QUALIFICATION CHARACTERIZATION OF MAJOR FIELD OF STUDY "ECONOMICAL MATHEMATICS" FOR "MASTER OF SCIENCE" DEGREE WITH PROFESSIONAL QUALIFICATION "MASTER OF MATHEMATICS"

Major "Economical mathematics" is of professional field 4.5 Mathematics. Education in a degree "Master" has a regular form lasts one year (two semesters).

General characteristics of the program: The students completed this major fild of study have specialized knowledge and skills in modern applications of mathematics and mathematical modeling. By incorporating Informatics disciplines, ensure students' knowledge in the field of information systems in the economy. Part of the courses are optional, which allows students to prepare more thoroughly in their desired field of theory and applications of mathematics, and to attend additional courses in mathematics, informatics, economics, insurance and other. The training ends with a state exam or thesis defense, which will allow them to individually solve relevant to mathematics and its application tasks.

Requirements to preparation of students completing this major field of study

Students completed MSc degree in Economical Mathematics have to possess following knowledge, skills and competences:

- Skills to create a mathematical model of a situation to prove mathematical statements and to solve problems with theoretical or applied nature;
- Ability to abstraction, logical development of formal mathematical theories and establishing links between them;
- Ability for mathematical modeling of real world phenomena and describe through mathematical apparatus of the studied processes and phenomena;
- Ability to deal with new tasks from different areas of knowledge;
- Ability to understand problems and derive the general regularities in them;
- Ability to formulate complex problems of optimization, decision making and to interpret the obtained solutions in terms of the context of the problem to be solved;
- Ability to make mathematical arguments and conclusions from them clear, precise and accurate mathematical language, in oral and written form to those for whom it is intended decision of the mathematical problem;
- Knowledge of the process of learning and teaching of mathematics in different levels of training.

Career opportunities: The students completed this Master's program are prepared to apply mathematical formalism and use new technologies in different application areas - banks, insurance companies, the economy and trade, scientific research teams. Graduates of the Master's program "Economical Mathematics" have the opportunity to continuing education at PhD degree. They can work as teachers and researchers in universities and research institutes.

Qualification characterization of Major field of study "Economical Mathematics" for MSc degree is a basic document that determines rules for developing the curriculum. This qualification characterization is conformed to legislation in the area of higher education in Republic of Bulgaria.

CURRICULUM Field of Study: Economical Mathematics, 2016

First Year			
First Semester	ECTS credits	Second Semester	ECTS credits
Compulsory Courses		Compulsory Courses	
Micro and Macroeconomics	8.0	Information science in economics	5.0
Finance	5.5	Stochastic models in economics	5.0
Financial mathematics	6.0	Optional course	5.0
Operations research	5.5	Thesis	15.0
Optional course	5.0		
		<u>Optional Courses</u>	
<u>Optional Courses</u>		Game theory	5.0
Finance and financial operations	5.0	Nonlinear dynamics and economics	5.0
Insurance	5.0	Time series	5.0
Econometrics	5.0		
Technologies, competition and	5.0		
business strategies in the XXI			
century			
	Total 30		Total 30

TOTAL FOR 1 ACADEMIC YEAR: 60 CREDITS

COURSES DESCRIPTION

COMPULSORY COURSES

MICRO AND MACROECONOMICS

Semester: 1 semester
Course Type: Lectures and seminars
Hours per week: 3 lecture hours and 3 seminar hours / Fall Semester
ECTS credits: 8,0 credits
Lecturer: Assoc. Prof. Dr. Plamen Patchev, PhD
Department: Department of International Economic Relations, Faculty of Economics, South-West University "Neofit Rilski" – Blagoevgrad, e-mail: plamenp@swu.bg
Course Status: Compulsory course in the M.Sc. Curriculum of Economic Mathematics.
Short Description: The course is designed primarily for the analysis of the main aspects of

the theory and practice of democratic market economy type. It clarifies the basic methodological formulations and provides an overview of economic laws, valid for the entire line of business /those having universal significance/. Course contents: Need, purpose, and key aspects of developing and managing projects. Nature and basic characteristics of the financial analysis of projects. Stages and key areas of financial analysis of projects. Basic financial concepts. Time value of money. Compounded and discounted cash flows. Annuities. Criteria and methods of financial analysis and project evaluation. Static methods

for financial analysis of projects. Dynamic methods of financial analysis of projects. Choice between alternative projects. Methods for selecting between two or more projects. Essence of the risk in developing and managing projects. Approaches and methods of analysis and risk assessment.

