QUALIFICATION CHARACTERISTICS
Of the "Bussines Informatics And Econometrics" FOR
DEGREE "MASTER "
With professional qualification "Master in Informatics"
2 YEAR (4 SEMESTERS)

I. Requirements for professional skills and competencies for enrolled students

Students accepted for training in this specialty must present diplomas "Bachelor". The procedure for submission of documents and admission is determined by the Faculty of Mathematics and Natural Sciencies.

II. Requirements for professional skills and competencies of graduates

SWU " Neofit Rilski" prepare qualified specialists in informatics who can apply their knowledge and skills in science , culture, education and economy in southwestern Bulgaria , the country and abroad.

In specialty "Businessinformatics and Econometrics" students acquire skills and knowledge for the development of application software and application software technology in business. Higher education is achieved based on a wide range of courses. Advanced preparation of students of a material provided with computer equipment of last generation software products that meet the requirements of the 21st century.

In the two-year program computer science in the study of mathematical models in economics, modern computer equipment , deployment and implementation of software and information technologies, modern methods and systems design , development and implementation of software in business are covered and basic knowledge required.

Upon completion of this degree students can work as programmers in software development, system administrators in various areas of business, government and public administration, financial institutions and banks, private companies, educational and health institutions, brokerages and others, developers, software engineers and systems administrators and others.

Graduates educational qualification Master in Informatics receive:

• in-depth knowledge of the basic models and systems and implementation of software and information technology;

• ability to implement information products and information systems in different areas of the business and evaluate systems and to develop models to assess the financial risk in the financial markets, insurance and more.

• ability to develop and implement software applications;

• solid theoretical knowledge in the field of informatics and mathematics, and solid practical skills that meet the latest European standards.

• formation of affinity and capacity for independent research and design activities .

• basis for continuing education in the educational and scientific degree "Doctor" .

• good opportunities for such specialists in the country and abroad.

• mindset and affinity (openness) to the rapidly changing requirements of the information society .

III. Requirements for the preparation of graduates

Upon graduating student will be able to realize and take positions that require:

• show a thorough knowledge of the basic models and systems and implementation of software and information technology;

• to implement information products and information systems in different areas of the business;

• evaluate systems and developing models for assessing financial risk in financial markets, insurance and more.

• to develop and implement software applications.

Qualification characteristics of the "Informatics" in degree "Master" with professional qualification of "Master in Informatics" is the basic document that defines the development of curricula and syllabuses . It is consistent with the regulations in the field of higher education in Bulgaria.

First year			
First semester	ECTS credits	Second semester	ECTS credits
Compulsory courses		***Compulsory Courses***	
Functional Programming	4	Algorithms in Graphs and Networks	6,5
Computer Programming and Data Structures	5,5	Databases	7
		Probability and Statistics	7
Discrete Mathematics	5,5	Practical Course in Computer Programming	3
Computer Architectures	5		
Computer Networks and Communications	5,5	Optional 1	2
		Optional 2	4,5
Numerical Analysis and Mathematical Optimization	4,5		
		Optional Courses	
		Group 1	
		Practical Course in Databases	
		Practical Course in Perl	
		Practical Course in Web Design	
		Practical Course in Combinatorics, Coding Theory and Cryptography	
		Optional Courses	
		Group 2	
		Logical Programming	
		Software Engineering	
		Combinatorics, Coding Theory and Cryptography	
	Total 30		Total 30
Second year			
First semester	ECTS credits	Second semester	ECTS credits
Compulsory courses		***Compulsory courses***	
Introduction in financial mathematics	4,5	Time Series and Forecasting	4,5
Econometrics	4,5	Financial Management	3,5
Scientific programing	7	Finance	3
Optional course 3	7	Optional course 5	2
Optional course 4	7	Optional course 6	2
		Preparation for a written state exam or thesis defense	15
Optional courses			
Group 3:			
Programing in R language		***Optional courses***	
Statistical Analysis		Group 5:	
Group 4:		Stock markets	
Financial analysis		International finance	
Operations Research		Group 6:	
Insurance		Theory of Money	
		Game Theory for Economists	
		Analysis of Financial Risk	
	Total 30		Total 30

ANNOTATIONS OF COURSES

FUNCTIONAL PROGRAMMING

Semester: **1 semester**
Type of Course: **Lectures and tutorials in computer lab**
Hours per week - **2 hours lectures and 1 hour tutorials in computer lab**
Credits Numbers: **4,0 credits**
Course Status: Core course in curriculum of major Informatics, Bachelor degree.
The course is introduction in design and programming in Scheme LISP dialect.
Objectives:

The student should obtain knowledge of:

- Design and programming in Scheme.
- Practical aspects of functional programming.

Methods of teaching: seminars, tutorials, discussions, project based method.
Pre- requirements: C++ programming and Data Structure
Assessment and Evaluation

Quizzes - 30%
Final Test- 70%

The course is successful completed with at least 65% of all scores.
Registration for the Course: not required (core course)
Registration for the Exam: coordinated with the lecturer and the Student Service Office
References

1. Абелсън, Х., Дж. Сасмън Структура и интерпретация на компютърни програми. София, СОФТЕХ, 1994
2. Тодорова , М. Езици за функционално и логическо програмиране, първа част: функционално програмиране, София, СИЕЛА, 2004
3. Хендерсон, П. Функциональное програмирование: применение и реализация. Москва, Мир, 1983.

COMPUTER PROGRAMMING AND DATA STRUCTURES

Semester: 1-st semester
Type of Course: lectures, seminars and labs
Hours per week – 3 lectures + 1 seminars + 1 labs per week
Credits Numbers: 5,5
Course Status: Ffundamental course from the Computer Science MSc Curriculum (after BSc in another major field of study).The course is providing basic knowledge in development of algorithms, using certain programming language, running and testing the programs under certain operation system. The structure and the main operational principles of the computer systems are given. The means and accuracy of information presentation are also considered. Some of the key classes of algorithms and data structures are studied. The main techniques of the structural approach of programming and their application using JAVA programming language are introduced. The aim of the course is to teach the students the techniques in development of algorithms and programs using JAVA programming language. The knowledge will be used in the general theoretical, technical and some special courses.

Objectives:
Basic objectives and tasks:

- The students get knowledge of algorithm thinking;
- to give knowledge of the Data structures, that can process with computer;
- to give knowledge of the methods and skills in programming.
- to give knowledge of the syntax of a program language (JAVA);
- to give knowledge of the good style in programming;
- to give knowledge of the basic principles when develop applications

Methods of teaching: lectures, tutorials, group seminars or workshop, projects, other methods
Pre- requirements: Basic knowledge in Mathematics.
Exam: Written examination and discussion at the end of the semester, individual tasks and the general students' work during the semester.
Registration for the Course: not necessary
Registration for the Exam: Coordinated with the lecturer and the Student Service Office
References:

1. H. Schildt *Java 2 A Beginners Gide*. McGraw-Hill, 2001.
2. K. Arnold, J. Goslin, D. Holmes *The Java Programming Languag*. Sun Microsystems,2000.
3. Саймън Харис, Джеймс Рос *Основи на алгоритмите.* Wiley, 2006.
4. Dori Smith *JAVA for Word Wide Web.* Peachpit Press, 1999.
5. H. Maruyama, K. Tamura, N. Uramoto *XML and JAVA: Developing Web applications*, Addion-Wesley, 2001.
6. Иван Плачков *Ръководство по програмни езици.* УниСофт-Пловдив, 2000

DISCRETE MATHEMATICS

Semester: **1 semester**
Course type: **Lectures and tutorials**
ECTS Credits: **5,5 credits**
Course status: **Compulsory Course in the Computer Science B.S. Curriculum**

The Course is an Introduction in Discrete Structures used as a mathematical model in different computer science areas: logic, operations and relations in finite algebraic structures, representations of them as data structures, Boolean algebras, graphs, complexity of algorithms, combinatorics, finite automata etc.

Course aims: Non-trivial introduction in some important for Computer science areas, allowing the students to use effectively their knowledge in solving combinatorial problems.

