QUALIFICATION CHARACTERIZATION[1]
OF MAJOR FIELD OF STUDY "MATHEMATICS"
FOR "BACHELOR OF SCIENCE" DEGREE
WITH PROFESSIONAL QUALIFICATION "MATHEMATICIAN"

South-West University "Neofit Rilski" prepares qualified experts in Mathematics that can apply their knowledge and skills in the area of science, culture, education and economics in Bulgaria and abroad.

Specialty "Mathematics" by the compulsory subjects included in the curriculum provides fundamental widespread knowledge of mathematics and by the optional subjects in-depth knowledge in selected students mathematical area or field of informatics, economics, ecology, business, law and etc. Graduates have basic knowledge in mathematical areas: algebra, geometry, calculus, complex analysis, differential equations, probability and statistics, numerical methods, mathematical optimization, analytical mechanics, discrete mathematics, object-oriented programming, data structures and algorithms and information technology. Students graduated in "Mathematics" have profound theoretical knowledge and skills to solve mathematical problems, as well as programming skills. In the learning process, they acquire skills and knowledge to independently search for information in the literature and the Internet, multimedia presentations of various projects, as well as proficiency in English.

After completion of Bachelor of Science (BSc) degree in Mathematics, students obtain opportunity for successful continuation of education in higher degrees (Master of Science and PhD) in Bulgaria and abroad.

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

- profound knowledge of basic concepts, principles, theories and results in different areas of mathematics;
- depth knowledge in the "elementary" mathematics (studied in high school);
- knowledge of specific programming languages and software;
- knowledge of English and Information Technology.

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1 *Qualification characterization of Major field of study "Mathematics" for BSc 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: Mathematics

First Year			
First Semester	**ECTS credits**	**Second Semester**	**ECTS credits**
Compulsory Courses		***Compulsory Courses***	
Linear algebra	7.0	Mathematical analysis II	8.0
Analytical geometry	7.0	Algebra I	8.0
Mathematical analysis I	7.0	Object-oriented programming	6.0
Introduction to programming	5.0	Mathematical logic	5.0
Introduction to mathematics	2.0	Foreign language II	3.0
Foreign language I	2.0	Sport	
	Total 30		**Total 30**
Second Year			
First Semester	**ECTS credits**	**Second Semester**	**ECTS credits**
Compulsory Courses		***Compulsory Courses***	
Mathematical analysis III	8.0	Graph theory	4.0
Ordinary differential equations	8.0	Mathematical optimization	7.5
Algebra II	6.0	Operating systems	6.0
Number theory	5.0	Partial differential equations	7.5
Introduction to Information Systems and Technologies	3.0	Optional course 1	5.0
		Optional Courses	
		Semigroup theory	5.0
		Representation theory of groups	5.0
		Finite algebraic structures	5.0
		Introduction to coding theory	5.0
		Written and spoken culture	5.0
	Total 30		**Total 30**
Third Year			
First Semester	**ECTS credits**	**Second Semester**	**ECTS credits**
Compulsory Courses		***Compulsory Courses***	
Numerical analysis I	9.0	Theory of probability and statistic I	9.0
Differential geometry	9.0	Database	9.0
Discrete mathematics	7.0	Numerical Methods 2	7.0
Optional course 2	5.0	Optional course 3	5.0
Sport		Sport	
Optional Courses		***Optional Courses***	
High School Course in Algebra and Analysis	5.0	High School Course in Geometry	5.0
Generating functions	5.0	Data processing and analysis with VBA and MS Excel	5.0
Constructive theory of functions	5.0	Introduction to LATEX-2ε	5.0
Uniform Distribution of Sequences	5.0	Graphic design of printed and promotional materials	5.0
Numerical methods Monte Carlo	5.0		

	Total 30		**Total 30**
Fourth Year			
First Semester	**ECTS credits**	**Second Semester**	**ECTS credits**
Compulsory Courses		***Compulsory Course***	
Theory of probability and statistic II	9.0	Computer models in the natural sciences	3.0
		Complex analysis	6.0
Fundamentals of arithmetic	6.0	Analytics mechanic	6.0
Optional course 4	5.0	Optional course 7	5.0
Optional course 5	5.0	Graduation	10.0
Optional course 6	5.0		
		Optional Courses (course 7)	
Optional Courses (course 4)		Mathematical models of economics	5.0
Differential manifolds	5.0	Introduction to cryptography	5.0
Fundamentals of geometry	5.0	Combinatorial ring theory	5.0
		Project management	5.0
Optional Courses (course 5)			
Operational research	5.0		
Applied statistic	5.0		
Numerical methods for extremum problems	5.0		
Decision making support algorithms in economics and management	5.0		
Optional Courses (course 6)			
Mathematics' fundamentals of computer graphics	5.0		
Mathematical theory of database	5.0		
Programing with Object Pascal and Delphi	5.0		
Programing with C++ Builder	5.0		
	Total 30		**Total 30**
TOTAL FOR 4 ACADEMIC YEARS: 240 CREDITS			

COURSES DESCRIPTION

COMPULSORY COURSES

LINEAR ALGEBRA

Semester: 1 semester
Course Type: Lectures and tutorials
Hours per week: 3 lecture hours and 2 tutorial hours / Fall Semester
ECTS credits: 7.0 credits
Lecturer: Assoc. Prof. Dr. Mihail Kolev
e-mail: mkkolev@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description: The education of that discipline includes some of the basic notations in combinatory and complex numbers. Students study matrices, determinants, systems linear equations and methods for their solving, linear spaces, linear transformations, and quadratic forms.
Course Aims: The students have to obtain knowledge and skills to apply the learned theory for modeling and solving real practical tasks, to do basic operations with matrices, to solving determinants and systems linear equations using the methods of Gauss and Kramer, to be able to distinguish the correspondence between algebraic objects, to determine their characteristics and to transfer them on others – difficult to examine.
Teaching Methods: lectures, tutorials, homework, and problem solving tests.
Requirements/Prerequisites: The students should have basics knowledge from school mathematics.
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. A. Borisov, Il. Guidzhenov, Il. Dimitrova. "Linear Algebra". University Press, South-West University "Neofit Rilski", Blagoevgrad, 2009 /in Bulgarian/.
2. A. Borisov. M. Kacarska. "Handbook on Linear Algebra and Analytic geometry". University Press, South-West University "Neofit Rilski", Blagoevgrad, 2012 /in Bulgarian/.
3. K. Denecke, K. Todorov. "Lectures on Linear Algebra". University Press, South-West University "Neofit Rilski", Blagoevgrad, 1992 /in Bulgarian and German/.
4. M. Aslanski, B. Giurov. "Handbook on Linear Algebra". University Press, South-West University "Neofit Rilski", Blagoevgrad, 1999 /in Bulgarian/.
5. K. Dochev, D. Dimitrov. "Linear Algebra". Sofia, 1977 /in Bulgarian/.

6. D. Dimitrov. “Collections of Problems on Linear Algebra”. Sofia, 1978 /in Bulgarian/.

Additional Titles
1. A. Kurosh. “Course on Algebra”. Sofia, “Nauka i izkustvo”, 1967 /in Bulgarian and Russian/
2. D.K. Fadeev, I.S. Sominski. “Handbook on Algebra”. Moscow, “Nauka”, 1968 /in Russian/.
3. I.V. Proskuriakov. “Handbook on Linear Algebra”. Moscow, “Nauka”, 1967 /in Russian/.
4. V.A. Ilin, E.G. Pozniak. “Linear Algebra”. Moscow, “Nauka”, 1984 /in Russian/.

ANALYTIC GEOMETRY

Semester: 1 semester
Course Type: Lectures and tutorials
Hours per week: 3 lecture hours and 2 tutorial hours /Fall Semester
ECTS credits: 7.0 credits
Lecturer: Prof. Ph.D. Ilia Giudjenov
e-mail: iliadgl@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University “Neofit Rilski” – Blagoevgrad, tel. +35973588532

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description: The education of that discipline includes learning of vector calculus, affine coordinate systems and analytic representations of straight lines and planes. After introducing the cross ratio, the projective coordinate systems are used as well. The basic elements of the projective, of the affine and of the metric theory of the curves and the surfaces of the second degree are taught.
Course Aims: The students have to obtain knowledge and skills for application of the analytic apparatus for research of geometric objects.
Teaching Methods: lectures, tutorials, homework, problem solving tests.
Requirements/Prerequisites: Linear Algebra and Mathematical Analysis

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. A. Borisov. “Lectures on Analytic geometry”. University Press, South-West University “Neofit Rilski”, Blagoevgrad, 2000 /in Bulgarian/.
2. A. Borisov. “Handbook on Analytic geometry”. University Press, South-West University “Neofit Rilski”, Blagoevgrad, 2011 /in Bulgarian/.
3. Borisov, A., I. Dimitrova. Examination versions of problems in Analytic geometry. University Press, South-West University "Neofit Rilski", Blagoevgrad, 2012 /in Bulgarian/.
4. G. Stanilov. “Analytic geometry”. Sofia, 2000 г./in Bulgarian/.

Additional Titles

1. A. Borisov. “Analytic geometry”. University Press, South-West University “Neofit Rilski”, Blagoevgrad, 1993 /in Bulgarian/.
2. A. Gjonov, N. Stoev. “Handbook on Analytic geometry”. Sofia, 1988 /in Bulgarian/.
3. N. Martinov . “Analytic geometry”. Sofia, 1989 /in Bulgarian/.
4. B. Petkanchin. “Analytic geometry”. Sofia, 1961 /in Bulgarian/.