Course Aims: The aim is to justify the idea that the entire business as a direct or indirect connection with the major issues of supply and demand, "strong" and "weak" pulse of the market on "balance" the efficiency and profitability of implementation of specific planning, reporting mandatory conditions ensuring economic development entities in the long term, etc.

Teaching and assessment: Teaching is in the form of lectures and seminars. At the beginning of each lecture a short introduction is provided to ease the transition from one topic to another. New topics are discussed with students to achieve continuity of training and help students draw their own conclusions.

Registration for the exam: coordinated with the lecturer and student Service Department **References:**

Basic Titles

- 1. Е. Бояджиева, М. Кьоглер. Основи на икономическата теория. Благоевград 2005.
- 2. Л. Йотова. Икономикс. Част I и II. Изд. УНСС, София 2008.
- 3. И. Димов. Обща икономическа теория. Изд. "Абагар". В. Търново 2004.
- 4. Г. Хартман. Пазарна икономика. Част I и II. Изд. "Булвест-2000", София 2003.
- 5. Е. Сотирова. Сборник от задачи тестове по макроикономика. УНСС, София 2003.
- 6. Проф. Стоядин Савов "Икономикс", С. 1996 г. в два тома.
- 7. Проф. Камен Миркович, "Икономикс", С. 2001 г.
- 8. Пламен Пъчев "Микроикономика" С.-Бл. 2011 г.

Additional Titles

- 1. Дж. М. Кейнс. Обща теория на заетостта, лихвата и парите. Изд. "Хр. Ботев", София 1994.
- 2. М. Фридмън. Немирството на парите. Епизоди от монетарната история. ИК "Дамян Яков", София 1994.
- 3. Р. Рийч. Трудът на нациите. Как да се подготвим за капитализма на XXI век. Унив. изд. "Св. Климент Охридски", София 1992.
- 4. Р. Хайлбронер, Л. Търоу. Икономика за всички. Изд. "Интерпринт", София 1993.
- 5. Учебен речник по икономикс. Том I и II. Изд. "Сиела", София 2003.
- 6. Проф. Поль Самуэлсон "Экономика", М. 1976 г. /Препоръчително е да се ползват учебниците на този автор самостоятелно или в съовторство с Нордхаус на съответните западни езици, които студентът владее/
- 7. Проф. Гернот Хартман "Пазарна икономика", С. 1992 г. в две части

FINANCE

Semester: 1 semester

Course Type: Lectures and seminars

Hours per week: 3 lecture hours and 1 seminar hour /Fall Semester

ECTS credits: 5.5 credits

Lecturer: Assoc. Prof. Elena Stavrova, PhD

Department: Department of Finance and accounting, Faculty of Economics, South-West University "Neofit Rilski" – Blagoevgrad

tel. +35973588532, e-mail: stavrova@swu.bg

Course Status: Compulsory course in the M.Sc. Curriculum of Economic Mathematics.