Teaching methods: lectures, tutorials, group seminars or workshop, projects, other methods

Requirements/ Prerequisites: Basic knowledge in Mathematics.

Materials: Textbook and manual of the course are published, instructions for every laboratory theme and exemplary programs; access to web sites via Internet.

Evaluation: Written examination and discussion at the end of the semester, individual tasks and the general student's work during the semester.

Registration for the course : not necessary

Registration for the exam: in the department office, co-ordinated with the lecturer.

COMPUTER ARCHITECTURES

Semester: **First semester**
Form of the course: **Lectures/exercises**
Hours (per week): **3 hours lectures + 1 hours exercises per week, winter semester**
Credits: **5 (five) credits**

Status of the course in the educational plan:
The course is compulsory in the educational plan of MSc curriculum in Informatics.

Description of the course:
The course covers the advanced computer systems, their programming and functional model, introduce information in computer organization and memory types (major, operational, permanent, outdoor, etc.), system interruptions, features and technology solutions, conveyor ADP modes, system bus (types and structures), some problems of modern computer architectures (RISC, parallel and multiprocessor computer systems).
Scope of the course:
Obtaining knowledge of a systematic overview of the modern computer architecture, systems to form the theoretical and practical basis for better understanding of the work of computers to acquire skills in programming in assembly language.
Methods: discussions, practical exercises of the codes under consideration
Preliminary requirements: The students must have basic knowledge from mathematics.
Evaluation: permanent control during the semester (two written exams) and final exam.
Registration for the course: by application in the Educational Office
Registration for exam: up to agreement with the teacher and the Educational Office

Literature:

1. Брадли, Д. "Програмиране на асемблер за персонален компютър IBM/PC" Техника, София, 1989

2. Иванов Р. "Архитектура и системно програмиране за Pentium базирани компютри", Габрово, 1998.

3. J. L. Hennessy, D. A. Patterson. Computer Architecture: A Quantitative Approach (3rd ed.). Morgan Kaufmann Publishers, 1996.

4. Боровски Б., Боровска П., Архитектура на ЕИМ и микрокомпютри, Техника,

1992.

5. Горслайн Дж., Фамилия ИНТЕЛ, Техника, 1990.
6. Въчовски И., Наръчник по 32-разредни микропроцесори.
7. Компютърна енциклопедия, издателство Nisoft, част I и II.

COMPUTER NETWORKS AND COMMUNICATIONS

Semester: **First semester**
Form of the course: **Lectures/exercises**
Hours (per week): **3 hours lectures + 1 hours exercises per week, winter semester**
Credits: **5,5 (five) credits**

COURSE STATUS IN THE CURRICULUM:
Compulsory for the students of speciality "Informatics" – bachelor degree .

DESCRIPTION OF THE COURSE:
The course discuses the problems concerning design, building and application of computer networks. The lectures begin with introduction to computer networks, principles of building, historical development and their contemporary classification. Open system interconnection model of ISO is presented. Teaching course includes basic principles of building and functioning of Local Area Networks (LAN) illustrated by practical technical solutions in LAN Ethernet. The lectures on the most popular in the world computer network Internet present its basic characteristics, principles of functioning and application. The laboratory work helps to better rationalization of lecture material and contribute to formation of practical skills.

AIMS AND OBJECTIVES OF THE COURSE:
The aim of the course is to acquaint students with the basic principles, standards and tendencies of development in the field of computer networks. This will help them in future to professionally solve system tasks in the area of network communications.

TEACHING METHODS:
Lectures (with slides, multimedia projector) and additional text materials; laboratory work (based on instructions) with a tutorial for every laboratory theme.

PREREQUISITES:
Basic knowledge in informatics.

AUXILIARY MEANS FOR TEACHING:
Computer and multimedia projector for the course. Computer, development software, local area network, Internet and a tutorial for every laboratory theme.

METHOD OF ASSESSMENT: written examination (work for fixed time).

ARRANGEMENT FOR EXAMINATION: in the department office, co-ordinated with the lecturer.

NUMERICAL ANALYSIS AND MATHEMATICAL OPTIMIZATION

Semester: 1 semester
Course Type: lectures
Hours per Week/FS/SS: 3 lecture hours per week/SS
ECTS Credits: 4.5 credits
Department: Informatics, telephone: 073 / 588 532

Course Status: Compulsory Course in the Business Informatics and Econometrics M.S. Curriculum, period of study 4 semesters

Course Description: The course in Numerical Analysis and Mathematical Optimization includes basic results and methods in the area of Numerical Analysis and Mathematical Programming: part Numerical Analysis: basic methods for approximating functions – interpolation (Lagrange interpolating formula, interpolation error, divided differences, Newton from of interpolating polynomial) and least squares data fitting; numerical differentiation and numerical integration (Newton-Cotes quadrature formulas: midpoint rule and rectangular rule, trapezoidal rule, Simpson's rule); basic methods for numerical solution of nonlinear equations (false position method, secant method, Newton-Raphson method); numerical methods for solving systems of linear equations (Gauss and Gauss-Jordan methods, method of LU decomposition, etc.); part Mathematical Optimization: theory and methods of Linear Programming (general and canonical form of the linear programming problem, graphical solution of two-dimensional linear programs, simplex method, the big M method, duality in linear programming); linear transportation problem (finding starting solution, method of potentials); matrix games (minimax theorem of John von Neumann, graphical solution of games *2 x 2, 2 x m, m x 2*, relationship between matrix games and linear programming).

Course Objectives: Students should obtain knowledge about basic numerical methods and basic results and methods of linear programming.

Teaching Methods: lectures
Requirements/Prerequisites: Mathematical Analysis, Linear Algebra, Analytic Geometry
Assessment: written final exam
Registration for the Course: **not necessary**
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
Basic Titles:

1. Bl. Sendov, V. Popov – "Numerical Analysis", Part I, Kliment Ohridski Sofia University Press, Sofia, 1996 (in Bulgarian).
2. B. Boyanov – "Lectures on Numerical Analysis", Darba Publishing House, Sofia, 1995 (in Bulgarian).
3. "Numerical Analysis Problem Book", 2-nd ed., Kliment Ohridski Sofia University Press, Sofia, 1994 (in Bulgarian).
4. M. Kaschiev – "Numerical Analysis Handbook", Martilen Publishing House, Sofia, 1994 (in Bulgarian).
5. V. Pasheva – "Introduction to Numerical Analysis", Technical University, Sofia, 2009 (in Bulgarian).
6. S.M. Stefanov – "Quantitative Methods of Management", 2003 (in Bulgarian).

Additional Titles:

1. R. L. Burden, J. D. Faires – "Numerical Analysis", 9-th ed., Cengage Learning, Stamford, CT, USA, 2011.
2. J. D. Faires, R. L. Burden – "Numerical Methods", 4-th ed., Brooks/Cole Publishing Company, Pacific Grove, CA, USA, 2013.
3. S.M. Stefanov – "Numerical Analysis", MS4004-2203, Limerick, 1998.
4. Hamdy A. Taha – "Operations Research: An Introduction", Prentice Hall, 10-th ed., 2017.

Abbreviation:
FS: Fall Semester
SS: Spring Semester

ALGORITHMS IN GRAPHS AND NETWORKS

Semester: 2 semester
Cours Tipe: Lectures and tutorials
Hours per week/FS/SS: 3 lecture hours, 1 tutorial hours per week/SS
ECTS credits: 6,5 credits
Course Status: Obligatory course in the Computer Science M.Sc. Curriculum.
Short Description:

Because of its wide applicability, the study of graph theory has been expanding at a very rapid rate during recent years; a major factor in this growth being the development of large and fast computing machines.

Although, in general, algorithmic efficiency is considered of prime importance, the present course is not meant to be a course of efficient algorithms. Often a method is discussed because of its close relation to (or derivation from) previously introduced concepts. The overriding consideration is to leave the student with as coherent a body of knowledge with regard to graph analysis algorithms, as possible.

In this course are considered some elements of the following main topics;

Introduction in graph theory (essential concepts and definitions, modeling with graphs and networks, data structures for networks and graphs, computational complexity, heuristics).

