		16.2.	Independent tasks	30 hours
		16.3.	Home study - assignments	60 hours

17.	Method of assessment		
	17.1.	Tests	70 points
	17.2.	Individual work/project (presentation: written and oral)	20 points
	17.3.	Activity and participation	10 points

18.	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Requirement for signature and passing the final exam	Attendance 80% of the teaching Submitted individual works and Completed duties of exercises	
20.	Language of instruction	Albanian, Macedonian and English language	
21.	A method of monitoring the quality of teaching	Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students	

22. Literature

22.1. Required reading

No.	Author	Title	Publisher	Year
1.	M. L. Shooman	Reliability of Computer Systems and Networks: Fault Tolerance, Analysis, and Design.	John Wiley & Sons, Inc	2002
2.	Ilene Burnstein	Practical Software Testing: A ProcessOriented Approach	Springer Professional Computing	2006
3.				

22.2. Additional literature

No.	Author	Title	Publisher	Year
1.	Paul Ammann and Jeff Offutt	Introduction to Software Testing (2nd edition)	Cambridge University Press	2016
2.				
3.				

Serial number: 8

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Machine Learning Algorithms**			
2.	Code	23ISE22A030			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / second semester	7.	Number of ECTS credits	6
8.	Name of the professor	Assistant prof. dr. Stojan Kitanov			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** The aim of the course is to familiarize students with the basics of modern techniques in the field of machine learning. After completing the course, candidates will: have in-depth knowledge of advanced machine learning technologies and methods; they will be able to understand, analyze and formulate general problems in the field of machine learning; they will be able to successfully apply machine learning algorithms in solving real problems; they will be able to conceptualize, analyze, implement and evaluate the performance of a machine learning system.				
11.	**Course Content:** An introduction to machine learning and data mining techniques. Data warehouses: partitioning and aggregation, data cubes and metadata. Pre-processing, selection and transformation. Base selection, trait selection, statistical analysis. Clustering - K-Means and EM, Sobweb. Associative rules and time sequence analysis. Finding rules, multi-level rules. Spanning trees and inductive rule derivation. ID3, C45, SART, neural networks. Predictive techniques. Post-processing. Visualization and retrieval of visual data. Scalability and parallel mining. Data mining strategies in finance. Data mining of text, multimedia data and the web. Introduction to Machine Intelligence. Univariate and Multivariate Linear Regression. Logistic regression, hypothesis representation, classification, cost functions, error evaluation, model selection and validation. Bayesian theory, naive Bayesian classifier, neural networks, support vector machines, decision trees, lazy classifiers. Ensembles. Unsupervised learning and reinforcement learning. Current Issues in Machine Intelligence.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .		2 x 15 = 30 hours

		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours
16.	Other forms of activities	16.1.	Project tasks	45 hours
		16.2.	Independent tasks	30 hours
		16.3.	Home study - assignments	60 hours

17.	Method of assessment		
	17.1.	Tests	70 points
	17.2.	Individual work/project (presentation: written and oral)	20 points
	17.3.	Activity and participation	10 points

18.	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Requirement for signature and passing the final exam	Attendance 80% of the teaching Submitted individual works and Completed duties of exercises	
20.	Language of instruction	Albanian, Macedonian and English language	
21.	A method of monitoring the quality of teaching	Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students	

22. Literature

22.1. Required reading

No.	Author	Title	Publisher	Year
1.	Peter Harrington	Machine Learning in Action	Manning Publications	2012
2.	U.M.Fayyad, G. Piatetaky-Shapiro, P. Uthurusam.	Advances in Knowledge Discovery and Data Mining	AAAI/MIT Press	1996
3.	Christopher M. Bishop	Pattern Recognition and Machine Learning	Springer	2006

22.2. Additional literature

No.	Author	Title	Publisher	Year
1.	Ethem Alpaydin	Introduction to Machine Learning	MIT Press	2004

		2.	Ian H. Witten, Eibe Frank, Mark A. Hall	Data Mining: Practical Machine Learning Tools and Techniques	Morgan Kaufmann	2011
		3.	Pang-Ning Tan, Michael iand Steinbach Vipin ’Kumar	Introduction to Data Mining	Pearson	2006