Short Description: The course is aimed to transmit to the students the basic knowledge about the state fiscal and budget policy. The material includes a reasonable compromise between theoretical and practical information. The course is aimed at letting the students: (i) to consider the particularities of the state finance system; (ii) to acquire new basic knowledge and skills for organizing and managing of the public finances; (iii) to be aware of the methods for planning and regulating in the state fiscal and budget sphere, as well as of the applicable organization structures in this regard; (iv) to apply the existing techniques for generation of innovative and creative ideas in the tax policy; (v) to be able to identify, evaluate and avert and limit the risk that accompany the management of the public finances. **Course contents:** Money. Pubic (fiscal) finances. Consolidated State Budget. Budget Processing. Fiscal Decentralization. Taxes. Tax System and Tax Policy. Direct Taxation of the Property. Direct Income Taxation. Indirect Taxation. Excise Duties. Customs Duties and Customs Duty Policy. Value Added Tax. The Non Tax Revenues in the State Budget. Social Insurance. Budget Deficit and its Financing. Tax and Finance Controlling. International Public Finances

Teaching and assessment: Teaching is in the form of lectures. At the beginning of each lecture a short introduction is provided to ease the transition from one topic to another. New topics are discussed with students to achieve continuity of training and help students draw their own conclusions. In training priority is given to practical and independent work by students.

Registration for the exam: coordinated with the lecturer and student Service Department **References:**

Basic Titles

- 1. Ч. Николов Д. Стоилова Е. Ставрова "Публични финанси" БОН Благоевград 2010
- 2. Стоянов, В., Финанси, ИК Галик, София, 2008

Additional Titles

- 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

FINANCIAL MATHEMATICS

Semester: 1 semester

Course Type: lectures and seminars

Hours per Week: 3 lecture hours and 2 seminars hour / Fall Semester

ECTS Credits: 6.0 credits

Lecturers: Associate Professor Mihail Kolev, Ph.D.

Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,

tel. +35973588532, e-mail: mkkolev@abv.bg

Course Status: Compulsory course in M.Sc. Curriculum of Economic Mathematics.

Course Description:

The subject includes the study of basic concepts of financial mathematics, financial calculations which are used in the process of banking practice. Students are also introduced to the basics of statistical databases and obtain information about patterns and trends that may occur, their utility in the evaluation and decision-making in certain activities in the bank sector.

Purposefully, emphasis is put on the instrumentation and the application of statistical methods that emerge in different banks, namely: addition, organization and presentation of statistical data, presentation of statistics, descriptive statistics, variance, correlation, indexing, and analysis of time series. Practical application methods related to the use of different quantitative methods in economics are treated – types of interests, calculation features of discount operations and techniques of discounted cash flows, preparation of repayment plans and methods that calculate the profitability of financial instruments.

Course Aims:

The subject "Financial Mathematics" aims to offer a thorough and detailed understanding of the concepts, principles, approaches and techniques in financial calculations.

Teaching Methods: lectures and seminars

Requirements/Prerequisites: Mathematical Analysis I

Assessment: written final exam, two problems solving tests per semester

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

- 1. Мейсън, А., Браун, Л., Петров, С., Финансова математика, МБИ, София, 2012, г.
- 2. Дочев, Д., Николаев, Р., Петков, Й., Финансова математика, Варна, Унив. Издат. Наука и икономика, 2010, ISBN: 978 954 21 0499 5.
- 3. Цончев, Р., Финансови изчисления, НБУ.
- 4. Йовков, Й. Петков, В., Финансова математика, "Нова звезда", София, 2001, ISBN: 954 8981 32 7.

5. Van Horn, J., Vachowicz Jr., Fundaments of Financial Menagement, Prentice Hall, Upper Saddle River, New Jersy 07458, 2001.

OPERATIONS RESEARCH

Semester: 1 semester Course Type: lectures and tutorials Hours per Week: 2 lecture hours and 2 lab hour per week/Fall Semester ECTS Credits: 5.5 credits Lecturer: Prof. Peter Milanov, PhD Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532, e-mail: milanov@swu.bg Course Status: Compulsory course in M.Sc. Curriculum of Economic Mathematics. 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; Marcov 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 Exam: coordinated with lecturer and Student Service Department **References:**

- 1. E. S. Vencel "Operations Research: Problems, Principles, Methodology", 2-nd ed., Nauka, Moscow, 1988 (in Russian).
- 2. Yu. P. Zaichenko "Operations Research", Visshta Shkola, Kiev, 1988 (in Russian).
- 3. S. M. Stefanov "Quantitative Methods of Management", Heron Press, Sofia, 2003 (in Bulgarian).
- 4. Hamdy A. Taha "Operations Research. An Introduction", 9-th ed., Prentice Hall, USA, 2010.
- 5. S. M. Stefanov "Separable Programming. Theory and Methods", Kluwer Academic Publishers, Dordrecht–Boston–London, 2001.