MATHEMATICAL ANALYSIS I

Semester: 1 semester
Course Type: lectures and seminars
Hours per Week: 3 lecture hours and 3 seminars hour / Fall Semester
ECTS Credits: 7.0 credits
Lecturers: Associate Professor Visil Grozdanov, Ph.D.
e-mail: vassgroz@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University “Neofit Rilski” – Blagoevgrad, tel. +35973588532,

Course Status: Compulsory course in Mathematics B.C. Curriculum.
Short Description: The main topics to be considered:

- Numerical sequences
- Numerical series
- Limit, continuity and differentiability of functions
- Integrals of functions of real variables
- Applications of the integral calculation

Course Aims:
This course develops in details the problems of numerical sequences, numerical series, differential and integral calculation of functions of one real variable.
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: Basic knowledge of courses in Elementary Mathematics, Linear Algebra, Analytical Geometry is necessary.
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. V. A. Ilin, V. A. Sadovnichi, B. H. Sendov, Mathematical Analysis, V. 1 and 2, Sofia, Science and Art, 1989.
2. Ia. Tagamlitzky, Differential Calculation, Sofia, Science and Art, 1971.
3. Ia. Tagamlitzky, Integral Calculation, Sofia, Science and Art, 1971.

4. I. Prodanov, N. Hadjivanov, I. Chobanov, Collection of problems of Differential and Integral Calculation, Sofia, Science and Art, 1976.
5. V. Grozdanov, K. Iordjev, A. Markovska, Guidance for solving of problems of mathematical analysis- first part, "Neophit Rilsky" publishing house, Blagoevgrad, 2012.

Additional Titles:

1. S. M. Nikol'skii, Course of Mathematical Analysis, V. 1 and 2, Moskow, Science, 1973.
2. L. D. Kudrjavcev, Mathematical Analysis, V. 1 and 2, Moskow, Science, 1976.
3. L. D. Kudrjavcevв, A. D. Kutassov, V. I. Chehlov, M. I. Shabunin, Collection of problems of mathematical analysis, Science, Moskow, 1984.

INTRODUCTION TO PROGRAMMING

Semester: 1 semester
Type of Course: lectures and tutorials in computer lab
Hours per week: 4 hours lecture and 2 hours tutorials in computer lab/ Fall Semester
ECTS Credits: 5.0 credits
Lecturer: Assist. Prof. Ph.D. Ivo Damyanov
e-mail: damianov@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532
Course Status: Compulsory course in Mathematics B.C. Curriculum.

Course description: Introduction to programming is the first course in scope of programming for the students of major "Mathematics". The course includes topics of syntax and semantics of programming languages construct and statements. The course is based on the C++.
Objectives: The main goal of the course is the students to master principles of programming and algorithms.
Methods of teaching: lectures, tutorials, discussions, problem passed method, Project based method.
Pre- requirements: No need.
Assessment and Evaluation Practical work and test- 50%
Final Exam 50%
The course is successful completed with at least 65% of all scores.
Registration for the Exam: coordinated with the lecturer and the Student Service Office
References:
1. Interactive lectures and online materials in www.e-learning.swu.bg

INTRODUCTION TO MATHEMATICS

Semester: 1 Semester
Course type: lectures/ exercises
Hours per week: 2 hours lectures, 0 hours exercises/labs
ECTS credits: 2.0 credits

Lecturer: Assoc. Prof. Ph.D. Vasil Grozdanov
e-mail: vassgroz@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, SWU "Neofit Rilski" - Blagoevgrad, Phone: 073/588557

Course Status: Compulsory course in the B.S. Curriculum of "Pedagogy of Teaching of Mathematics, Informatics and Information Technology".

Short Description: The course Fundamentals of mathematics present a review, with some extension, of the high school algebra and geometry. The course objective is to align all students' knowledge of high school mathematics. On the other hand, this course will represent a transition from elementary to higher mathematics. Some major topics in algebra and geometry will be introduced with some extensions.

Course Objectives: The purpose of this course is for students to gain knowledge and skills in all important topics of high school mathematics and to apply this knowledge in their studies and future pedagogical work.

Teaching Methods: lectures, exercises, consultations, homework, coursework, and ongoing tests.

Requirements/Prerequisites: Basic knowledge of elementary mathematics is required.

Assessment: ongoing tests and final written exam.

Registration for the exam: in agreement with the teacher and the department of student education.

FOREIGN LANGUAGE 1

Semester: Second semester
Course type: Seminars
Hours per week: 4 hours per week / Summer Semester
ECTS credits: 5.0 credits
Lecturer: Assist. Bogdan Filatov
e-mail: bogdan@abv.bg
Department: Faculty of Phylology, SWU "Neofit Rilski" – Blagoevgrad

Course Status: Compulsory course in Mathematics B.C. Curriculum.

Course description:

Introducing students to the basic components of English phonology, morphology and syntax. It helps students learn and practice communicating in everyday situations including asking and answering questions, using the telephone, taking messages, initiating conversations, asking for directions, making invitations and closing conversations. Class activities include role-playing, small-group activities and short presentations. It also develops skills in reading speed and comprehension. Students are introduced to reading strategies such as skimming, scanning, guessing meaning from context, previewing, predicting, making inferences and giving opinions. Reading materials include short stories, news articles, computer passages and a simplified novel.

Goal:

The goals of the course is to enable students to speak and write effectively and confidently in their professional and personal lives. Students become acquainted with the basic terminology in the specific field.

Teaching methods: Seminars
Prerequisites: The knowledge acquired at high school is useful.
Examination and assessment procedures: The estimation of the acquired knowledge is based on a written exam
Registration for examination: coordinated with the lecturer and the academic affairs department

References:

1. Soars, John & Liz, New Headway Elementary - fourth edition, Oxford University Press, 2011
2. Soars, John & Liz, New Headway Pre-Intermediate - fourth edition, Oxford University Press, 2012
3. Raymond Murphy, English Grammar in Use, fourth edition with answers, Cambridge University Press, 2012
4. Carter, R., McCarty, M., Mark, G., O'Keeffe, A., English Grammar Today: An A-Z of Spoken and Written Grammar, Cambridge University Press, 2011

MATHEMATICAL ANALYSIS II

Semester: 2 semester
Course Type: lectures and seminars
Hours per Week: 3 lecture hours and 2 seminars hour / Summer Semester
ECTS Credits: 8 credits

Lecturers: Associate Professor Visil Grozdanov, Ph.D.
e-mail: vassgroz@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course in Mathematics B.C. Curriculum.
Course Description:
The course Mathematical Analysis II includes basic concepts of mathematical analysis: improper integral, functions of two and more variables; continuity of functions of several variables; partial derivatives, local and relative extrema; implicit functions; double and triple Riemanm integral, and their applications for finding arias and volumes; line integrals of first and second type; surface integrals of first and second type; basic formulas for integrals of Mathematical Physics.
Course Aims:
Students should obtain knowledge for Mathematical Analysis II, which is a basic mathematical discipline. This knowledge is necessary for studying, Mathematical Analysis III, Ordinary Differential Equations, Numerical Methods, Optimization.
Teaching Methods: lectures and seminars
Requirements/Prerequisites: Mathematical Analysis I
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:

1. Yaroslav Tagamlitski – Differential Calculus, Nauka and Izkustvo Publishing House, Sofia, 1971 (in Bulgarian).
2. Yaroslav Tagamlitski – Integral Calculus, Nauka and Izkustvo Publishing House, Sofia, 1978 (in Bulgarian).
3. V. A. Ilin, V.A. Sadovnichi, B.H. Sendov – Mathematical Analysis, Vol. 1, Vol.2, Nauka and Izkustvo Publishing House, Sofia, 1989 (in Bulgarian).
4. I. Prodanov, N. Hadjiivanov – Problem book in Differential and Integral Calculus, Nauka and Izkustvo Publishing House, Sofia, 1976 (in Bulgarian).
5. E. Varbanova, Lectures on Mathematical Analysis – I, Publishing house of Technical university Sofia, Sofia, 2009.
6. V. Grozdanov, K. Jordjev, A. Markovska, Methodological conduire for solving of problems of Mathematical Analysis – part I, Publishing house "Neophit Rilsky" Blagoevgrad, 2012.
7. V. Grozdanov, K. Jordjev, Ts. Mitova, Methodological conduire for solving of problems of Mathematical Analysis – part II, Publishing house "Neophit Rilsky" Blagoevgrad, 2013.
8. V. Grozdanov, K. Jordjev, Ts. Mitova, Methodological conduire for solving of problems of Mathematical Analysis – part III, Publishing house "Neophit Rilsky" Blagoevgrad, 2013.

ALGEBRA I

Semester: 2-nd semester
Course Type: Lectures and tutorials
Hours per week: 3 lecture hours and 2 tutorial hours /Summer Semester
ECTS credits: 8.0 credits

Lecturer: Assos. Prof. Dr. Ilinka Dimitrova
e-mail: ilinka_dimitrova@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description:
The education of that discipline includes some of the main notations of the semigroup and group theory, ring and field theory, algebraic polynomials. The definitions are introduced in an abstract way and explained with many examples. The Cayley theorem, the Lagrange theorem and the main theorem for the cyclic groups are proved. The main tools for investigations of the symmetric group are described and the importance of the symmetric group is underlined in applications. Characteristic of field and simple fields are introduced. There is detailed analysis of certain important rings. In the last part the classical polynomial questions like quotient/remainder theorem, Euklid's algorithm, Horner's scheme, roots of polynomials, symmetric polynomials are considered.