Tree algorithms (spanning tree algorithms, variations of the minimum spanning tree problem, branchings and arborescences).

Shortest-path algorithms (types of shortest-path problems and algorithms, shortest-paths from a single source, all shortest-path algorithms, the k- shortest-path algorithm, other shortest-paths).

Maximum- flow algorithms (flow-augmenting paths, maximum-flow algorithm, extensions and modifications, minimum-cost flow algorithms, dynamic flow algorithms).

Matching and assignment algorithms (introduction and examples, maximum-cardinality matching in a bipartite graph, maximum-cardinality matching in a general graph, maximum-weight matching in a bipartite graph, the assignment problem).

The chinest postman and related arc routing problems (Euler tours and Hamiltonian tours, the postman problem for undirected graphs, the postman problem for directed graphs).

The traveling salesman and related vertex routing problems (Hamiltonian tours, basic properties of the traveling salesman problem, lower bounds, optimal solution techniques, heuristic algorithms for the TSP).

Location problems (classifying location problems, center problems, median problems).

Project networks (constructing project networks, critical path method, generalized project networks).Course Aims:
Students should obtain basic knowledge and skills for solving optimization problems for graphs and networks.

Teaching Methods: lectures, tutorials, individual student's work

Requirements/Prerequisites: Linear Algebra, Linear optimization

Assessment: 3 homework D1,D2,D3; 2 tests K1, K2 (project); written final exam

Rating: $= 0{,}2 \cdot \left(\frac{\mathbf{D}1 + \mathbf{D}2 + \mathbf{D}3}{3}\right) + 0{,}5 \cdot \left(\frac{\mathbf{K}1 + \mathbf{K}2}{2}\right) + 0{,}3$ (Exam)

Registration for the Course: by request at the end of the current semester (when is not obligatory course).

Registration for the Exam: coordinated with the lecturer and Students Service Department

References:
1. Mirchev,Iv., "Graphs". "Optimization algorithms for networks", Blagoevgrad,2001 (in Bulgarian).
2. Mirchev,Iv., "Mathematical programming", Blagoevgrad, 2000 (in Bulgarian).
3. Minieka, E., "Optimization Algorithms for Networks and Graphs, Marcel dekker, Inc., New York and basel, 1978 /Майника, Э.Алгоритмы оптимизации на сетях и графах, М., "Мир" р1981/.
4. Christofides, N., Graph Theory. An Algorithmic Aproach, Academic Press lnc /London/ Ltd. 1975, 1997 /Кристофидес, Н. Теория графов. Алгоритмический подход, М., "Мир", 1978/.
5. Swami, M., Thulasirman, Graphs, Networks and Algorithms, John Wiley & Sons, 1981 /Сваами М., К. Тхуласирман. Графы, сети и алгоритмы, М., "Мир", 1984/.

Abbreviation:
FS: Fall Semester
SS: Spring Semester

DATABASES

Semester: 2 semester
Course Type: lecture
Hours per week/FS/SS: 3 lecture; 2 exercise week/SS
ECTS credits: 7
Course Status: Obligatory course in the Computer Science

In this course we will present Database Theory. Course contains programmer/analyst – oriented in database management, practical training.
Course Aims:
Students should obtain knowledge and skills for designing of real database;
Teaching Methods: lectures, demonstrations and work on project
Requirements/Prerequisites: Linear algebra, Computer languages.
Assessment: course project
Registration for the Course: *by request at the end of the current semester*
Registration for the Exam: coordinated with the lecturer and Student Service Department

References:
Basic Titles:
1. Pavel Azalov. Database. Relation and objective approach, Tehnika, 1991 г.
2. Rex Hogan. A Practical Guide to Database Design, CRC Press, 2018, USA
3. J .C. Shepherd, Database Management: Theory and application. 1990, Boston

Abbreviation:
FS: Fall Semester
SS: Spring Semester

PROBABILITY AND STATISTIC

Semester: 2 **semester**
Type of Course: **lectures,** in **computer lab**
Hours per week – **3 hours lectures, 2 hours tutorials in computer lab/winter se**
Credits Numbers: **7 credits**
Course Status: obligatory course in curriculum of major Informatics. Bachelor degree.

In this course questions of Probability and Mathematical Statistics are considered. Algorithms connected with finding structural and numerical characteristics of graph's are represented. Basic notion of Probability and Statistics are considered connected with Theory of Estimations, and Decision Theory in case of big and small samples, testing of hypothesis based on models about the probability distributions of the features in the investigated population.

Objectives:

The students should obtain knowledge and understanding that the intercourse character needs to discover the connection Mathematics- Informatics- Physics- Economics and much more other sciences :

Methods of teaching: seminars, tutorials, discussions, project based method.
Pre- requirements: It is helpful the students have some knowledge in Analysis and Information Technology

Assessment and Evaluation

Three semestrials tests witch estimations will have part in the final estimation (50%)

The course is successful completed with at least 65% of all scores.
Registration for the Course: obligatory course
Registration for the Exam: coordinated with the lecturer and the Student Service Office

PRACTICAL COURSE IN COMPUTER PROGRAMMING

Semester: 2nd semester
Course Type: labs
Hours per week/SS: 2 labs hours per week/SS
ECTS credits: 3.0 credits
Course Status: Compulsory Course in Master of Science Curriculum of Informatics

The course discusses the visual design environments and event-driven programming (Turbo C + + Builder, Visual Studio Express Edition, Turbo Delphi), through which can be created application software system. For example the development of software during the classes used programming language C++ (or C# or ObjectPascal). Students learn the principles of planning, design, development and testing of software and information systems.

Course Objectives:

The course aims to extend knowledge of programming with visual design environments and event-driven programming.
After completion of the course students should be able to:

- Give a specification to plan and design software;
- Develop software using a visual design environment and event-driven programming;
- Tested the final software product;
- Establish help support system and user guide.

Teaching Methods: Lectures, demonstrations, work on project and teamwork.

Requirements/Prerequisites: Needed basic knowledge of operating systems, information technology, object-oriented programming and databases. Desirable Knowledge of programming languages C + +, ObjectPascal and / or C #.

Assessment: Evaluating the student shall be carried out in the sixth grad scale. During the laboratory sessions the student receives n-assessments on current projects - CP1-CPn and protects the end of the semester individual course project - ICP. The final evaluation - FE is calculated according to: FE = ((CP1 + ... + CPn) / n + ICP) / 2

Registration for the Course: ***By request at the end of the current semester***
Registration for the Exam: Coordinated with the lecturer and Student Service Department
References:
Basic Titles:

1. 11. Will Briggs (2019) C++ for Lazy Programmers. Quick, Easy, and Fun C++ for Beginners, Apress

2. 12. Josh Lospinoso (2019) C++ Crash Course. A Fast-Paced Introduction, Cengage Learning PTR.

Additional Titles:

3. Borland Software Corporation. Borland C++ 6 for Windows Developers Guide. Borland Publishing 2002

Abbreviation:
SS: Spring Semester

PRACTICAL COURSE IN DATABASES

Semester: 2nd semester
Course Type: lab exercises
Hours per week/SS: 2 labs hours per week/SS
ECTS credits: 2.0 credits
Course Status: Optional Course in Master of Science Curriculum of Informatics
The course is practical introductions in Relational Database Management Systems (RDBMS). The students learns principles and methods for modeling data in relational database systems, and modeling applications for one-users account environment. Examine type of tasks in area of small office automations and stages on they realization.
The course is naturally continuation on course of databases.

Course Objectives:
The course aims to extend knowledge of databases with visual design environments and event-driven programming.
After completion of the course students should be able to:

- modeled data in the context of database;
- apply a systematic approach to developing small software applications in the field of database;
- implement small projects of automation of office activities in the field of database.

Teaching Methods: Lectures, demonstrations, work on project and teamwork.

Requirements/Prerequisites: Needed basic knowledge of information technology, databases, object-oriented programming and work with MS Access. Desirable Knowledge of programming languages C + +, ObjectPascal and / or C #.