INFORMATION SYSTEMS IN ECONOMICS

Semester: 2 semester

Course type: Lectures and tutorials in computer lab

Hours per Week: 1 lecture hour and 3 lab hour per week / Summer Semester

ECTS Credits: 5.0 credits

Lecturer: Assoc. Prof. Ivan Trenchev, Ph.D.

Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,

tel. +35973588532, e-mail: trenchev@swu.bg

Course status: Compulsory Course in M.Sc. Curriculum of Economic Mathematics

Course description:Information society. Abstract models of computers. Programming technology. Hardware and software. Operation systems. Word processing. Table-processing – MS-EXCEL. Computer networks. HTML and XML documents. E-mail, web-browsing, FTP.

Course aims: Non-trivial introduction in basic information systems and technologies used in economics.

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

Requirements/ Prerequisites: Basic knowledge in Computer science.

Materials: Textbook and manual of the course are published; 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 exam: in the department office, co-ordinated with the lecturer.

Literature:

- 1. Пламенка Боровска, Компютърни системи, Сиела, 2009.
- 2. Ангел Ангелов, Учебна среда за обучение по електронни таблици, София, 2012.
- 3. Марсел Гание, Преминаване към Linux + CD, СофтПрес, 2010.
- 4. Windows Vista в лесни стъпки, СофтПрес, 2010.
- 5. Венцислав Джамбазов, Уеб базирани потребителски интерфейси, НБУ, 2011.
- 6. Георги Илиев, Димитър Атамян, Мрежи за данни и интернет комуникации, Нови знания, 2009.
- 7. Денис Колисниченко, HTML 5 & CSS 3 практическо програмиране за начинаещи, Асеневци, 2012.
- 8. Анета Зашева, Информационни системи Приложение в оперативното управление, София, 2012.

STOCHASTIC MODELS IN ECONOMICS

Semester: 2 semester Course type: Lectures and tutorials in computer lab Hours per Week: 2 lecture hours and 2 lab hour per week / Summer Semester ECTS Credits: 5.0 credits Lecturers: Assoc. Prof. Elena Karashtranova, PhD **Department:** Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,

tel. +35973588532, e-mail: <u>helen@swu.bg</u>

Course status: Compulsory Course in M.Sc. Curriculum of Economic Mathematics **Short Description**: The main topics to be considered:

- basic economic tasks that require stochastic modeling;
- construction of stochastic models of real problems of economy and analyzing them;
- practical ability to construct stochastic models and etc.

Course Aims: The aim of the studied subject is to give students theoretical knowledge and practical experience in the construction of stochastic models in the economy.

Teaching Methods: Lectures, tutorials, homework, problem-solving tests. During the lectures students are acquainted with the basic theoretical material- definitions, theorems, applications, with the methods of theorems proofs. During seminars students solve practical problems. The knowledge obtained within the theoretical practice is used and it is also used in the process of problem solving.

Requirements/Prerequisites:

Assessment: permanent control during the semester including homework and two written exams, and written exam in the semester's end on topics from tutorials and on topics from lectures.

Registration for the exam: coordinated with the lecturer and student Service Department **References:**

Basic Titles:

1. Аласдър Смит. Математическо въведение в икономиката. Изд. "Кл. Охридски" 2000

- 2. Oksendal B., StochasticDifferentialEquations, 6th edition, Springer, 2003.
- 3. Ross S.M., Introduction to ProbabilityModels, 10th edition, AcademicPress, 2010.