Course Aims:
The students have to obtain knowledge and skills for the theoretical foundations of the semigroup and group theory, ring and field theory, and polynomials as well as the applications of this apparatus for solving some practical tasks, related to other mathematical and informatical subjects. The obtained knowledge on this fundamental discipline are directed to be used by students in their education on other subjects.
Teaching Methods: lectures, tutorials, homework, and problem solving tests.
Requirements/Prerequisites: The students should have basics knowledge from Number theory and Linear algebra.

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. Bojilov, A., P. Siderov, K. Chakaryan. Problems in Algebra, Vedi Press, Sofia, 2006 /in Bulgarian/.
2. Denecke, K., K. Todorov. Foundations of Algebra. University Press, South-West University "Neofit Rilski", Blagoevgrad, 2001 /in Bulgarian/.
3. Genov, G., S. Mihovski, T. Mollov, Algebra, University Press, "Paisii Hilendarski", Plovdiv, 2006 /in Bulgarian/.
4. Mihailov, I., N. Zyapkov. Algebra and Galois Theory, Faber Press, Veliko Tarnovo, 2004 /in Bulgarian/.
5. Siderov, P., K. Chakaryan. Notes on Algebra, Vedi Press, Sofia, 2006 /in Bulgarian/.

Additional Titles

1. Dochev, K., D. Dimitrov, V. Chukanov. Handbook on Algebra. Sofia, 1976 /in Bulgarian/.
2. Dodunekov, S., K. Chakaryan. Problems in Number Theory. Regalia Press, 1999 /in Bulgarian/.
3. Fadeev, D.K., I.S. Sominski. "Handbook on Algebra". Moscow, "Nauka", 1968 /in Russian/.
4. Kurosh, A. Course on Algebra. Sofia, "Nauka I izkustvo", 1967 /in Bulgarian/.
5. Okunev, L. Ya. Algebra, Moscow, 1949 /in Russian/.
6. Proskuriakov, I.V., "Handbook on Linear Algebra". Moscow, "Nauka", 1967 /in Russian/.
7. Skornyakov, L.A., Elements of Algebra. Moscow, 1986 /in Russian/.

OBJECT-ORIENTED PROGRAMMING

Semester: 2 semester
Type of Course: lectures and labs
Hours per week: 2 lectures + 2 labs / Summer Semester
ECTS credits: 6.0 credits

Lecturer: Assoc. Prof. Ph.D. Irena Atanasova
e-mail: irenatm@swu.bg

Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.

Course description:

In the course students are introduced with methods and means of Object-oriented programming. The course is providing basic knowledge in development of algorithms, their programming by using particular programming language, running and testing of 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 C++ programming language are introduced. The aim of the course is to teach the students with the techniques in development of algorithms and programming by using C++ programming language. The knowledge will be used in the general theoretical, technical and some special courses.

Objectives:

Basic objectives and tasks:

- The students give knowledge for algorithum thinking;
- to give knowledge for methods and skils in Object-oriented programming in integrated development environment for visual programming;
- to give knowledge for Data structures, that can process with computer;
- to give knowledge for methods and skills in programming.
- to give knowledge for good style in programming;
- to give knowledge for basic principles when develop applications

Methods of teaching: lectures, tutorials, group seminars or workshop, projects, other methods

Pre- requirements:

The course is continued of the course "Introduction in programming".
Basic knowledge in Mathematics.

Exam:

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: Coordinated with the lecturer and the Student Service Office

References:

1. Pavel Azolov, Object Oriented Programming. Data Structures and STL. Sofia, Ciela, 2008.
2. Magdalen Todorova C ++ Programming. Ciela, 2002.
3. M. Todorova, Object-oriented C ++-based programming. Sofia, Ciela, 2011.Herbert Schildt *Teach Yourself C++,* McGraw-Hill, 1998.
4. Cay S. Horstmann *Computing Consepts with C++ Essentials*, John Wiley & Sons, 1999.
5. Steve Donovan *C++ by Example.* Que/Sams,2002.
6. Tan Kiat Shi, Wili-Hans Steeb, Yorick Hardi *Symbolic C++: An Introduction to Computer Algebra using Object-Oriented Programming.* Springer, 2000.

7. Dimitar Bogdanov Object oriented programming with C ++. Sofia, Technology, 2002.
8. Hristo Krushkov C ++ Programming. Plovdiv, Macro, 2006.
9. Brian Overland C ++ in plain language. AlexSoft, 2003.
10. Magdalina Todorova, Petar Armenyanov, Dafina Petkova, Kalin Georgiev, Collection of C ++ programming tasks. Part One - Introduction to Programming. Sofia, TechnoLogica, 2008.
11. Magdalina Todorova, Peter Armyanov, Kalin Georgiev, Collection of C ++ programming tasks. Part Two - Object-Oriented Programming. Sofia, TechnoLogica, 2008
12. Preslav Nakov, Panayot Dobikov Programming = ++ algorithms. Sofia, 2005.
13. GS Ivanova, TN Nichushkina, EK Pugachev Object-Oriented Programming. Moscow, Moscow State University, 3003.
14. Kent Reisdorf, Ken Henderson Borland C ++ Builder. Master yourself

MATHEMATICAL LOGIC

Semester: 2 semester
Type of Course: lectures and tutorials
Hours per week: 2 hour lecture and 1 hour tutorials / Summer Semester
ECTS credits: 5.0 credits
Lecturers: Prof. PhD. Borislav Yurukov
e-mail: yurukov@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Course description:
The course Mathematical logic aims to teach the basic concepts and results of propositional and predicate logic and propositional and predicate calculus. It deals with concrete first-order theories.
Course Aims:
The course is aimed at introducing students to the development of concepts and methods of mathematical logic within the context of development in mathematics.
Teaching methods: lectures, demonstrations, problem solving
Prerequisites: The acquired knowledge is useful.

Examination and assessment procedures: The estimation of the acquired knowledge is based on a written exam which consists of problem solving and theoretical knowledge examination (writing on a topic from the syllabus provided to students)
Registration for examination: coordinated with the lecturer and the academic affairs department.
References:

Basic Titles:

1. Introduction to mathematical logic, E. Mendelssohn, "Science", Moscow 1976
2. Fairy Tales by Logic, S.Payi & Collective, "Kl.Ozhrideki" University, Sofia 1990
3. Princess or Tiger?, R. Smalian, "Peace", Moscow 1985

Additional Titles:

1. A concept of logic, Seventh edition. Hurley, Springer, 2009, http://ihtik.lib.ru/2012.03_ihtik_mathematic/
2. Set Theory and Logic, Robert Roth Stoll, Springer 2009
3. Applied Computer Science, Shane Torbert, 2011
4. Concise Guide to Computation Theory, Akira Maruoka, 2011
5. How to Solve It: A New Aspect of Mathematical Method, George Pólya, 2008

FOREIGN LANGUAGE 2

Semester: 2 semester
Course type: lab
Hours per week: 2 hours exercises
ECTS credits: 3.0 credits:
Assessment: ongoing assessment
Lecturer: Assist. Bogdan Filatov
e-mail: bogdan@abv.bg
Department: Faculty of Phylology, SWU “Neofit Rilski” – Blagoevgrad

Course Status: Compulsory course in the B.S. Curriculum of “Pedagogy of Teaching of Mathematics, Informatics and Information Technology”.

Short Description: The course "English Language" introduces students with the basics of English - grammar and vocabulary. The covered topics include phonetics, spelling, the parts of speech, verb tenses and syntax in English.

Course Objectives: The purpose of the course is to provide students with knowledge of grammar rules and basic lexical knowledge; to meet the minimum requirements for written and spoken English language; to gain the ability to understand and use the common computer terminology.
Teaching Methods: Lab
Requirements/Prerequisites: Minimum initial knowledge from high school would serve as a basis for upgrading new knowledge and skills.
Assessment: ongoing assessment
Registration for the course: it is necessary to apply to the department at the end of current semester.
Registration for the exam: in agreement with the teacher and the department of student education.
References:
1. English for Mathematicians and Computer Scientists, Sofia 2001
2. English for Bulgarians l, II part, Sofia 2000

MATHEMATICAL ANALYSIS III

Semester: 3 semester
Course Type: lectures and seminars
Hours per Week: 3 lecture hours and 2 seminars hour / Fall Semester
ECTS Credits: 8.0 credits
Lecturers: Associate Professor Nikolay Kitanov, Ph.D.
e-mail: nkitanov@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532

Course Status: Compulsory course in Mathematics B.C. Curriculum.
Short Description:
The course in Mathematical Analysis III includes basic concepts of the functional analysis: metric, topological, linear normed, Euclidean and Hilbert spaces. The technique of the Fourier series is considered.
Course Aims:
Students should obtain knowledge for Functional Analysis, which is a basic mathematical discipline. This knowledge is necessary for studying, Complex analysis, Ordinary Differential Equations, Numerical Methods, Optimization.
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: Mathematical Analysis I and II.
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. A. N. Kolmogorov, S. B. Fomin, Elements of the theory of functions and functional analysis, "Science", Moskow, 1976.
2. A. A. Kirrilov, A. D. Gvashiani, Theorems and problems on functional anakysis, "Science", Moskow, 1979.
3. V. A. Ilin, V. A. Sadovnichi, B. H. Sendov,, Mathematical analysis, vol. and 2, "Science and Art ", Sofia, 1989.