Assessment: Evaluating the student shall be carried out in the sixth grad scale. During the laboratory sessions the student receives n-assessments on current projects - CP1-CPn and protects the end of the semester individual course project - ICP. The final evaluation - FE is calculated according to: FE = ((CP1 + ... + CPn) / n + ICP) / 2

Registration for the Course: ***Submitted an application to the academic department at the end of current semester.***
Registration for the Exam: Coordinated with the lecturer and Student Service Department
References:
Basic Titles:

1. Churcher, C. Beginning Database Design: From Novice to Professional. Paperback, 2007
2. Peter Rob, Carlos Coronel. Database Systems: Design, Implementation, and Management. Hardcover, 2007
3. Rod Stephens. Beginning Database Design Solutions (Wrox Programmer to Programmer). Paperback, 2008

Additional Titles:

1. Borland Software Corporation. Borland Developer Studio 2010. Borland Publishing 2010

Abbreviation:
SS: Spring Semester

PRACTICAL COURSE IN PERL

Semester: 2nd semester
Course Type: labs
Hours (weekly)/WS/SS: 2 labs per week/SS
ECTS Credits: **2.0** credits
Course Status: Optional course from the Computer Science Master Curriculum.

Short Description:
This course observes Perl language and it application in different aspects of software development and data processing.

Course Aims:
The course aim is to give theoretical and practical background to students to use script languages in software development.

Teaching Methods: Labs.
Requirements/Prerequisites: Knowledge in Operating Systems, Programming Basics, Discrete Mathematics.

Exam: final exam
Registration for the course: *A request is made by students at the end of the current semester*
Registration for the exam: Coordinated with lecturer and Students Service Department

References:

1. http://idamianov.web.officelive.com/
2. David Till, Teach Yourself Perl 5 in 21 day
3. http://www.perl.org
4. http://docs.rinet.ru/Perl5_examples/
5. http://docs.rinet.ru/PerlSBlohami/
6. http://docs.rinet.ru/Using_Perl5_in_Web/

PRACTICAL COURSE IN WEB DESIGN

Semester: 2nd semester
Course Type: lab exercises
Hours per week/SS: 2 labs hours per week/SS
ECTS credits: 2.0 credits
Lecturer: Assistant Prof. Velin Spasov Kralev, PhD
Department: Informatics, telephone: 073 / 8889132, e-mail: velin_kralev@swu.bg
Course Status: Optional Course in Master of Science Curriculum of Informatics

The proposed curriculum dealing with issues and techniques in the field of Web design. Techniques are presented concerning the construction of static and dynamic pages and bringing them into full sites. Deals with the current software to develop web sites and also language HTML, DHTML and CSS.
The course is the basis for the courses "Programming in Internet" and "Internet technologies".

Course Objectives:
The course is for students to gain a comprehensive picture of the structure and language capabilities of HTML, DHTML and CSS.
After completion of the course students should be able to:

- use language HTML, DHTML, CSS, and through them to create Web sites;
- knowledge of current development environments for the Web.

Teaching Methods: Lectures, demonstrations, work on project and teamwork.

Requirements/Prerequisites: Needed basic knowledge of information technology. Desirable Knowledge of programming languages C + +, ObjectPascal and / or C #.

Assessment: Evaluating the student shall be carried out in the sixth grad scale. During the laboratory sessions the student receives n-assessments on current projects - CP1-CPn and protects the end of the semester individual course project - ICP. The final evaluation - FE is calculated according to: FE = ((CP1 + ... + CPn) / n + ICP) / 2

Registration for the Course: ***Submitted an application to the academic department at the end of current semester.***

Registration for the Exam: Coordinated with the lecturer and Student Service Department
References:
Basic Titles:

1. Aditya Ravi Shankar, Pro HTML5 Games: Learn to Build your Own Games using HTML5 and JavaScript, 2nd Edition, Apress, 2017
2. Jennifer Niederst Robbins and Aaron Gustafson. Learning Web Design: A Beginner's Guide to (X)HTML, StyleSheets, and Web Graphics. Paperback, 2007
3. Patrick McNeil. The Web Designer's Idea Book: The Ultimate Guide To Themes, Trends & Styles In Website Design. Paperback, 2008

Additional Titles:

1. Ethan Watrall and Jeff Siarto. Head First Web Design. Paperback, 2008

Abbreviation:
SS: Spring Semester

PRACTICAL COURSE IN COMBINATORICS, CODING THEORY AND CRYPTOGRAPHY

Semester: **Second semester**
Form of the course: **Exercises**
Hours (per week): **2 hours exercises per week, summer semester**
Credits: 2 (two) **credits**

Status of the course in the educational plan:
The course is optional in the MSc curriculum in Informatics.

Description of the course:
The Practical course is scheduled to be held simultaneously with the course of Combinatorics, Coding Theory and Cryptography (CCC), which introduced the basic concepts of coding theory, error-correcting codes, Hamming distance, code parameters, equivalency of codes, and encoding and decoding with linear codes, syndrome decoding, cyclic codes. In the cryptographic part, the classical chiphers are considered and followed by the modern systems for secret and public keys.
Scope of the course:
The aim of the course is students to acquire practical skills for working with linear codes over finite field, perfect codes, Hamming codes, and practical applications of coding theory and cryptography.

Methods: discussions, practical exercises on the codes under consideration

Preliminary requirements: The students must have basic knowledge from the Number theory and algebra, probability theory, coding theory and cryptography

Evaluation: permanent control during the semester (two written exams) and exam – coursework problem

Registration for the course: by application in the Educational Office
Registration for exam: up to agreement with the teacher and the Educational Office

Literature:

1. R. Hill. A first course in coding theory, Calderon Press, Oxford, 1986.

2. F. J. MacWilliams, N. J. A. Sloane, The theory of error-correcting codes, New York, North Holland, 1977 (руски превод Москва, Свьязр 1979).

3. W. Peterson, E. Weldon Jr., Error-correcting codes, Second edition, Cambridge (Mass), MIT Press, 1971 (руски превод Москва, Мир, 1976).

4. Р. Блейхут. Теория и практика кодов, контролирующих ошибки, Москва, Мир, 1986.

5. Записки (www.moi.math.bas.bg/~peter).

LOGIC PROGRAMMING

Semester: 2 semester
Type of Course: lectures and labs
Hours per week - 2 lectures + 1 seminar per week
Credits Numbers: 4,5
Course Status: Optional course from the Computer Science Bachelor Curriculum.

The course provides introduction to logic programming. The main techniques of the structural approach of programming and their application using Prolog programming language are introduced.
Objectives:
The aim of the course is to teach the students with the techniques in development of algorithms and programmes using Prolog programming language. The knowledge will be used in the general theoretical, and some special courses for example programming for artificial intelligence
Methods of teaching: lectures and labs in a computer classroom
Pre-requirements: Basic knowledge in "Programming and Data structures" and “Mathematical Logics”.
Exam: Written examination and discussion at the end of the semester, individual programming task and the general student’s work during the semester.
Registration for the Course: not necessary
Registration for the Exam: Coordinated with the lecturer and the Student Service Office
References:

1. М. Тодорова Езици за функционално и логическо програмиране, втора част Логическо програмиране. София, Сиела, 2003.
2. И. Держански, И. Ненова “Пролог за лингвисти.” Tempus S-JEP-07272-94, 1997.W. F. Clocksin, C. S. Mellish “Programming in Prolog” Springer-Verlag, 1984.
3. I. Bratko “Prolog Programming for Artificial Intilligence. Addison-Wesley,1986.
4. G. Metakides, A. Nerode “Principles of Logic and Logic Programming” Elsever, 1996.

5. John Malpas “Prolog: A Relational Language and its Application.Prentis-Hall,1987.

6. A. Thayse, P. Gribomont, G. Louis, D. Snyers, P. Wodon, P. Goshet, E. Gregoire, E. Sanchez, Ph. Delsarte “Approshe Logique de L’Intelligence Artificielle. Paris, Bordas, 1988.