4. Божкова М., Случайни процеси, 2012

Additional Titles:

1. Grimmett G., Stirzaker D., *ProbabilityandRandomProcesses*, 3rd edition, Oxford UniversityPress, 2001.

2. Димитров Б., Янев Н., *Вероятности и статистика*, Университетско издателство "Св. Климент Охридски", 2002.

3. Стоянов Й., Стохастични процеси – теория и приложение, Наука и изкуство, 1978

OPTIONAL COURSES

FINANCE AND FINANCIAL OPERATIONS

Semester: 1 semester Course Type: lectures Hours per Week: 2 lecture hours per week/Fall Semester ECTS Credits: 5.0 credits Lecturer: Prof. Gancho Ganchev, PhD Department: Department of Finance and accounting, Faculty of Economics, South-West University "Neofit Rilski" – Blagoevgrad, e-mail: ganchev@swu.bg Course Status: Optional course in M.Sc. Curriculum of Economic Mathematics

Course Description: The course "Finance and financial operations" aims to introduce students to the theory of capital markets, as well as the most important institutional fundamentals of stock trading and stock exchange transactions.

The material is selected in accordance with the prescribed workload and specifics of the course and within a reasonable compromise between the theoretical and empirical material gives priority to the relationship between economic theory and actual market behavior of investors, issuers and other market agents. To this end, consider some topics that are not included in the curriculum in securities and financial markets of other economic subjects.

Discipline is one of the main subjects in the training of specialists with higher economic education of all specialties. It specifies a number of theoretical issues related to micro and macroeconomics, while giving practical knowledge necessary for successful work in a competitive market environment

Course Aims: The aim of the course is to give students the necessary theoretical knowledge for correct interpretation of the economic behavior of investors, issuers, speculators, brokers and financial supervisory authorities.

Teaching and assessment: Teaching is in the form of lectures. At the beginning of each lecture a short introduction is provided to ease the transition from one topic to another. New topics are discussed with students to achieve continuity of training and help students draw their own conclusions. In training priority is given to practical and independent work by students.

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

References:

Basic Titles:

- 1. Кругман П. Р., Международен икономикс, УНСС, София 2014
- 2. Ганчев Г. Т., Финансите като система, Благоевград, 2010
- 3. Попов Д., Ценни книжа и фондови борси, Сиела, 2001 г., 367 с.
- 4. Стоянов С., Фючърси, опции и синтетични ценни книжа, Тракия-М, 1999 г., Б

5. Ганчев Г., Ставрова Е., Международни финанси и финансова политика, Благоевград, 2009.

Additional Titles:

- 1. 50 Years of Money and Finance: Lessons and Challenges, SUERF, 2013
- 2. Madura J., Financial Markets and Institutions, South-Western College Publishing, 2001
- 3. Douglas L. G., Bonds Risk Analysis, New York Institute of Finance, 1990
- 4. Hyman D., Economics, IRWIN, 1988
- 5. Gandolfo G., International Monetary Theory and Open Economy Macroeconomics, Springer Verlag, 1987

6. Banking Sector Development in Central and Eastern Europe, Institute for EastWest Studies, 1996

7. Buckle M., Thompson J., The UK Financial System: Theory and Practice, Manchester University Press, 1999

8. Block S., Hirt G., Foundations of Financial Management, RICHARD D. IRWING, INC., 1984

9. 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

10. Стоименов, Милчо, Финансиране на международната търговия, София, 1999

11. Христов М., Христов С., Книга за парите, АБАГАР, 2002

12. Йорданов Й., Инвестиционни фондове: Структура, мениджмънт, оценка, Варна 2002.

13. Неновски, Николай, Свободните пари, издателство "Проф. Марин Дринов", БАН, София, 2000 г.

INSURANCE

Semester: 1 semester Course Type: lectures Hours per Week: 2 lecture hours per week/Fall Semester ECTS Credits: 5.0 credits Lecturer: Assistant Prof. Vladimir Tsenkov, PhD

Department: Department of Finance and accounting, Faculty of Economics, South-West University "Neofit Rilski" – Blagoevgrad, e-mail: <u>v.tsenkov@swu.bg</u>

Course Status: Optional course in M.Sc. Curriculum of Economic Mathematics **Course Description:** The goal of the course is to introduce to the students the essence of insurance as a specific type of business and the role of the state in insurance. Different types of insurance contracts are presented with an emphasis on their permanent features and characteristics.