ORDINARY DIFFERENTIAL EQUATIONS

Semester: 3 semester
Course Type: lectures and seminars
Hours per week: 3 lecture hours and 2 tutorial hours /Fall Semester
ECTS credits: 8,0 credits
Lecturers: Associate Professor Nikolay Kitanov, Ph.D.
e-mail: nkitanov@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532

Course Status: Compulsory course from Mathematics B.C. Curriculum.
Course Description:
Mathematical methods of investigation are used in every field of science and technology. Differential Equations are the foundations of the mathematical education of scientists and engineers. The main topics are: First-order Linear equations with constant coefficients: exponential growth, comparison with discrete equations, series solutions; modeling examples including radioactive decay and time delay equation. Linear equations with non-constant coefficients: solution by integrating factor, series solution. Nonlinear equation: separable equations, families of solutions, isoclines, the idea of a flow and connection vector fields, stability, phase-plane analysis; examples, including logistic equation and chemical kinetics. Higher-order Linear equations: complementary function and particular integral, linear independence, reduction of order, resonance, coupled first order systems. Examples and PC-models of nonlinear dynamics, order and chaos, attractors. etc.
Course Aims:
The main goal is the students to master the instruments and methods of modeling in science.
Teaching Methods: lectures, tutorials, homework, tests, etc.
Requirements/Prerequisites: Calculus I and II, Linear Algebra and Analytical Geometry.

Exam: tests, homework, final exam
Registration for the exam: Coordinated with lecturer and Students Service Department

References:
1. Differential Equations, 2008, http://www.sosmath.com/diffeq/diffeq.html
2. Popivanov P., P. Kitanov, Ordinary differential equations. SWU Blagoevgrad, 2000.
3. Borisov A., Il.Gudzhenov. Mathematics, Part 3. Elements of Integral Calculus. Elements of ordinary differential equations
4. Boss. B. Lectures on mathematics. Differential equations. M. 2004.
5. Zhivkov A, E. Khorozov, O. Hristov http://debian.fmi.uni-sofia.bg/~horozov/DifferentialEquations/book.pdf (X.2007-2008)
6. http://www.exponenta.ru/educat/class/courses/ode/theme1/theory.asp 2013.
7. Ordinary Differential Equation http://www.mat.univie.ac.at/~gerald/ftp/book-ode/ode.pdf
8. Пушкаров. Д. Математически методи на физиката.Ч. I., ЮЗУ, Бл.1993г.
9. Эльсгольц. Л.Дифференциальные уравнения и вариационное вычисление. М. 2000.

10. 11. Дорозов, А. Т.Драгунов. Визуализация и анализ инвериантных множеств динамических систем. Москва, 2003г.
11. Ризниченко. Г.Математические модели в биофизике и экологии..М, 2003г.
12. Stewart J. Calculus. III ed. (AUBG). 1996.
13. Сп.Манолов, А.Денева и др. Висша математика, част 3. Техника, 1977г.

ALGEBRA II

Semester: 3 semester
Course Type: Lectures and tutorials
Hours per week: 2 lecture hours and 2 tutorial hours /Fall Semester
ECTS credits: 6.0 credits
Lecturer: Assos. Prof. Ph.D Ilinka Dimitrova
e-mail: ilinka_dimitrova@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description:
The second part of the course in algebra for students in "Mathematics" developed the ideas of the first part. The course begins with the study of the rings of polynomials of one variable. The algebraic closeness of the field of complex numbers is proved. Some basic consequences of the d'Alembert theorem are considered. The decomposition of polynomials with real coefficients is studied. The existence of a root of indecomposable polynomial in a suitable extension of the field of constants is determined. The discriminant and resultant of polynomials are considered. A special attention is paid to solving nonlinear algebraic systems of equations using resultant and to solving algebraic equations of third and fourth degree, reciprocal equations, and binomial equations. Some extensions of the fields are studied. The question of the finite fields is also included. In view of the many applications in analysis and algebra itself the theory of λ-matrices and Jordan canonical form of numerical matrices are studied. The course ends with some elements of the theory of associative algebras.
Course Aims:
The students have to obtain more deep knowledge and skills for the basic algebraic structures and polynomials of one variable as well as the applications of this apparatus for solving some practical tasks, related to other mathematical subjects. The obtained knowledge on this fundamental discipline are directed to be used by students in their education on other subjects. The content of the course gives the students the opportunity to be able to study alone or in some of the elective courses in more detail various aspects of algebra.
Teaching Methods: lectures, tutorials, homework, and problem solving tests.
Requirements/Prerequisites: The students should have good knowledge from Algebra 1.
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. Bojilov, A., P. Siderov, K. Chakaryan. Problems in Algebra, Vedi Press, Sofia, 2006 /in Bulgarian/.
2. Denecke, K., K. Todorov. Foundations of Algebra. University Press, South-West University "Neofit Rilski", Blagoevgrad, 2001 /in Bulgarian/.
3. Genov, G., S. Mihovski, T. Mollov, Algebra, University Press, "Paisii Hilendarski", Plovdiv, 2006 /in Bulgarian/.
4. Mihailov, I., N. Zyapkov. Algebra and Galois Theory, Faber Press, Veliko Tarnovo, 2004 /in Bulgarian/.
5. Siderov, P., K. Chakaryan. Notes on Algebra, Vedi Press, Sofia, 2006 /in Bulgarian/.

Additional Titles
1. Dochev, K., D. Dimitrov, V. Chukanov. Handbook on Algebra. Sofia, 1976 /in Bulgarian/.
2. Dodunekov, S., K. Chakaryan. Problems in Number Theory. Regalia Press, 1999 /in Bulgarian/.
3. Fadeev, D.K., I.S. Sominski. "Handbook on Algebra". Moscow, "Nauka", 1968 /in Russian/.
4. Kurosh, A. Course on Algebra. Sofia, "Nauka I izkustvo", 1967 /in Bulgarian/.
5. Okunev, L. Ya. Algebra, Moscow, 1949 /in Russian/.
6. Proskuriakov, I.V., "Handbook on Linear Algebra". Moscow, "Nauka", 1967 /in Russian/.
7. Skornyakov, L.A., Elements of Algebra. Moscow, 1986 /in Russian/.

NUMBER THEORY

Semester: 3 semester
Type of the course: Lectures and tutorial
Hours per week: 2 lecture hours and 1 tutorial hour / Fall Semester
ECTS credits: 5.0 credits
Lecturer: Prof. Dr.Sc. Oleg Mushkarov
e-mail: muskarov@math.bas.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description: Main topics:

- Divisibility
- Primes and the Fundamental theorem of Arithmetic
- Congruences
- Fermat's, Euler's and Wilson's theorems
- Quadratic residues
- Diophantine equations
- Arithmetic functions

Course Aims:

To develop in details the basic notions and methods of elementary Number theory and their applications for solving problems of divisibility, linear and quadratic congruences and Diophantine equations.

Teaching Methods:

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

Requirements/Prerequisites: Basic knowledge of the courses in Elementary Mathematics, Linear and Abstract Algebra.

Assessment: Written exam on problem solving and on the theoretical material from the lectures.

Registration for the exam: Students and the lecturer agree on the convenient dates within the announced calendar schedule of examination session.

References:

Basic Titles

1. S. Dodunekov, K. Tchakarjan, Number theory problems, Regalia, 1999.
2. Lecture notes (www.moi.math.bas.bg/~peter).
3. T. Andreescu, D. Andrica, Number Theory, Birkhauser, 2009.

Additional Titles

1. J. Silverman, A Friendly Introduction to Number Theory, Prentice-Hall, Inc., 1997
2. P. Boivalenkov, E. Kolev, O. Mushkarov, N. Nikolov, Bulgarian Mathematical Competirions 2006 – 2008, UNIMATH, Sofia, 2008.
3. P. Boivalenkov, E. Kolev, O. Mushkarov, N. Nikolov, Bulgarian Mathematical Competirions 2009 – 2011, UNIMATH, Sofia, 2012.

INTRODUCTION TO INFORMATION SYSTEMS AND TECHNOLOGIES

Semester: 3 Semester

Course type: lectures and labs

Hours per week: 2 lectures /1 hour labs

ECTS credits: 3.0 credits

Lecturer: Prof. Ph.D. Daniela Tuparova

e-mail: ddureva@swu.bg

Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, SWU "Neofit Rilski" - Blagoevgrad, Phone: 073 / 588 532

Course Status: Compulsory course in the B.S. Curriculum of "Pedagogy of Teaching of Mathematics, Informatics and Information Technology".

Short Description:

The course is an introduction to information systems and technologies. Basic and theoretical concepts of information technologies – information, information activities, informatics and information technologies, basic functions of operating systems, word processing systems, data processing systems, multimedia presentation of information to the public are considered in

theoretical and practical terms, the most popular services on the global Internet, information protection, legal and ethical aspects when using information technologies.

The course is a natural continuation of the courses in Informatics and Information Technology from high school.

Course Objectives: Students must acquire knowledge of:

- Basic concepts in information technology;
- Types of base and application software and its application;
- The most popular services on the global Internet;
- Protection of information and legal and ethical aspects when using information technology.

Teaching Methods: lectures, lab work, discussions and problem solving.