Serial number: 9

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Master Thesis**			
2.	Code	23ISE22A040			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / second semester	7.	Number of ECTS credits	6
8.	Name of the professor	The teaching staff of the Faculty of Information Sciences and the University "Mother Teresa" in Skopje can be a mentor for a master's thesis			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** Students aim to develop a software application and analyze it in detail, using knowledge from the subjects they have followed during their studies.				
11.	**Course Content:** Each student works individually with the help of the chosen mentor on the chosen topic, which it must be previously approved by the Teaching and Research Council of the Faculty of Information Sciences. After completing the mentoring phase and checking the student's file, the student submits an Application for the public defense of the master's thesis before the Commission and the audience to the Teaching and Research Council of the Faculty of Information Sciences during the regular examination session. If the Educational Scientific Council of the Faculty of Information Sciences accepts the Application, the Educational Scientific Council of the Faculty of Information Sciences makes a decision on the establishment of a commission for the review of the master's thesis, which includes the mentor as a member. If the Academic Scientific Council of the Faculty of Information Sciences accepts the peer review, the Academic Scientific Council of the Faculty of Information Sciences makes a decision on the formation of a committee for the public defense of the master's thesis, which includes the mentor as a member. Then as the final act is the public defense of the master's thesis before a committee and an audience.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2			

15.	Forms of teaching activities	15.1.	Consultations	2 x 15 = 30 hours
		15.2.		
16.	Other forms of activities	16.1.	Independent learning and working	150 hours
		16.2.		
		16.3.		

17.	Method of assessment		
	17.1.	Individual work/project (presentation: written and oral)	80 points
	17.2.	Activity and participation	20 points
	17.3.		

18.	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Requirement for signature and passing the final exam	Passed all courses in the study program	
20.	Language of instruction	Albanian, Macedonian and English language	
21.	A method of monitoring the quality of teaching	Mechanisms of internal evaluation and surveys	

22.	Literature					
	22.1.	Required reading				
		No.	Author	Title	Publisher	Year
		1.				
		2.				
		3.				
	22.2.	Additional literature				
		No.	Author	Title	Publisher	Year
		1.				
		2.				
		3.				

Serial number: 10

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Advanced Programming of Mobile Devices**			
2.	Code	23ISE22B050			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / second semester	7.	Number of ECTS credits	6
8.	Name of the professor	Associate prof. dr. Mirlinda Ebibi			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** The purpose of this course is for students to get to know the basics of programming mobile devices in different platforms such as Android, iOS, Windows and others. After completing the course, the student is expected to understand and have in-depth knowledge of mobile operating systems, in-depth knowledge of programming native mobile applications, mobile web.				
11.	**Course Content:** Mobile operating systems (Android and iOS). Native apps and mobile web apps, conceptual differences and development approach. Concepts of mobile application development, with reference to the differences that mobility brings. Mobile infrastructures, difference between mobile and wireless. Characteristics of mobile applications (multimodal interaction, multiple communication channels, infrastructure limitations). User interfaces and interaction in mobile applications. Characteristics of a mobile user (inability to focus, differences originating from different cultures). User-centered methods and tools for mobile application design. Development platforms and technologies. Testing of mobile applications and their implementation. Integration of mobile applications in information systems. Mobile applications and their interoperability with web-based solutions. Multi-context mobile solutions. Ubiquitous devices and services. Mobile Sensor Technologies and Applications. Short-range communication technology. Mobile sensor systems. Integration with databases, working with memory on mobile devices, mobile animated graphics. Mobile social networks, location-based applications and games, mobile electronic banking, mobile electronic commerce, mobile learning, mobile health services.				
12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.				
13.	Total available time	180 hours			
14.	Allocation of available time	2+1			
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours	
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours	
16.	Other forms of activities	16.1.	Project tasks	45 hours	
		16.2.	Independent tasks	30 hours	
		16.3.	Home study - assignments	60 hours	
17.	Method of assessment				

	17.1.	Tests	70 points
	17.2.	Individual work/project (presentation: written and oral)	20 points
	17.3.	Activity and participation	10 points

18.	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Requirement for signature and passing the final exam	Attendance 80% of the teaching Submitted individual works and Completed duties of exercises	
20.	Language of instruction	Albanian, Macedonian and English language	
21.	A method of monitoring the quality of teaching	Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students	

22. Literature

Required reading

No.	Author	Title	Publisher	Year
1.	Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura	Programming Android: Java Programming for the New Generation of Mobile Devices	O'Reilly Media	2013
2.	Maximiliano Firtman	Programming the Mobile Web	O'Reilly Media	2013
3.	Tommi Mikkonen	Programming Mobile Devices: An Introduction for Practitioners	Wiley	2007

22.1.

Additional literature

No.	Author	Title	Publisher	Year
1.	Daniel Vaughan	Windows Phone 7.5 Unleashed	Sams	2012
2.	Adrian Kosmaczewski	Mobile JavaScript Application Development: Bringing Web Programming to Mobile Devices	O'Reilly Media	2012

22.2.