Course contents: Essence, functions and significance of insurance. Types of insurance contracts in the Republic of Bulgaria according to the Insurance Act. Personal and property insurance. Life insurance – types and characteristics. Entering into an insurance contact. Insurance contracts offered in Bulgaria and their characteristics. Covered and uncovered risks. Object and subject of insurance. Insurer's liability. Insurance sum and insurance premium. Liquidation of damage. Income and expenditures of insurance companies. Reserves and taxation of insurance companies. Marketing strategies in insurance.

Teaching and assessment: Teaching is in the form of lectures. At the beginning of each lecture a short introduction is provided to ease the transition from one topic to another. New topics are discussed with students to achieve continuity of training and help students draw their own conclusions. Lectures are enriched with tables, schemes and practical examples to illustrate theory. The course ends with an examination. In training priority is given to practical and independent work by students. Students are informed about the organization of training, the on-going control, the assessment and examination at the first lecture. **Registration for the Course:** by request at the end of the previous academic year **Registration for the exam:** coordinated with the lecturer and student Service Department

References:

- 1. Илиев, Б., "Застраховане", изд. "Фабер", 2013;
- 2. Христозов, Ж., Димитров, П., "Застрахователни продукти", издателство на ВУЗФ, 2012;
- 3. Илиев, Б., Ерусалимов, Р., "Застрахователни продукти", изд. "Фабер", 2009;
- 4. Йотов, Й., Илиев, Б., "Основи на застраховането", Свищов, 2004;
- 5. Илиев, Б. и др., "Основни принципи на застраховането", изд. Свищов, 2008;
- 6. Драганов, Хр., Близнаков, Й., "Застраховане", изд. Тракия-М, 2000;
- 7. Драганов, Хр., Нейков, М., "Имуществено и лично застраховане", изд. Тракия-М, 2008;
- 8. Габровски, Р. и др., "Корпоративен риск мениджмънт", Свищов, 2004;

- 9. Георгиев, Р., "Управлението на риска и застраховането", учебно помагало <u>http://www.rgeorgiev.com/p/blog-page_2744.html</u>, 2010;
- 10. Василев, В., "Рисково-базиран надзор върху работата на неживотозастрахователните дружества в България", изд. "Фабер", 2010;
- 11. Наредба за реда и методиката за образуване на застрахователните резерви;
- 12. Застрахователен кодекс;

ECONOMETRICS

Semester: 1 semester

Course Type: lectures

Hours per Week: 2 lecture hours per week/Fall Semester

ECTS Credits: 5.0 credits

Lecturer: Assoc. Prof. Ivan Trenchev, PhD

Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,

tel. +35973588532, e-mail: trenchev@swu.bg

Course Status: Optional course in M.Sc. Curriculum of Economic Mathematics

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

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

Registration for the exam: coordinated with the lecturer and student Service Department **References:**

- 1. Introduction in R language, 2013. http://www.r-project.org/
- 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

TECHNOLOGIES, COMPETITION AND BUSINESS STRATEGIES IN THE XXI CENTURY

Semester: 1 semester

Course Type: lectures

Hours per Week: 2 lecture hours per week/Fall Semester

ECTS Credits: 5.0 credits

Lecturer: Assoc. Prof. Michail Kolev,

Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,

tel. +35973588532, e-mail: mkkolev@swu.bg

Course Status: Optional course in M.Sc. Curriculum of Economic Mathematics

Course Description: Discipline "Technology and competition in the XXI century" is related to the current issues of strategic management and development of strategic thinking. Above all, the main part of the course, along with a significant number of examples is devoted to the new role of IT and managers in business today. Furthermore, key issues of strategy are discussed in the context of contemporary organizations value. They will be useful to students who are interested in more in-depth and systemic understanding of modern business and the development of its strategic thinking.