Requirements/Prerequisites: No special knowledge is required beyond the lessons learned in Computer Science and Information Technology from high school.

Assessment: Assessment by ongoing control and a written exam (test).

Registration for the course: it is necessary to apply to the Student Education Department at the end of the current semester.

Registration for the exam: in agreement with the teacher and the teaching department.

GRAPH THEORY

Semester: 4 semester
Type of Course: lectures and seminars
Hours per week: 2 lecture hours + 1 seminar hour / Summer Semester
ECTS credits: 4.0 credits
Lecturers: Ass.Prof. PhD Nikolay Kitanov
e-mail: nkitanov@abv.bg
Department: Department of Mathematics, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588557,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Course description:
The 1970s ushered in an exciting era of research and applications of networks and graphs in operations research, industrial engineering, and related disciplines. Graphs are met with everywhere under different names: "structures", "road maps" in civil engineering; "networks" in electrical engineering; "sociograms", "communication structures" and "organizational structures" in sociology and economics; "molecular structure" in chemistry; gas or electricity "distribution networks" and so on.
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. The direct and detailed representation of practical systems, such as distribution or telecommunication networks, leads to graphs of large size whose successful

analysis depends as much on the existence of "good" algorithms as on the availability of fast computers. In view of this, the present course concentrates on the development and exposition of algorithms for the analysis of graphs, although frequent mention of application areas is made in order to keep the text as closely related to practical problem-solving as possible. 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).
- Matching and assignment algorithms (introduction and examples, maximum-cardinality matching in a bipartite graph).
- The chinesse 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).

Course Aims: Students should obtain basic knowledge in Graph theory and skills for solving optimization problems for graphs and networks.

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

Requirements/Prerequisites: Graphs, Discretion Programming

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

Rating: = 0,2.(D1+D2+D3)/3 + 0,5.(K1+K2)/2 + 0,3.(Exam)

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

References:

Basic:

1. Minieka, E., Optimization Algorithms for Networks and Graphs, Marcel Dekker, Inc., New York and Basel, 1978 (Майника, 3. Алгоритми оптимизации на сетях и графах, М., "Мир", 1981).

Additional:

1. Keijo Ruohonen. GRAPH THEORY. math.tut.fi/~ruohonen/GT_English.pdf, 2008
2. Ronald Gould. Graph Theory (Dover Books on Mathematics. 2012. US Cafifornia.
3. Lih-Hsing Hsu , Cheng-Kuan Lin, Graph Theory and Interconnection Networks. 1420044818, 2008,
4. Team DDU.Christofides, N., Graph Theory. An Algorithmic approach, Academic Press lnc (London) Ltd. 1975, 1977 (Крисгофидес, И. Теория графов. Алгоритмический подход, М., "Мир", 1978).
5. Swamy, M., K. Thulasirman, Graphs, Networks and Algorithms, John Wiley & Sons, 1981 (Сваами М., К. Тхуласирман. Графм, сети и алгоритми, М., "Мир", 1984).

MATHEMATICAL OPTIMIZATION

Semester: 4 semester
Course Type: Lectures and tutorials
Hours per week: 3 lecture hours and 2 tutorial hours /Summer Semester
ECTS credits: 7.5 credits
Lecturer: Assoc. Prof. Stefan Stefanov, PhD
e-mail: stefm@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description:
The course in Optimization (Mathematical Programming) includes basic results and methods for solving various types optimization problems and related topics: nonlinear optimization problems, linear optimization problems (simplex method, duality in linear optimization, transportation problem, assignment problem), matrix games (John von Neumann minimax theorem, graphical method for solving 2 x 2, 2 x n, and m x 2 games, relation between matrix games and linear optimization), convex analysis (convex sets, sum of sets and product of a set with a real number, projection of a point onto a set, separation of convex sets, extreme points, cones, polar cones, representation of convex cones, representation of convex sets, polyhedrons, convex functions, directional derivatives, subgradients and subdifferentials), convex optimization problems (Kuhn-Tucker theorem), quadratic optimization problems.
Course Aims: Students should obtain basic knowledge and skills for solving optimization problems under consideration.
Teaching Methods: lectures and tutorials

Requirements/Prerequisites: Mathematical Analysis, Linear Algebra, Analytic Geometry.
Assessment: written final exam
Registration for the Exam: coordinated with the lecturer and Students Service Department

References:
Basic Titles:
1. P. Kenderov, G. Hristov, A. Dontchev – "Mathematical Programming", Kliment Ohridski Sofia University Press, Sofia, 1989 (in Bulgarian).
2. "Mathematical Programming Problem Book", Kliment Ohridski Sofia University Press, Sofia, 1989 (in Bulgarian).
3. Stefan M. Stefanov – "Quantitative Methods of Management", Heron Press, 2003 (in Bulgarian).

Additional Titles:
4. Stefan M. Stefanov – "Separable Programming. Theory and Methods", Kluwer Academic Publishers, Dordrecht – Boston – London, 2001.
5. Hamdy A. Taha – „Operations Research. An Introduction", 9-th ed., Prentice Hall, USA, 2010.

OPERATION SYSTEMS

Semester: 4 semester
Type of Course: lectures and tutorials in computer lab
Hours per week: 2 hours lecture and 3 hours tutorials in computer lab/ Summer Semester
ECTS credits: 6.0 credits
Lecturers: Prof. Nina Sinyagina, PhD
e-mail: nisina36@abv.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Course description: The course is introduction in area of operation systems. Basic knowledge and skills in Linux and Microsoft Windows are covered.
Objectives:

The student should obtain knowledge of:

- Basic principles of operation systems.
- Basic administration skills in area of operation systems.

Methods of teaching: lectures, tutorials, discussions, project based method.

Pre- requirements: Database systems (core course)
Assessment and Evaluation

Pre-exam test – 30%
Final Test- 70%

The course is successful completed with at least 51% of all scores.
Registration for the Exam: coordinated with the lecturer and the Student Service Office
References

1. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall, Third Edition 1998; Fifth Edition 2005.

PARTIAL DEFFERENTIAL EQUATIONS

Semester: 4 semester
Course Type: lectures and seminars
Hours per week: 3 lecture hours and 2 tutorial hours /Fall Semester
ECTS credits: 7.5 credits
Lecturer: Assoc. Nikolay Kitanov
e-mail: nkitanov@abv.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course from Mathematics B.C. Curriculum.

Course Description:
Differential Equations are the foundations of the mathematical education of scientists and engineers. The main topics are: Equations from variational problems; Partial differential equations; Equations of first order Linear equations; Quasilinear equations; A linearization method; Nonlinear equations in two variables; Initial value problem; Nonlinear equations; Classification; Linear equations of second order; Quasilinear equations of second order; Quasilinear elliptic equations; Systems of first order; Systems of second order; Hyperbolic equations; Wave equations; Case n=3; Case n = 2; Inhomogeneous equation; Initial-boundary value problems; Oscillation of a string.; Oscillation of a membrane; Inhomogeneous wave equations; Parabolic equations; Poisson's formula; Inhomogeneous heat equation; Uniqueness; Elliptic equations of second order Fundamental solution; Green's function; Besides numerous applications inside mathematics, the PDEs form the core part of our scientific understanding of the physical world: from physics to chemistry, to biology, to meteorology. The Heat Equation.The flow of heat. The fundamental solution. Brownian Motion. Laplace's Equation. Conservative vector fields and potentials. The Wave Equation. The wave equation in 1,2,3 dimensions Characteristic curves in the plane. Characteristic surfaces in higher dimensions. Equations of Fluid and Gas Dynamics. Conservation Laws . Examples and PC-models.
Course Aims: This course aims to master the instruments and methods of modeling in science and to provide the background necessary to initiate work on a Ph.D. thesis in PDEs for beginning graduate students**.**
Teaching Methods: lectures, tutorials, homework, tests, etc.

Requirements/Prerequisites: Ordinary differential equations, Calculus I and II, Linear Algebra and Analytical Geometry.
Exam: tests, homework, final exam
Registration for the exam: Coordinated with lecturer and Students Service Department

References:

1. Bers, L. Partial Differential Equations (in Lectures in Applied Mathematics). N.-Y.1964
2. DifferentialEquations, 2008, http://www.sosmath.com/diffeq/diffeq.html
3. Ordinary Differential Equation http://www.mat.univie.ac.at/~gerald/ftp/book-ode/ode.pdf
4. Arfken, G. "Partial Differential Equations of Theoretical Physics." §8.1 in Mathematical Methods for Physicists, 3rd ed. Orlando, FL: Academic Press, pp. 437-440, 1985.
5. Bateman, H. Partial Differential Equations of Mathematical Physics. New York: Dover, 1944.
6. 6. Conte, R. "Exact Solutions of Nonlinear Partial Differential Equations by Singularity Analysis." Sep 2000. http://arxiv.org/abs/nlin.SI/0009024.
7. Kamke, E. Differentialgleichungen Lösungsmethoden und Lösungen, Bd. 2: Partielle Differentialgleichungen ester Ordnung für eine gesuchte Function. New York: Chelsea, 1974.
8. Folland, G. B. *Introduction to Partial Differential Equations, 2nd ed.* Princeton, NJ: Princeton
9. University Press, 1996.
10. Kevorkian, J. *Partial Differential Equations: Analytical Solution Techniques, 2nd ed.* New York: Springer-Verlag, 2000.
11. Morse, P. M. and Feshbach, H. "Standard Forms for Some of the Partial Differential Equations of Theoretical Physics." Methods of Theoretical Physics, Part I. NY: McGraw-Hill, pp. 271-272, 1953.
12. Polyanin, A.; Zaitsev, V.; and Moussiaux, A. Handbook of First-Order Partial Differential Equations. New York: Gordon and Breach, 2001.
13. Press, W. H.; Flannery, B. P.; Teukolsky, S. A.; and Vetterling, W. T. "Partial Differential
14. Equations." Ch. 19 in *Numerical Recipes in FORTRAN: The Art of Scientific Computing, 2nd ed.*
15. Cambridge, England: Cambridge University Press, pp. 818-880, 1992.
14. Sobolev, S. L. Partial Differential Equations of Mathematical Physics. New York: Dover, 1989.