7. J. Doores, A. R. Reiblein, S. Vadera “Prolog – programming for tomorrow” Sigma Press, 1987.

SOFTWARE ENGINEERING

Semester: **2 semester**
Type of Course: **lectures and tutorials in computer lab**
Hours per week: **2 hours lecture and 1 hour tutorials in computer lab**
Credits Numbers: **4,5 credits**
Course Status: Elective course in curriculum of major Informatics. Master degree.

Fundamental software engineering techniques and methodologies commonly used during software development are studied. Topics include various life cycle models, project planning and estimation, requirements analysis, program design, construction, testing, maintenance and implementation, software measurement, and software quality. Emphasized are structured and object-oriented analysis and design techniques, use of process and data models, modular principles of software design, and a systematic approach to testing and debugging. The importance of problem specification, programming style, periodic reviews, documentation, thorough testing, and ease of maintenance are covered.

Objectives:

- Analyze software development, define the key principles and techniques of software engineering and software project management.
- Identify the main bottlenecks and difficulties in the software process, and the available methods for mitigating them.
- Recognize challenges and opportunities associated with rapid technological advances in the field of software development.

Methods of teaching: lectures, tutorials, discussions, project based method.
Pre - requirements: No (core course)
Assessment and Evaluation
Project - 40%, Final Test - 60%
The course is successful completed with at least 65% of all scores.
Registration for the Course: No (core course)
Registration for the Exam: coordinated with the lecturer and the Student Service Office
References

1. Ескенази А., Н. Манева, Софтуерни технологии, II-ро преработено и допълнено издание, КЛМН, София 2006

2. Simple Easy Learning (2018) "Software Engineering Tutorial: Absolute Beginners"; https://www.tutorialspoint.com/software_engineering/index.htm.

COMBINATORICS, CODING THEORY, CRYPTOGRAPHY

Semester: **Second semester**
Form of the course: **Lectures/exercises**
Hours (per week): **3 hours lectures per week, summer semester**
Credits: **4,5 credits**

Status of the course in the educational plan:

The course is to be chosen in the educational plan of specialties Informatics, MSc after BSc in field different from Informatics.

Description of the course:
The course starts with introduction of the main notions of the Coding theory – error-correcting codes, Hamming distance, code parameters, equivalency of codes. Then the necessary algebraic background (finite fields and vector spaces over finite fields) is developed and encoding and decoding with linear codes (including syndrome decoding) are studied. Important classes of codes are introduced and the theory of cyclic codes is developed. In the cryptographic part the classical chiphers are considered and followed by the modern systems for secret and public keys.

Scope of the course:
Obtaining knowledge of the theoretical backgrounds and practical abilities for applications of the Coding theory and the cryptography. Development of abilities for work with (linear) codes over finite field with special emphasis of their algebraic and combinatorial properties.

Methods: lectures, discussions, practical exercises of the codes under consideration

Preliminary requirements: The students must have basic knowledge from the Number theory and algebra.

Evaluation: permanent control during the semester (two written exams) and exam in the semester's end in two parts – problems solving and answering theoretical questions.

Registration for the course: *by application in the Educational Office in the end of the semester*

Registration for exam: up to agreement with the teacher and the Educational Office

Literature:

1. Notices (www.moi.math.bas.bg/~peter)

2. Raymond Hill. A First Course in Coding Theory, Calderon Press, Oxford, 1986.

SCIENTIFIC PROGRAMING

Semester: 2 semester
Course Type: lectures
Hours per Week/FS/SS: 2 lecture and 3 lab hours per week hours per week/FS
ECTS Credits: 7 credits

Course Description: The proposed course will address some basic methods for designing and solving scientific problems. The main objectives of the course is to equip students with practical skills and knowledge to work with specialized software programs and search for information in academic libraries. The course will demonstrate the approach to the mathematical modeling of real problems and

ways of solving them. The models will be tested in practice.

Course Objectives:
Upon completing the course, the student should be able to:
- Describe the basic theoretical aspects of molecular modeling techniques
- Evaluate the successes and limitations of molecular modeling
- Analyze the results of molecular modeling calculations
- Evaluate and discuss current literature related to molecular modeling

Teaching Methods: : lectures
Requirements/Prerequisites: Computer skills,

Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
1. Basak S., Grunwald G., Niemi G., Use of Graph-Theoretic and Geometric Molecular Descriptors in Structure-Activity Relationships, in From Chemical Topology toThree-Dimensional Geometry, edited by Balaban A., Plenum Press N.Y., 1997
2. Baxter M.J., Beardah C.C.,Beyond the histogram − improved approaches to simple data display in archaeology using kernel density estimates, Department of Mathematics, Statistics and Operationa lResearch, The Nottingham Trent University, http://science.ntu.ac.uk/msor/ccb/romenew.ps
3. Baxter M.J., Beardah C.C.,MATLAB Routines for Kernel Density Estimation and the Graphical Representation of Archaeological Data Department of Mathematics, Statistics and Operational Research, The Nottingham Trent University, 2010, http://science.ntu.ac.uk/msor/ccb/caarev.ps
4. Boething R.S., Mackay D. (editors), Handbook of Property Estimation Methods for Chemicals. Environmental and Health Sciences, Lews Publishers, 2000
5. Bohacek R.S., McMartin C., Multiple Highly Diverse Structures Complementary to Enzyme Binding Sites: Results of Extensive Application of a de Novo Design Method Incorporating Combinatorial Growth

Abbreviation:
FS: Fall Semester
SS: Spring Semester

STATISTICAL ANALYSIS

Semester: 1 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 3 lecture hours and 2 lab hour per week/FS
ECTS Credits: 4 credits
Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: The proposed course will address some basic methods for statistical data analysis. The main objectives of the course are for students to acquire theoretical and practical skills and knowledge to work with specialized software for statistical analysis. The course will demonstrate the approach to the mathematical modeling of real problems and ways of solving them. The models will be tested in practice.

Course Objectives: Parametric and nonparametric methods in research for graduate students majoring in natural sciences or social sciences. The topics are selected from, but not restricted

to, contingency tables and chi-squared tests, correlation, simple linear regression and multiple regression, design and analysis of variance, logistic regression, and introduction to multivariate statistics. A major statistical package is used as a tool to aid calculations for many of the techniques.

Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Computer skills, Algebra

Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:

1. Eric Goh Ming Hui. Learn R for Applied Statistics: With Data Visualizations, Regressions, and Statistics, 1st edition, 2019, Apress, New York
2. An Introduction to Statistical Methods and Data Analysis, Belmont, 1997
3. Norman Matloff. The Art of R Programming, 2011

Abbreviation:
FS: Fall Semester
SS: Spring Semester

OPERATIONS RESEARCH

Semester: 3 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 3 lecture hours and 2 lab hours per week/FS
ECTS Credits: 7 credits
Department: Informatics, telephone: 073 / 588 532
Course Status: Optional Course in the Business Informatics and Econometrics M.S. Curriculum, period of study 4 semesters

Course Description: The course in Operations Research includes the following main topics: basic concepts in Operations Research; deterministic models, models with uncertainty and stochastic models, especially the facility location (production planning) problem in deterministic and stochastic version; stochastic programming and stochastic quasigradient methods; dynamic programming and Bellman's principle of optimality; the concept of algorithm, algorithmic (computational) complexity and NP-hard problems; discrete (including integer) optimization problems and network optimization; scheduling theory; queueing theory; game models, matrix game theory and the relationship between matrix game theory and linear programming; decision making theory; fuzzy sets and their application to decision making and management; multi-objective (vector) optimization and Pareto optimality; Markov processes (discrete and continuous); the concept of Monte-Carlo methods and their applications. Software for solving some of the problems under consideration will also be demonstrated.

Course Objectives: Students should obtain knowledge about basic results and methods for studying various real objects, events, phenomena, etc. by using mathematical methods and computes.

Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Numerical Analysis, Mathematical Optimization

Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects

(grade weight is 40 %).

Registration for the Course: **by request at the end of the previous academic year**
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
Basic Titles:

1. E. S. Vencel – „Operations Research: Problems, Principles, Methodology“, 3-rd ed., Knorus, Moscow, 2014 (in Russian).
2. Yu. P. Zaichenko – “Operations Research”, Slovo, Kiev, 2003 (in Russian).
3. S. M. Stefanov – “Quantitative Methods of Management”, 2003 (in Bulgarian).