The course addresses both classic approaches and methods of strategic analysis, and relatively new topics for strategic innovation, creative problem solving business, new understanding of competition-cooperation in ecosystem differences with other perspectives, approaches and methodologies. As a useful addition to offering strategic topics audio information systems. This course does not imply any special prior knowledge and skills in the field of strategic management and sufficient general knowledge of students of bachelor level in science and / or economy.

The program includes a relatively new topics - mostly related to the new role of IT and IT-managers, strategy and strategic thinking in the XXI century adapted for a master's degree in economic mathematics requirements.

Course Aims: The course aims to clarify and acquisition of basic theoretical knowledge and methods of program material, skills for solving problems in the topics, examples and guidelines on the application of the knowledge.

Teaching Methods: lectures

Assessment: written final exam, two problems solving tests per semester

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. Василева А. Стратегическо планиране и управление. <u>http://www.bg-ikonomika.com/2012/</u> 11/ strategichesko-planirane-i-upravlenie.html.
- 2. Василева А. Стратегическо мислене: <u>http://www.bg-</u>ikonomika.com/**2012**/10/17_11.html
- 3. Христов Ст. Стратегическото мислене в бизнеса. "Данъчна практика" С. 2002 № 6,
- 4. Гибсън, Р., Преосмисляне на бъдещето, С. 2001.
- 5. Дракър, П., Практика на управлението, С. 2001.
- 6. Майкълсън, Дж., Сун Дзъ: Изкуството за войната за мениджъри, С. 2001.
- 7. Райс, А., Дж. Траут, Маркетинговые войны, М. 2000.
- 8. Дракър, П., Мениджмънт предизвикателствата през 21 век, 2000.
- 9. The World Bank, World Development Report 2002.
- 10. Холанд, У., Промяната: стилът на XXI век, 2000.

11. Маринов, Р. Стратегически комуникационни подходи. Стратегически комуникации и управление на знанието, НБУ, 2009.

http://ebox.nbu.bg/strategicheski_komunikacii/sk1.html

12. Василева, А. Стратегически мениджмънт. <u>http://www.bg-ikonomika.com/2012/10/</u> strategicheski-menidjmynt.html.

- 13. Василева А. Стратегическо планиране и управление. http://www.bg-ikonomika.com /2012/ 11/ strategichesko-planirane-i-upravlenie.html
- 14. Теорията на хаоса и стратегическото мислене. В сп.Геополитика

http://geopolitica.eu/drugi- statii/ 933-teoriyata-na-haosa-i-strategicheskoto-mislene C. 2010

15. Ковачева, Р., Вл. Шопов. Как да мислим ЕС стратегически.

http://www.mediapool.bg/kak-da-mislim-es-strategicheski-news210523.html. C.2013

- 16. Антропов М. Стратегия и стратегическое мышление. М. 2012
- 17. Тасев, М. Синергетика и образование. Педагогика. Кн.10. 2001.

GAME THEORY

Semester: 2 semester Course Type: lectures and tutorials Hours per Week: 2 lecture hours and 2 tutorial hours per week/ Summer Semester ECTS Credits: 5.0 credits Lecturer: Prof. Petar Milanov, PhD Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532, e-mail: <u>milanov@swu.bg</u> Course Status: Optional course in M.Sc. Curriculum of Economic Mathematics

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.Introduction to Game Theory, 2012, http://gametheory.net/lectures/level.pl

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.

NONLINEAR DYNAMICS

Semester: 2 semester

Course Type: lectures and seminars

Hours per Week: 2 lecture hours and 2 seminars hour per week/ Summer Semester

ECTS Credits: 5.0 credits

Lecturer: Assoc. Prof. Michail Kolev,

Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,

tel. +35973588532, e-mail: mkkolev@swu.bg

Course Status: Optional course in M.Sc. Curriculum of Economic Mathematics **Course Description:** The course "Nonlinear dynamics" is optional for students of second semester plan for the master's degree of specialty "Economic mathematics" (two-semester course). Linearization of mathematical methods makes it possible to see significant moments in the dynamics (evolution) of real complicated nonequilibrium systems that are substantially non-linear. Complexity, nonlinearity, neravnovesnostta "cooperativeness", interconnection, etc. Of modern processes (in particular economic) require the study and application of the dynamic approach, taking into account more and specificity of nonlinear dynamics with its specific conceptual apparatus, with its nonlinear mathematical models especially in the era of explosive developing information technologies and their implications.