		3.	Carol Hamer	Creating Mobile Games: Using Java ME Platform to Put the Fun into Your Mobile Device and Cell Phone (Technology in Action)	Apress	2007

Serial number: 10

Attachment No. 3		**Course program from the second cycle of studies**			
1.	Name of the course	**Semantic Technologies**			
2.	Code	23ISE22B060			
3.	Study program	Applied Software Engineering, one year studies			
4.	Organizer of the study program (unit, i.e. institute, department, department)	Mother Teresa University Faculty of Information Sciences, Skopje			
5.	Degree (first, second, third cycle)	Second cycle			
6.	Academic year / semester	First year / second semester	7.	Number of ECTS credits	6
8.	Name of the professor	Assistant prof. dr. Fisnik Doko			
9.	Prerequisites for enrolling in the course	None			
10.	**Course objectives (competencies):** This course is an introductory course covering the semantic web languages RDF (S), OWL and SPARQL. The course is a combination of lectures covering the practical and theoretical aspects of the aforementioned languages and extensive practical sessions on modeling and querying semantic knowledge bases.				
11.	**Course Content:** WEB 2.0. Examples of WEB 2.0. WEB 2.0 and user generated content. Social networks and collective intelligence. WEB 2.0 technologies. Impact of Web 2.0 on business and society. Web 2.x technologies. Web services and cloud computing. Web 3.0 and Semantic Web Concepts. Web 3.0 technologies. Web 3.0 applications and web data management. Security of web services. Management of web services. Mobile web services. Future trends in the development of web technologies and services. A framework for describing resources. General idea of graph-based data representation and basic concepts Expert RDF ternary language. Advanced functions for RDF. Tips for Publishing RDF Data RDF Schema (RDFS). A discussion of the added value of an instance-driven schema. Syntax and semantics of basic features: classes, properties and their characteristics. Relationships between RDFS dictionary elements. Computers answer typical searches across RDFS datasets RDFS satisfiability and existence. Using Protege to Model and Search RDFS Datasets Limitations of RDFS. Searching the Semantic Web with SPARQL. Querying Datasets with the SPARQL StarDog Engine Filters and SPARQL Expressions Property Path Names. Complex graphics schemes with advanced features such as optional sections, aggregation and ordering. Other types of queries Update with SPARQL. OWL Web Ontology Language. Basic concepts and differences in RDFS Overview of OWL modeling constructs. Modeling and assessing the benefits of alternative models in a specific application context. Interchangeability of construction models. A discussion of the trade-off between expressiveness of lan-calculation modeling and computational efficiency in searching OWL profiles. Limits on the expressive power of OWL.				

12.	Learning methods: interactive teaching, practical teaching, laboratory exercises, seminar work.			
13.	Total available time	180 hours		
14.	Allocation of available time	2+1		
15.	Forms of teaching activities	15.1.	Lectures - theoretical teaching .	2 x 15 = 30 hours
		15.2.	Exercises (laboratory, classroom), seminars, teamwork.	1 x 15 = 15 hours
16.	Other forms of activities	16.1.	Project tasks	45 hours
		16.2.	Independent tasks	30 hours
		16.3.	Home study - assignments	60 hours

17.	Method of assessment		
	17.1.	Tests	70 points
	17.2.	Individual work/project (presentation: written and oral)	20 points
	17.3.	Activity and participation	10 points

18.	Assessment criteria (points/grade)	up to 50 points	5 (five) (F)
		from 51 to 60 points	6 (six) (E)
		from 61 to 70 points	7 (seven) (D)
		from 71 to 80 points	8 (eight) (C)
		from 81 to 90 points	9 (nine) (B)
		from 91 to 100 points	10 (ten) (A)
19.	Requirement for signature and passing the final exam	Attendance 80% of the teaching Submitted individual works and Completed duties of exercises	
20.	Language of instruction	Albanian, Macedonian and English language	
21.	A method of monitoring the quality of teaching	Quizzes, post-unit tests, progress monitoring, internal evaluation and survey of students	

22. Literature

22.1. Required reading

No.	Author	Title	Publisher	Year
1.	Serge Abiteboul, Ioana Manolescu, Philippe Rigaux, Marie-Christine Rousset, Pierre Senellart	Web data Management	Cambridge University Press	2012
2.	Michael P. Papazoglou	Web Services: Principles and Technology	Pearson Education Limited	2008
3.	Grigoris Antoniou and Frank van Harmelen	A Semantic Web Primer, 2nd Edition	The MIT Press	2008

22.2. Additional literature

No.	Author	Title	Publisher	Year

		1.	Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph	Foundations of Semantic Web Technologies	Chapman & Hall/CRC	2010
		2.	John Davies (Editor), Rudi Studer (Co-Editor), Paul Warren (Co-Editor)	Semantic Web Technologies: Trends and Research in Ontology- based Systems	Addison Wesley (5th Edition)	2009
		3.				