Additional Titles:

4. Hamdy A. Taha – „Operations Research. An Introduction”, 10-th ed., Pearson, USA, 2017.
5. S. M. Stefanov – “Separable Programming. Theory and Methods”, 4-th ed., Springer, Dordrecht–Boston–London, 2016.

Abbreviation:
FS: Fall Semester
SS: Spring Semester

INTRODUCTION IN FINANCIAL MATHEMATICS

Semester: 3 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 3 lecture hours and 1 lab hour per week/FS
ECTS Credits: 4,5credits
Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: This course puts forward key mathematical and statistical topics to help students understand economics at a deeper level. After completing this course, students will have a basic level of understanding of the goals, assumptions, benefits and negatives of probability modeling. This understanding will be invaluable when approaching new statistical topics and will provide students with a framework and foundation for future self learning.

Course Objectives: Students should obtain knowledge about basic results and methods for studying various real objects, events, phenomena, etc. by using mathematical methods and computes.

Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Numerical Analysis, Mathematical Optimization

Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:

1. Eric Goh Ming Hui. Learn R for Applied Statistics: With Data Visualizations, Regressions, and Statistics, 1st edition, 2019, Apress, New York
2. Clarence H. Richardson. Financial Mathematics, Lightning Source Incorporated, 2008
3. Salih N. Neftci. An Introduction to the Mathematics of Financial Derivatives, Academic Press, 2000
4. Eric Goh Ming Hui. Learn R for Applied Statistics: With Data Visualizations, Regressions, and Statistics, 1st edition, 2019, Apress, New York

Abbreviation:
FS: Fall Semester
SS: Spring Semester

ECONOMETRICS

Semester: 3 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 3 lecture hours and 1 lab hour per week/FS
ECTS Credits: 4,5credits
Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: Learn mathematical, programming and statistical tools used in the real world analysis and modeling of financial data. Apply these tools to model asset returns, measure risk, and construct optimized portfolios using the open source R programming language and Microsoft Excel. Learn how to build probability models for asset returns, to apply statistical techniques to evaluate if asset returns are normally distributed, to use Monte Carlo simulation and bootstrapping techniques to evaluate statistical models, and to use optimization methods to construct efficient portfolios.

Topics covered include:

- Computing asset returns
  Univariate random variables and distributions
  - Characteristics of distributions, the normal distribution, linear function of random variables, quantiles of a distribution, Value-at-Risk

- Bivariate distributions
  - Covariance, correlation, autocorrelation, linear combinations of random variables
- Time Series concepts
  - Covariance stationarity, autocorrelations, MA(1) and AR(1) models
- Matrix algebra
- Descriptive statistics
  - histograms, sample means, variances, covariances and autocorrelations
- The constant expected return model
  - Monte Carlo simulation, standard errors of estimates, confidence intervals, bootstrapping standard errors and confidence intervals, hypothesis testing , Maximum likelihood estimation, review of unconstrained optimization methods

Course Objectives: Students should obtain knowledge about basic results and methods for studying various real objects, events, phenomena, etc. by using mathematical methods and computes.

Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Linear algebra, Numerical Analysis, Mathematical Optimization

Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

Registration for the Course: by request at the end of the previous academic year

References:

1. Eric Goh Ming Hui. Learn R for Applied Statistics: With Data Visualizations, Regressions, and Statistics, 1st edition, 2019, Apress, New York.
2. Numerical Methods in Finance and Economics A MATLAB Based Introduction Second Edition Statistics in Practice, John Wiley & Sons, 2009
3. Applied Statistics Using SPSS, STATISTICA, MATLAB and R, Springer, 2008
4. Хаджиев, В., Статистически и иконометричен софтуер, Варна, Унив. изд. ИУ, 2002, 112 с.
5. Knuth D.E. Postscript about NP-hard Problems, SIGACT News, 1974.
6. Reingold E.M., Neivergelt J., Deo N. Combinatorial algorithms (Theory and Practice), 1980.
7. М. Константинов. Въведение в Matlab. Софт Прес 2008.
8. Introduction in MATLAB. www.mathworks.com, 2011

Abbreviation:

FS: Fall Semester
SS: Spring Semester

TIME SERIES AND FORECASTING

Semester: 4 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 3 lecture hours and 1 lab hour per week/FS
ECTS Credits: 4.5credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: Course Time Series and Forecasting refers to the use of sophisticated tools both to understand the massive amounts of data most business have available, and to put it to use in forecasting and in making better business decisions. Our group includes experts in advanced analytics, operations management, management science and business statistics. The discipline has research strengths in the areas of financial time series and quantitative risk management; business and economic forecasting; econometrics and Bayesian statistics; computationally intensive estimation; supply chain management and scheduling theory.

Course Objectives: Students should obtain knowledge about basic methods and models for time series analysis.

Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Mathematical finance
Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).
Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:

1. Bovas Abraham. Johannes ledolter. Statistical Methods for Forecasting, A JOHN WILEY & SONS, INC., PUBLICA'TIONp 2010
2. Introduction to Time Series Analysis http://gauss.stat.su.se/gu/e/ slidesTim e%20Series/Introduction%20to%20Time%20Series% 20Analysis.pdf, 2012
3. H.Scott Bierman and Luis Fernandez, Game theory with Economic Applications, Addison-Wesley Publishing Company, USA, 1998.
4. Norman Matloff. The Art of R Programming, 2011
5. Jim Albert. Bayesian Computation with R, Springer, 2009.

6. Phil Spector. Data Manipulation with R, 2008.

Abbreviation:
FS: Fall Semester
SS: Spring Semester

FINANCIAL MANAGEMENT

Course Title: Financial Management
Semester: 4 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 3 lecture hours and 1 lab hour per week/FS
ECTS Credits: 4.5credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: This course will improve your fluency in financial accounting, the language of business. You will learn how to read, understand, and analyze most of the information provided by companies in their financial statements. These skills will help you make more informed decisions using financial information.The course is designed to provide an understanding of financial accounting fundamentals for prospective users of corporate financial information, such as investors, creditors, employees, and other stakeholders (e.g., suppliers, customers). The course focuses on understanding how economic events such as operating activities, corporate investments, and financing transactions are recorded in the three main financial statements (i.e., the income statement, balance sheet, and statement of cash flows). Students will develop the technical skills needed to analyze financial statements and disclosures for use in financial analysis. Students will also learn how accounting standards and managerial incentives affect the financial reporting process.

Course Objectives: Students should obtain knowledge about efficient and effective management of money (funds) in such a manner as to accomplish the objectives of the organization. It includes how to rise the capital, how to allocate it i.e. capital budgeting.

Teaching Methods: lectures and tutorials

Requirements/Prerequisites: Finance

Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).
Registration for the Course: by request at the end of the previous academic year

Registration for the Exam: coordinated with lecturer and Student Service Department

References:
1. Brealey R.A., Myers S.C., Principles of Corporate Finance, NY, McGrow – Hill, 1998
2. Rose. P.S., Money and Capital Markets, Boston, 1989.
3. Brigham E., Gapenski L., Daves P., Intermediate Financial Management, Sixth Edition, US, Florida, Orlando, The Dryden Press,1999
4. Ross S., Westerfield R., Jaffe J., Jordan B., Modern Financial Management, Eighth Edition, Gatton college of business and economics, University of Kentucky, 2008

Abbreviation:

FS: Fall Semester
SS: Spring Semester

FINANCE

Course Title: Finance
Semester: 4 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 3 lecture hours and 1 lab hour per week/FS
ECTS Credits: 3.0 credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: Financial institutions are a pillar of civilized society, supporting people in their productive ventures and managing the economic risks they take on. The workings of these institutions are important to comprehend if we are to predict their actions today and their evolution in the coming information age. The course strives to offer understanding of the theory of finance and its relation to the history, strengths and imperfections of such institutions as banking, insurance, securities, futures, and other derivatives markets, and the future of these institutions over the next century.
This course is primarily devoted to the fundamental principles of valuation. We will learn and apply the concepts of time value of money and risk to understand the major determinants of value creation. We will use both theory and real world examples to demonstrate how to value any asset.