Course Aims: The aim of the nonlinear dynamics clarification and acquisition of basic theoretical knowledge and methods of program material, skills for solving problems in the topics, examples and guidelines on the application of the knowledge in the teaching of mathematical, economic and natural sciences.

Teaching Methods: lectures and seminars

Assessment: written final exam, two problems solving tests per semester

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. Puu, T. Nonlinear Economic Dynamics. Springer-Verlag Berlin Heidelberg . 1997. (Пуу, Т. Нелинейная экономическая динамика . РХД, Ижевск. 2000)
- 2. Панчев, Ст. Теория на хаоса (с примери и приложения), ИК "АИ "Проф. М. Дринов"", 2002.
- 3. Петерс Э. "Хаос и порядок на рынках капитала". Москва. "Мир", 2000.
- 4. Милованов, В. Синергетика и самоорганизация. Экономика. Бифозика. Москва, 2005.
- 5. Лысенко Ю.Г., и др. "Економическая динамика", Донецк: ДГУ, 2000.
- 6. Сергеева, Л. "Нелинейная економика: модели и методы", Запорожье, Полиграф, 2003.
- Lorenz, Hans-Walter. Nonlinear dynamical economics and chaotic motion _, Springer-Verlag, 1993
- 8. Goodwin, R. Chaotic Economic Dynamics, 1990.
- 9. Dechert, D. Chaos Theory in Economics: Methods, Models and Evidence.1996
- 10. Мандельброт, Б. "Фракталы, случай и финансы". "Регулярная и хаотическая динамика", 2004.
- 11. Zhang W-B. Synergetic Economics . Time and Change in Nonlinear Economics Springer Sprier in Synergetics .; Занг, В.-Б. Синергетическая икономика. Время и перемены в нелинейной экономической теории. http://bookfi.org/book/731035
- 12. Васин, В, А.Ряшко. Элементы нелинейной динамики.: ОТ порядка к хаосу. М.-И., 2006.
- 13. Haken, H. Synergetics: from physics to economics. Cambridge University Press. 2009.
- 14. Тасев, М. Синергетика и образование. Педагогика. Кн.10. 2001.

TIME SERIES

Semester: 2 semester

Course Type: lectures and seminars

Hours per Week: 2 lecture hours and 2 seminars hour per week/ Summer Semester

ECTS Credits: 5.0 credits

Lecturers: Associate Professor Preslav Dimitrov

Department: Mathematics, telephone: (073) 8889132

Course Status: Optional course in M.Sc. Curriculum of Economic Mathematics

Course Description:

The subject "Time Series" focuses on gaining knowledge and skills in the field of time series and forecasting. Regression models are considered. These models lead to solving different tasks and using different mathematical software. The course will demonstrate the ability of some software packages in the processing of data obtained from various scientific researches. The models will be practically tested. Thorough and detailed understanding of the concepts, principles, approaches and techniques in financial calculations is offered.

Course Aims:

The subject "Time Series" focuses on gaining knowledge and skills in the field of time series and forecasting. Regression models are considered. These models lead to solving different tasks and using different mathematical software. The course will demonstrate the ability of some software packages in the processing of data obtained from various scientific researches. The models will be practically tested. Thorough and detailed understanding of the concepts, principles, approaches and techniques in financial calculations is offered. **Teaching Methods:** lectures and seminars

Requirements/Prerequisites: Mathematical Analysis I

Assessment: written final exam, two problems solving tests per semester

Registration for the Course: by request at the end of the current semester

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.