15. Sommerfeld, A. *Partial Differential Equations in Physics.* New York: Academic Press, 1964.
16. Taylor, M. E. Partial Differential Equations, Vol. 1: Basic Theory. New York: Springer-Verlag, 1996.
17. Taylor, M. E. Partial Differential Equations, Vol. 2: Qualitative Studies of Linear Equations. New York: Springer-Verlag, 1996.
18. Taylor, M. E. *Partial Differential Equations, Vol. 3: Nonlinear Equations.* New York: Springer-
16. Verlag, 1996.
17. Trott, M. "The Mathematica Guidebooks Additional Material: Various Time-Dependent PDEs."
18. http://www.mathematicaguidebooks.org/additions.shtml#N_1_06.
19. Webster, A. G. Partial Differential Equations of Mathematical Physics, 2nd corr. ed. New York:
20. Dover, 1955.
21. Weisstein, E. W. "Books about Partial Differential Equations."
22. http://www.ericweisstein.com/encyclopedias/books/PartialDifferentialEquations.html.
23. Zwillinger, D. Handbook of Differential Equations, 3rd ed. Boston, MA: Academic Press, 1997.
24. Weisstein, Eric W. "Partial Differential Equation." From *MathWorld* – A Wolfram Web Resource. http://mathworld.wolfram.com/PartialDifferentialEquation.html

NUMERICAL ANALYSIS I

Semester: 5 semester
Course Type: Lectures and labs
Hours per week: 3 lecture hours and 2 lab hours /Fall Semester
ECTS credits: 9.0 credits
Lecturer: Assoc. Prof. Stefan Stefanov, PhD
e-mail: stefm@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Course Description:
The course Numerical Analysis includes basic numerical methods of mathematical analysis, algebra and differential equations: interpolation and least squares data fitting as methods for approximating functions given by tabulated data; numerical differentiation; numerical integration – Newton-Cotes and Gauss quadrature formulas; numerical solution of nonlinear equations; numerical solution of linear systems of algebraic equations; numerical solution of the initial-value problem for ordinary differential equations of first order; and numerical solution of the boundary value problem for ordinary differential equations of second order.
Course Objectives:
Students should obtain knowledge and skills for numerical solutions of problems in the area of mathematical analysis, algebra and differential equations, which are applicable for solving various problems.
Teaching Methods: lectures, tutorials and lab exercises

Requirements/Prerequisites: Mathematical Analysis, Linear Algebra, Analytic Geometry, Differential Equations

Assessment:
written final exam covering problems /omitted in case the average grade of two current problem tests is higher than Very Good 4.50/ (grade weight is 30 %) and theory on two topics (grade weight is 30 %); two homework (grade weight is 20 %) and two projects (grade weight is 20 %)
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; Part II, Nauka and Izkustvo Publishing House, Sofia, 1978 (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).

Additional Titles:

1. R. L. Burden, J. D. Faires – "Numerical Analysis", ", 9-th ed., Cengage Learning, Stamford, CT, USA, 2010.
2. J. D. Faires, R. L. Burden – "Numerical Methods", Brooks/Cole Publishing Company, Pacific Grove, CA, USA, 2002.
3. Stefan M. Stefanov – "Numerical Analysis", MS4004-2203, University of Limerick, 1998.

DIFFERENTIAL GEOMETRY

Semester: 5 semester
Course Type: Lectures and tutorials
Hours per week: 2 lecture hours and 3 tutorial hours / Fall Semester
ECTS credits: 9.0 credits

Lecturer: Assoc. Prof. Nikolay Kitanov, PhD
e-mail: nkitanov@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +3597358853

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description:
The course includes: studying of basic themes of the classical differential geometry of the curves, the one-parametric sets of straight lines and the surfaces in the three-dimensional real Euclidean space.
Course Aims:
The students have to obtain knowledge and skills for application of the differential-geometric methods for learning of geometric objects.
Teaching Methods: Lectures, tutorials, home works, problem solving tests.

Requirements/ Prerequisites: Analytic Geometry, Mathematical Analysis, Differential Equations.
Assessment: written exam 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. Borisov, A. Differential Geometry. University Press, South-West University "Neofit Rilski" Blagoevgrad, 1994(in Bulgarian).
2. Gjonov, A. Handbook on Differential Geometry. Sofia, 1999 (in Bulgarian).

Additional Titles:

1. Ivanova-Karatopraklieva, I. Differential Geometry. University Press "St. Kl. Ohridski", Sofia, 1994 (in Bulgarian).
2. Petkanchin, B. Differential Geometry. Sofia, 1964 (in Bulgarian).
3. Stanilov, G. Differential Geometry. Sofia, 1997 (in Bulgarian).

DISCRETE MATHEMATICS

Semester: 5 semester
Type of the course: Lectures and tutorial
Hours per week: 2 lecture hours and 2 tutorial hours / Fall Semester
ECTS credits: 7.0 credits

Lecturer: Assist. Prof. Margarita Todorova, PhD
e-mail: todorova@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description:
The course includes the following topics: Set theory, Graph theory, Finite state automata, Formal languages, Turing's machine, Decidability, Discrete functions.
Course Aims:
The aim of the course is to provide knowledge on the theoretical basis of the computing, on the formal languages, on discrete structures etc.
Teaching Methods:
The knowledge from the lectures are used in the tutorials to solve theoretical and practical problems concerning the course topics.
Requirements/Prerequisites: minimum knowledge about matrices, graphs, finite algebraic systems, number theory

Assessment: written exam on topics from tutorials and on topics from lectures.
Registration for the Exam: coordinated with the lecturer and Student Service Department.

References:

1. Denev, Y., S. Strakov, Discrete Mathematics, Blagoevgrad, 1995
2. Pavlov, R., S. Radev, S. Strakov, Mathematical Foundations of Informatics, Blagoevgrad, 1997
3. Denev, Y., R. Pavlov, Y. Demetrovich, Discrete Mathematics, Sofia, 1984
4. T. Fujisawa, T. Kasami, Mathematics for Radio Engineers, Radio and Communication, Moscow, 1984.
5. K. Chimev, Sl.Shtrakov, Mathematics with Informatics, Blagoevgrad, 1989.
6. SV Jablonski, Introduction to Discrete Mathematics, M., 1979.
7. SV Yablonski, GP Gavrilov, VB Kudryavtsev, Functions of Logic Algebra and Post Classes, M., 1966.
8. Z.Manna, Mathematical theory of computation, McGraw-Hill Book Company, NY, 1974.
9. V.J.Rayward-Smith, A first course in formal language theory, Bl.Sc.Publ., London, 1983.
10. A.Salomaa, Jewels of formal language theory, Comp.Sc.Press, Rockville, 1981.
11. Peter Linz, An Introduction to Formal Languages and Automata, 2006, Jones & Bartlett Publishers.

THEORY OF PROBABILITY AND STATISTIC I

Semester: 6 semester
Type of Course: lectures and tutorials in computer lab
Hours per week: 3 hours lectures and 2 hours tutorials in computer lab / Summer Semester
ECTS credits: 9.0 credits

Lecturers: Assoc. Prof. Elena Karashtranova, PhD
e-mail: helen@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Course description:
In this course questions of Probability and Mathematical Statistics are considered. Algorithms connected with finding structural and numerical characteristics of graphs 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 Exam: coordinated with the lecturer and the Student Service Office

References:

Basic Titles

1. Dimitrov, B., Yanev, N., Probabilities and statistics, 2001, Sofia.
2. Karastranova E., Interactive Probability Training and Statistics, Blagoevgrad, 2010
3. Karlberg K., Business Analysis with Microsoft Excel, SoftPress 2003
4. Feller, W. Probability Theory. Science and Art, Sofia, 1985.
5. The Statistics Homepage - http://www.statsoft.com/textbook/stathome.html © 1984-2008
6. Harrison P. G., Nonparametric density estimation, John Wiley, 2002
7. Kalinov K., Statistical Methods in Behavioral and Social Sciences, NBU, 2010
8. P. Kopanov, V. Noncheva, S. Hristova, Probabilities and statistics, manual for solving problems, Paisii Hilendarski University Publishing House, 2012, ISBN 978-954-423-796-7
9. G. Freiman, Exploratory data analysis, J., Isr.Math, 2002

Additional Titles:

1. Baĭnov, D., Teoriya na veroyatnostite i matematicheska statistika, Impuls M, Sofiya, 1990.
2. Vŭndev D., Teoriya na veroyatnostite i Statistika za Fizicheskiya fakultet na SU - http://stochastics.fmi.uni-sofia.bg/
3. Dimitrov, B., Karashtranova, E. Statistika za nematematitsi, 1993, Blagoevgrad.
4. Kalinov K., Statisticheski metodi v povedencheskite i sotsialnite nauki, Sofiya, 2001
5. Madgerova R., V. Kyurova, Statistika v turizma, YUZU,2009
6. Bainov, D., Probability Theory and Mathematical Statistics, Impulse M, Sofia, 1990.
7. Vandev D., Probability Theory and Statistics for the Faculty of Physics at Sofia University - http://stochastics.fmi.uni-sofia.bg/
8. Dimitrov, B., Karashtranova, E. Statistics for non-mathematicians, 1993, Blagoevgrad.
9. Kalinov K., Statistical Methods in Behavioral and Social Sciences, Sofia, 2001
10. R. Madgerova, V. Kurova, Tourism Statistics, SWU, 2009

DATABASE

Semester: 6 semester
Course Type: lectures and lab exercises
Hours per week/FS/SS: 3 lecture hours and 2 lab exercise hours / Summer Semester
ECTS credits: 9.0 credits

Lecturer: Prof. Peter Milanov, PhD
e-mail: milanov@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Course Description:
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 Exam: coordinated with the lecturer and Student Service Department

References:

1. Vidya Vrat Agarwal, Beginning C Sharp 5.0 Databases, 2012 New York Press,
2. Alapati and Bill Padfield, Expert Indexing in Oracle Database, 2011, New York Press,
3. Toby J. Teorey , Sam S. Lightstone , Tom Nadeau, H.V. Jagadish, Database Modeling and Design Database Modeling and Design, 2012, Morgan Kaufmann Press
4. Henry H. Liu, Oracle Database Performance and Scalability A Quantitative Approach, 2011 A Jon Wiley and Son, US
5. Pavel Azolov. Databases. Relational and Objective Approach, Technology, 1991.
6. Juliana Peneva, Databases. And part. Sofia, Regalia IR 6, 2002
7. Shepherd J.C. Database management: Theory and Application. Irwin Inc., USA 1990.
8. Meyer DR, The theory of relational databases. Mir Publishing House 1987.

NUMERICAL METHODS 2

Semester: 6 semester
Course Type: lectures and lab exercises
Hours per week/FS/SS: 3 lecture hours and 1 lab exercise hours / Summer Semester
ECTS credits: 7.0 credits
Lecturer: Assoc. Prof. Stefan Stefanov, PhD
e-mail: stefm@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Course Description:
Discipline training includes the study of the basics of uniform approximations (Chebyshov theory of alternative, uniform approximations with linear positive operators), variational methods for solving operator equations (in particular the boundary value problem for ordinary differential equations of II order), network methods for solving of partial differential equations (elliptic, hyperbolic and parabolic), as well as basic methods for solving integral equations - Voltaire and Fredholm equations of the second kind (the method of mechanical qua dramatics, method of degenerate nuclei, method of successive approximations (of resolvents).

Course Aims:
Students must acquire knowledge of uniform approximations, variational methods for solving operator equations, basic numerical methods for solving partial differential equations, and theory and methods for solving integral equations that are useful in solving various problems.

Teaching Methods: lectures, demonstrations and work on project

Requirements/Prerequisites: Linear algebra, Computer languages.
Assessment: course project Basic knowledge of mathematical analysis, linear algebra, analytical geometry, differential equations.
Assessment:
written final exam covering problems /omitted in case the average grade of two current problem tests is higher than Very Good 4.50/ (grade weight is 30 %) and theory on two topics (grade weight is 30 %); two homework (grade weight is 20 %) and two projects (grade weight is 20 %)
Registration for the Exam: coordinated with lecturer and Student Service Department

References:
Basic:

1. Approx. Sendov, V. Popov - Numerical Methods, Part I, University Publishing House "St. Kliment Ohridski ", Sofia, 1996; Part II, Science and Art, 1978.
2. B. Boyanov - Lectures on Numerical Methods, Sofia, 1995.
3. Collective - "Collection of Problems by Numerical Methods", 2nd ed., University Publishing House "St. Kliment Ohridski ", Sofia, 1994.
4. M. Kaschiev - A Guide to Numerical Methods, ed. Martilen, Sofia, 1994.

Additional:

1. R. L. Burden, J. D. Faires – "Numerical Analysis", ", 9-th ed., Cengage Learning, Stamford, CT, USA, 2010.
2. J. D. Faires, R. L. Burden – "Numerical Methods", Brooks/Cole Publishing Company, Pacific Grove, CA, USA, 2002.
3. Stefan M. Stefanov – "Numerical Analysis", MS4004-2203, University of Limerick, 1998.

THEORY OF PROBABILITY AND STATISTIC II

Semester: 7 semester
Type of Course: lectures and tutorials in computer lab
Hours per week: 2 hours lectures and 2 hours tutorials in computer lab / Fall Semester
ECTS credits: 9.0 credits

Lecturers: Assoc. Prof. Elena Karashtranova, PhD
e-mail: helen@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532,

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.

Course description:

In this course topics of Probability and Mathematical Statistics are considered. Algorithms connected with finding structural and numerical characteristics of graphs 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: Theory of probability and statistic I, Analysis, 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 Exam: coordinated with the lecturer and the Student Service Office

References:

Basic Titles

1. Dimitrov, B., Yanev, N., Probabilities and statistics, 2001, Sofia.
2. Karastranova E., Interactive Probability Training and Statistics, Blagoevgrad, 2010
3. Minkova L., Probability Models, FMI, Sofia University "Kliment Ohridski", 2011
4. Karlberg K., Business Analysis with Microsoft Excel, SoftPress 2003
5. Feller, W. Probability Theory. Science and Art, Sofia, 1985.
6. The Statistics Homepage - http://www.statsoft.com/textbook/stathome.html © 1984-2008
7. Harrison P.G., Nonparametric density estimation, John Wiley, 2002
8. Kalinov K., Statistical Methods in Behavioral and Social Sciences, NBU, 2010
9. P. Kopanov, V. Noncheva, S. Hristova, Probabilities and statistics, manual for solving problems, Paisii Hilendarski University Publishing House, 2012, ISBN 978-954-423-796-7
10. G.Freiman,Exploratory data analysis,J., Isr.Math, 2002

Additional Titles:

1. Bainov, D., Probability Theory and Mathematical Statistics, Impulse M, Sofia, 1990.
2. Vandev D., Probability Theory and Statistics for the Faculty of Physics at Sofia University - http://stochastics.fmi.uni-sofia.bg/
3. Dimitrov, B., Karashtranova, E. Statistics for non-mathematicians, 1993, Blagoevgrad.
4. Kalinov K., Statistical Methods in Behavioral and Social Sciences, Sofia, 2001
5. R. Madgerova, V. Kurova, Tourism Statistics, SWU, 2009

FUNDAMENTALS OF ARITHMETIC

Semester: 7-th semester
Course Type: Lectures and tutorials
Hours per week: 2 lecture hours and 1 tutorial hours /Fall Semester
ECTS credits: 6.0 credits
Lecturer: Assoc. Prof. Ilinka Dimitrova, PhD
e-mail: ilinka_dimitrova@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. ++35973588532

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description:
The compulsory course in Fundamentals of the Arithmetic has the objective to make the students familiar with the notation of "number" and connected with it operations and ordinance relation. The course comprises the natural numbers, the integer numbers, the rational numbers, and the real numbers and in particular cases the complex numbers. The course start with the definition of the notation "finite set" and the notation "induction set", which was introduced in the beginning of the 20-th century by B. Russell. The course pays attention to the notation natural number; to the operations addition and multiplication of two natural numbers; to the laws that they satisfy; to the inequality between two natural numbers. The students should learn to pass from a decimal system to an arbitrary system. The course continuing with extensions of the semiring of the natural numbers to the ring of the integer numbers, also to the semifield of the fractions and their ordinances. The course finishes with the consideration of the real and the complex numbers.
Course Aims:
Students should obtain knowledge and skills for the recent theoretical ideas and the whole scholar course of education in Algebra.
Teaching Methods: lectures, tutorials, homework, and problem solving tests.
Requirements/Prerequisites: The students should have basics knowledge from Number theory and High algebra.
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. Kl. Denecke, K. Todorov, Fundamentals of Arithmetic, Blagoevgrad 1999
2. N. Ziapkov, N. Yankov, I. Mihailov. Elementary Number Theory. „Faber", Veliko Tarnovo, 2008.
3. P. Petkov. Fundamentals of Arithmetic. Library of the Faculty of mathematics in University "Kliment Ohridski", Sofia.
Additional Titles
1. B. Petkanchin, Fundamentals of Mathematics, Sofia, 1959.