Course Objectives: Students should obtain knowledge about efficient and effective management of money (funds) in such a manner as to accomplish the objectives of the organization. It includes how to rise the capital, how to allocate it i.e. capital budgeting.

Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Finance
Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).
Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:

1. R.A. Musgrave, P.B. Musgrave, L. Kullmer “Public Finance in Theory and Practice” McGraw- Hill, Inc 1973
2. H. Rosen “Public Finance” Irwin McGraw- Hill 1998.
3. Anthony B. Atkinson and Joseph E. Stiglitz (1980). Lectures in Public Economics, McGraw- Hill Economics Handbook Series
4. Alan S. Blinder, Robert M. Solow, et al. (1974). The Economics of Public Finance, Brookings Institution. Table of Contents.
5. James M. Buchanan, ([1967] 1987). Public Finance in Democratic Process: Fiscal Institutions and Individual Choice, UNC Press. Description, scrollable preview, back cover, and chapter links via Econlib.

Abbreviation:

FS: Fall Semester SS:
Spring Semester

FINANCIAL ANALYSIS

Semester: 3 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 3 lecture hours and 1 lab hour per week/FS
ECTS Credits: 5.0 credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: The lectures on "Financial Analysis" are been developed in accordance with the general objectives of the training in "Biznesinformatika and Econometrics." In structural terms, covering both basic issues common to analysis of financial condition and financial management of different legally registered commercial companies, as well as specific issues related to the determination of liquidity, solvency and profitability of the company, the possibilities of using the operational and financial leverage and application of methods for evaluating the effectiveness of investment projects.
Course Objectives: Students should obtain knowledge for the following elements of a firm: Profitability, Solvency, Liquidity, Stability.
Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Finance
Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).
Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
1. Haim Levy, Marshall Sarnat, Capital Investment and Financial Decisions, Grada Publishing, Prague, 1999
2. Ross S., Westerfield R., Jaffe J., Jordan B., Modern Financial Management, Eighth Edition, Gatton college of business and economics, University of Kentucky, 2008
3. Kieso, D. E., Weygandt, J. J., & Warfield, T. D. (2007). Intermediate Accounting (12th ed.). Hoboken, NJ: John Wiley & Sons, p. 1320 ISBN 0-471-74955-9.
4. Ehrhardt, M., Brigham, E. (2008). Corporate Finance: A Focused Approach (3rd ed.). p. 131 ISBN 978-0-324-65568-1.

Abbreviation:

FS: Fall Semester
SS: Spring Semester

INSURANCE

Semester: 3 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 2 lecture hours /FS
ECTS Credits: 7 credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: Teaching in the Discipline of Insurance is informed by the four key areas in which risk is manifest, namely the risk of loss or damage to property; injury, loss or death to people; illness; and living too long. These risks drive the short-term insurance, life insurance, medical insurance, and retirement funding markets. Conceptually these areas are underpinned by the economic theory of risk and insurance, to which a substantial portion of

the third year course is devoted.
The course "Insurance" aims to familiarize students with the content and importance of insurance relations as a specific type of economic and financial relations with the activities through which they are carried out and the impact of the state on the the strengthening and development. With the types protection insurance and practices enabling the learners course to be oriented and aware of the main points related to the implementation of the insurance activity with emphasis on its practical dimensions represented by the specific insurance products.

Course Objectives: Students should obtain knowledge about the Insurance. Insurance involves pooling funds from many insured entities (known as exposures) to pay for the losses that some may incur. The insured entities are therefore protected from risk for a fee, with the fee being dependent upon the frequency and severity of the event occurring. In order to be an insurable risk, the risk insured against must meet certain characteristics. Insurance as a financial intermediary is a commercial enterprise and a major part of the financial services industry, but individual entities can also self-insure through saving money for possible future.
Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Finance
Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).
Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
1. Haurant S. (2005). FSA takes on insurance regulation. The Guardian.
2. Franklin, J., 2001, The Science of Conjecture: Evidence and Probability Before Pascal, Baltimore: Johns Hopkins University Press, 259.
3. Gollier C. (2003). To Insure or Not to Insure?: An Insurance Puzzle. The Geneva Papers on Risk and Insurance Theory;).
4. Margaret E. Lynch, Editor, "Health Insurance Terminology", Health Insurance Association of America, 1992, ISBN 1-879143-13-5.

Abbreviation:

FS: Fall Semester
SS: Spring Semester

STOCK MARKETS

Course Title: Stock markets
Semester: 4 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 3 lecture hours and 1 lab hour per week/FS
ECTS Credits: 2.0 credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: The classical economic theory of markets cannot account for some important issues, such as the coexistence of unemployment and vacancies; credit market rationing; or bubbles and crashes in asset prices. This course will explore markets with frictions, shedding light on these issues and other fundamental questions such as: What is a bank, why do we use money.

Financial institutions are a pillar of civilized society, supporting people in their productive ventures and managing the economic risks they take on. The workings of these institutions are important to comprehend if we are to predict their actions today and their evolution in the coming information age. The course strives to offer understanding of the theory of finance and its relation to the history, strengths and imperfections of such institutions as banking, insurance, securities, futures, and other derivatives markets, and the future of these institutions over the next century.

Course Objectives: Students should obtain knowledge about stock markets. Market participants include individual retail investors, institutional investors such as mutual funds, banks, insurance companies and hedge funds, and also publicly traded corporations trading in their own shares. Some studies have suggested that institutional investors and corporations trading in their own shares generally receive higher risk-adjusted returns than retail investors.
Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Finance
Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
1. "World Equity Market Declines: -$25.9 Trillion". Seeking Alpha. Retrieved 2011-05-31.
2. Quarterly Review Statistical Annex – December 2008". Bis.org. September 7, 2008. Retrieved March 5, 2010.
3. Cesari, Amedeo De; Espenlaub, Susanne; Khurshed, Arif; Simkovic, Michael (2010). "The Effects of Ownership and Stock Liquidity on the Timing of Repurchase Transactions". Paolo Baffi Centre Research Paper No. 2011-100. SSRN 1884171.
4. Simkovic, Michael (2009). "The Effect of Enhanced Disclosure on Open Market Stock Repurchases". Berkeley Business Law Journal 6 (1). SSRN 1117303

Abbreviation:

FS: Fall Semester
SS: Spring Semester

INTERNATIONAL FINANCE

Course Title: International finance
Semester: 4 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 2 lecture hours/SS
ECTS Credits: 2.0 credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: This course will discuss various aspects of the internationalization, including the reform of the international monetary system, the opportunities and challenges to internationalize, the evolution of monetary and exchange rate policies, and the implications .
This course will discuss various aspects of internationalization. Specifically, innovative

suggestions will be provided on topics including the reform of the international monetary system, the opportunities and challenges of the internationalization, and the evolution of monetary and exchange rate policies.
Since the internationalization is important to the future of an international financial center, the lectures will also discuss the possible implications of this process.

Course Objectives: This course provides the student the knowledge and skills needed to manage the complexities of financing exports, imports, and direct foreign investment. Primary topics include the nature or behavior of foreign exchange rates and managing the impacts of exchange rates on short- term and long-term international business activities and performance objectives. This course can be adapted for graduate or undergraduate levels.

Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Finance
Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).
Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:

1. Brigham E.F., Houston J.F., (2001), "Fundamentals of Financial Management", Harcourt College Publishers, 959 p.;
2.Mishkin F. S., (1992), "The Economics of Banking and Financial markets", Harper Collins pbl.; 3.Madura J., (2010), Financial Institutions and Markets, South-Western College Publishing; 4.Douglas L. G., (1990), Bonds Risk Analysis, New York Institute of Finance;
5.Hyman D., (1988), Economics, IRWIN;
6.Gandolfo G., (1987), International Monetary Theory and Open Economy Macroeconomics, Springer Verlag;

7.Banking Sector Development in Central and Eastern Europe, (1996), Institute for EastWest Studies; 8.Buckle M., Thompson J., (1999), The UK Financial System: Theory and Practice, Manchester University Press;
9.Block S., Hirt G., (1984), Foundations of Financial Management, RICHARD D. IRWING, INC.; 10.Ganchev G., (2000), Macroeconomic Problems (The Currency Board Arrangement; Maastricht Criteria; Macroeconic Policy), in Monitoring of Bulgaria's Accession to the European Union, Friedrich Ebert Stiftung, Sofia;

Abbreviation:

FS: Fall Semester
SS: Spring Semester

THEORY OF MONEY

Semester: 4 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 2 lecture hours/SS
ECTS Credits: 2.0 credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: The last three or four decades have seen a remarkable evolution in the institutions that comprise the modern monetary system. The financial crisis of 2007-2009 is a

wakeup call that we need a similar evolution in the analytical apparatus and theories that we use to understand that system. This course is an attempt to begin the process of new economic thinking by reviving and updating some forgotten traditions in monetary thought that have become newly relevant. Three features of the new system are central:

Most important, the intertwining of previously separate capital markets and money markets has produced a system with new dynamics as well as new vulnerabilities. The financial crisis revealed those vulnerabilities for all to see.
Second, the global character of the crisis has revealed the global character of the system, which is something new in postwar history but not at all new from a longer time perspective. Central bank cooperation was key to stemming the collapse, and the details of that cooperation hint at the outlines of an emerging new international monetary order.
Third, absolutely central to the crisis was the operation of key derivative contracts, most importantly credit default swaps and foreign exchange swaps. Modern money cannot be understood separately from modern finance, nor can modern monetary theory be constructed separately from modern financial theory. That's the reason this course places dealers, in both capital markets and money markets, at the very center of the picture, as profit-seeking suppliers of market liquidity to the new system of market-based credit.
Course Objectives: Students should obtain knowledge about the monetary economics.
Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Finance
Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).
Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:

1. Madura J., Financial Markets and Institutions, South-Western College Publishing, 2001.
2. Douglas L. G., Bonds Risk Analysis, New York Institute of Finance, 1990.
3. Hyman D., Economics, IRWIN, 1988.
4. Gandolfo G., International Monetary Theory andOpen Economy Macroeconomics, Springer Verlag, 1987
5. Banking Sector Development in Central and Eastern Europe, Institute for East West Studies, 1996
6. Buckle M., Thompson J., The UK Financial System: Theory and Practice, Manchester University Press, 1999
7. Block S., Hirt G., Foundations of Financial Management, RICHARD D. IRWING, INC., 1984
8. Ganchev G., Macroeconomic Problems (The Currency Board Arrangement; Maastricht Criteria; Macroeconic Policy), in Monitoring of Bulgaria's Accession to the European Union, Friedrich Ebert Stiftung, Sofia 2000

Abbreviation:
FS: Fall Semester
SS: Spring Semester

GAME THEORY FOR ECONOMISTS

Course Title: Game Theory for Economists
Semester: 4 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 2 lecture hours/SS

ECTS Credits: 2.0 credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: Game Theory for Economists studies the interactions of decision makers whose decisions affect each other. The analysis is from a rational viewpoint: every participant would like to obtain the outcome that he prefers most. However, each one has to take into account that the others are doing the same trying to get what they prefer most. At times this leads to fierce competition; at other times, to mutually beneficial cooperation; and in general, to an appropriate combination of these two extreme behaviors. Game theory, which may be viewed as a sort of "unified field" theory for the rational side of social science, develops the theoretical foundations for the analysis of such multi- person interactive situations, and then applies these to many disciplines: economics, political science, biology, psychology, computer science, statistics and law. Foremost among these is economic theory, where game theory is playing a central role.
Course Objectives: Students should obtain knowledge about the game theory and representation the game in Extensive form, Normal form and Characteristic function form.
Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Economics and Mathematical models.
Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).
Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:

1. Eric Goh Ming Hui. Learn R for Applied Statistics: With Data Visualizations, Regressions, and Statistics, 1st edition, 2019, Apress, New York
2. Game Theory, 2013, Massachusetts Institute of Technology, http://gametheory.net/lectures/level.pl 3.Robert Gibbons, Game theory for applied economists, Princeton University Press,1992.
4. J. McMillan , Games, Strategies and Managers, Oxford, 1992.
5. R. Myerson, Game theory:Analysis of conflict, Harvard University Press,1991
6. H.Scott Bierman and Luis Fernandez, Game theory with Economic Applications, Addison-Wesley Publishing Company, USA, 1998.

Abbreviation:

FS: Fall Semester
SS: Spring Semester

ANALYSIS OF FINANCIAL RISK

Course Title: Analysis of Financial Risk
Semester: 4 semester
Course Type: lectures and tutorials
Hours per Week/FS/SS: 2 lecture hours/SS
ECTS Credits: 2.0 credits

Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description: This course is an introduction to the theory and practice of financial engineering and risk management. We consider the pricing of derivatives, portfolio optimization and risk management and cast a critical eye on how these are used in practice.

Financial Engineering is a multidisciplinary field involving finance and economics, mathematics, statistics, engineering and computational methods. The emphasis of this course will be on the use of simple stochastic models and optimization for portfolio optimization, derivatives pricing and risk management.
Course Objectives: We hope that students who complete the course will have a good understanding of the "rocket science" behind financial engineering. But perhaps more importantly, we hope they will also understand the limitations of this theory in practice and why financial models should always be treated with a healthy degree of skepticism.
Teaching Methods: lectures and tutorials
Requirements/Prerequisites: Economics
Assessment: written final exam on two theoretical topics (grade weight is 60 %); two projects (grade weight is 40 %).

Registration for the Course: by request at the end of the previous academic year
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
1. K.K. Aase. On the St. Petersburg paradox. *Scand. Actuar. J.*, (1):69–78, 2001
2. Z. Bodie and R.C. Merton. Finance. Prentice Hall, 2000.
3. E.V. Boguslavskaya. Exact solution of a problem of the optimal control of investments in a diffusion model. Uspekhi Mat. Nauk, 52(2(314)):157–158, 1997.
4. A.N. Shiryaev. Quickest detection problems in the technical analysis of the financial data. In H. Geman et al., editor, in Mathematical Finance - Bachelier Congress 2000, pages 487–521, New York, 2002. Springer-Verlag.

Abbreviation:
FS: Fall Semester
SS: Spring
Semester

PROGRAMMING WITH R LANGUAGE

Semester: 1
Course Type: lectures and lab
Hours per Week/FS/SS: 3 lecture and 2 lab hours per week hours per week / FS
ECTS Credits: 4
Course Status: Optional Course in the Bisnesinformatics and Econometrics M.S. Curriculum

Course Description:

The course will demonstrate the ability of some scripting languages in processing data obtained from those obtained from various research activities. The created models will be tested in practice. Examples of scripting languages are: R language

Course Objectives:

The expected results are related and result from the set goal and tasks.

Teaching Methods: lectures and tutorials

Requirements/Prerequisites: Basic knowledge of numerical methods and mathematical optimization is required.

Assessment: written exam on two topics from the Synopsis, drawn at random (the grade is 60%); current control: two course assignments (assessment weighs 40%).

Registration for the Course: it is necessary to submit an application to the academic department at the end of the previous school year.

Registration for the Exam: coordinated with lecturer and Student Service Department

References:

1. Eric Goh Ming Hui. Learn R for Applied Statistics: With Data Visualizations, Regressions, and Statistics, 1st edition, 2019, Apress, New York.
2. Norman Matloff. The Art of R Programming, 2011
3. Jim Albert. Bayesian Computation with R, Springer, 2009.
4. Phil Spector. Data Manipulation with R, 2008.
5. Brian S. Torvitt, Torsten Hothorn. A Handbook of Statistical Analyses 2006. John Maindonald, John Braun.
6. Data Analysis and Graphics Using R: An Example-Based Approach, Cambridge University Press, 2003.

Abbreviation:

FS: Fall Semester
SS: Spring Semester