COMPUTER MODELS IN NATURAL SCIENCES

Semester: 8 semester
Course Type: lectures and labs
Hours per week: 2 lecture hours and 1 lab hour / Fall Semester
ECTS Credits: 3.0 credits
Lecturer: Assoc. Prof. Mihail Kolev, PhD
e-mail: mkkolev@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Course Description:
The course is adapted primarily for natural majors. The course consists of modules and mostly attractive PC-experiments of various processes in the natural sciences, colorful computer animations, graphics, drawings, formulas. For each section there was selected appropriate examples and problems to exercise. Possibility of changing job parameters, initial conditions etc. The course contains a wide range of popular topics and tasks of natural science presented by computer models in mechanics (relative motion. moment of Inertia. Elastic and Inelastic Collisions. Rocket Propulsion. Keplers Laws. Bernoullis Equation. Motion with Constant Acceleration. Weight and Weightlessness). Mechanical Oscillations and Waves. (Mechanical Waves. Transverse and Longitudinal Waves. Normal Modes of a String. Beats. Doppler Effect. Free Oscillations. Forced Oscillations). Thermodynamics and Molecular Physics (Kinetic Model of Ideal Gas. Gas Diffusion. Semipermeable Membrane. Maxwells Distribution. Brownian Motion. Isobaric, Isochoric, Isothermal. Adiabatic Process. Specific Heat of a Gas. Carnot Cycle. Evaporation and Condensation. Isotherms of a Real Gas. Thermodynamic Cycles. Work of Gas).Electric and Magnetic Field. (Motion Electromotive Force. Motion of a Charged Partcle in Magnetic Field. Mass Spectrometer. Faraday Experiments. Free Oscillations in L-R-C). Optics. (The Spherical Mirror. The Microscope. Newton's Rings. Interference Experiment of Young. Diffraction. Fresnel's Zones. The Diffraction Grating. Circular Apertures and Resolving Power. Polarizers. Polarization of Light). Modern Physics. (The Photoelectric Effect. The Compton Scattering. The Bohr's Postulates. Standing Electron Waves on a Circular Orbit. The Wave Properties of Particles. The Electron Diffraction. The Laser. Two Levels Model. The Binding Energy of Nucleus. Relativity of Length. Relativity of Time),etc.
Course Aims:
The main goal is the students to master the instruments and methods of modeling in science.
Teaching Methods: lectures, tutorials, homeworks, tests, etc.

Requirements/Prerequisites: Calculus I and II, Linear Algebra and Analytical Geometry, Differential Equations.
Exam: tests, home works, final exam.

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

References:

1. http://elearning-phys.uni-sofia.bg/~gchrista/Lekcii/ - СУ, 2013
2. Fular H. R. Fular, R.Fular. Physics, S, 1988.
3. Faynman R., R. . Leyton , M.Sends . Feynman Lectures on Physics (any edition).
4. Kirkpatrick / Wheeler. Physics. A World View, 2-nd ed. 1995
5. Open Physics. MM, I,II M. 2008
6. http://mathworld.wolfram.com/LorenzAttractor.html ,2013

COMPLEX ANALYSIS

Semester: 8 semester
Type of the course: Lectures and tutorial
Hours per week: 2 lecture hours and 2 tutorial hours / Fall Semester
ECTS credits: 6.0 credits
Lecturer: Prof. Dr.Sc. Oleg Mushkarov
e-mail: muskarov@math.bas.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description:
Main topics:

- Complex numbers and Mobius transformations
- Holomorphic functions
- Power series
- Conformal mappings
- Power series
- Elementary transcedental functions
- Cauchy theorem and applications
- Taylor and Laurant series
- Classification of the isolated singularities
- Residues and applications

Course Aims:
This course is an introduction to the classical Complex Analysis and its main purpose is to present some basic topics of the Theory of holomorphic functions of one variable as well as some of its applications.
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 in the process of problem solving.
Requirements/Prerequisites: Basic knowledge of the courses in Mathematical Analysis I, II and III and the course in Analytical Geometry.
Assessment:
Written exam on seminars and theoretical material from the lectures.

Registration for exam: Students and the lecturer agree on the convenient dates within the announced calendar schedule of examination session.

References:

Basic Titles:

1. Argirova, T., Theory of analytic functions, Sofia, Science and Art, 1988
2. Chakalov, L., An introduction of the theory of analytic functions, Sofia, Science and Art, 1957.
3. Alfors, L., An introduction of the theory of analytic functions, Sofia, Science and Art, 1971.

Additional Titles:

1. P. Bojadjiev, V. Hadjiiski, Complex analysis, Sofia University Pres, Sofia, 2004.
2. V. Hadjiiski, Problems in Complex analysis, Vedi, Sofia, 1997.
3. Argirova, T., Genchev, T., Collection of problems of theory of analytic functions, Sofia, Science and Art, 1986.
4. Argirova, T. Genchev, T., Mobius transformations, Sofia, Science and Art, 1971.

ANALITIC MECHANIC

Semester: 8 semester
Type of Course: lectures and tutorials
Hours per week: 2 hours lectures and 2 hours tutorials / Summer Semester
ECTS credits: 6.0 credits

Lecturer: Assoc. Prof. Mihail Kolev, PhD
e-mail: mkkolev@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Compulsory course in the B.S. Curriculum of Mathematics.
Short Description:

The basic sections of mechanics – statics, kinematics, dynamics are considered. Basic mechanical concepts are introduced, such as force, connection, reaction, force pair, force moment and force pair, center of gravity, reference body, trajectory, velocity and acceleration in Cartesian and curvilinear coordinates. The basic axioms and theorems of statics, kinematics and dynamics are considered.

During the seminars, tasks that are directly related to the topics covered during the lectures are solved.

Out-of-class employment for the course includes mastering the lecture material, homework, working in the library and the Internet, consulting, preparation for supervisory work and more.

Course Aims:

The aim of the course is to acquaint students with the basic concepts of Analytical Mechanics, which is one of the disciplines related to the applications of mathematics. As a result, students preparing for future teachers are expected to gain an understanding of mathematical models, their

study and interpretation of classical mechanics, and to gain experience through the study and self-construction of such models over time. seminars and extracurricular work.
Teaching Methods: Lectures, tutorials, homework, problem solving tests.
Assessment: written exam 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. Lectures on analytical mechanics. A. Anchev, L. Lilov, Art. Radev. SU "Cl. Ohridski ", Sofia, 1988.
2. Guide to Analytical Mechanics. K. Markov. SU "Cl. Ohridski ", Sofia, 2001.
3. Analytical Mechanics. G. Fowles, G. Cassiday, Cengage Learning, 2004.
4. An Introduction to Analytical Mechanics. M. Cederwall, P. Salomonson, Chalmers Univ. of Technology, 2009.
5. Classical Mechanics. J.R. Taylor, Univ. Science Books, 2005.

Additional Titles:

1. Guide to Analytical Mechanics - Part I. I. Iliev, M. Kapitanova, PU "P. Hilendarski ", Plovdiv, 1980.
2. Manual of Analytical Mechanics - Part II. I. Iliev, M. Kapitanova, PU "P. Hilendarski ", Plovdiv, 1992.
3. Analytical Mechanics, Bl. Dolapchiev, Science and Art, Sofia, 1966.
4. Notes on Analytical Mechanics, I. Bengston, 2013.

OPTIONAL COURSES

SEMIGROUP THEORY

Semester: 4-th semester
Course Type: Lectures
Hours per week: 3 lecture hours / Summer Semester
ECTS credits: 5.0 credits

Lecturer: Assoc. Prof. Ilinka Dimitrova, PhD
e-mail: ilinka_dimitrova@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. ++35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Short Description:
The term "semigroup" first appeared in mathematical literature in the beginning of XX century, but the theory of semigroups really began at the end of the 20s. At 60 years of XX century the theory of semigroups becomes dynamically developing area of modern algebra with a wide variety of problems and different applications. During these years, appeared the first books

devoted to the theory of semigroups. In recent years, the semigroups have been extensively studied in different aspects by many authors in Bulgaria and in many famous mathematical centers abroad. The relationship between semigroups, languages and automata is one of the most important aspects of contemporary semigroup theory. They also occur in theoretical computer science, coding theory, differential equations, functional analysis, mathematical linguistics, and many other areas. The course begins with the study of basic concepts, properties and examples of the theory of semigroups. Ideals, congruence and theorems for homomorphism and isomorphism of semigroups are considered. Particular attention is paid to the Green's relations and symmetric semigroup. The course continued with the study of a number of semigroups with specific properties such as regular semigroups, inverse semigroups, simple semigroups, Rees matrix semigroups and free semigroups.

Course Aims:

The purpose of this course is to introduce students to the basic theory of the semigroups and its applications to the other mathematical disciplines. The content of the course gives the students the opportunity to be able to study alone and in more details the theory of the semigroups; to be able to follow other courses that use semigroup theory; to be able to attend specialized scientific seminars in algebra; to be able to reading articles and books in this field.

Teaching Methods: lectures, homework, and problem solving tests.

Requirements/Prerequisites: The students should have basics knowledge from Algebra.

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

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. A.H. Clifford and G.B. Preston, The algebraic theory of semigroups, Vol. I & II, Mathematical Surveys of the Amer. Math. Soc. 7, 1961 & 1967.
2. J.M. Howie, An introduction to semigroup theory, Academic Press, 1976.
3. J.M. Howie, Fundamentals of semigroup theory, Clarendon Press, 1995.
4. M. Petrich, Introduction to semigroups, Merrill, Columbus, Ohio, 1973.
5. M. Petrich, Inverse semigroups, Wiley, New York, 1984.
6. Е.С. Ляпин, Полугрупы, Государственное издательство физико-математической литературы, Москва, 1960.

Additional Titles

1. P.M. Higgins, Techniques of semigroup theory, Oxford University Press, 1992.
2. G. Lallement, Semigroups and combinatorial applications, Wiley, 1979.

REPRESENTATION THEORY OF GROUPS

Semester: 4-th semester

Course Type: Lectures

Hours per week: 3 lecture hours / Summer Semester

ECTS credits: 5.0 credits

Lecturer: Acad. Prof. Dr.Sc. Veselin Drenski
e-mail: drensky@math.bas.bg
Department: Bulgarian Academy of Sciences

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Short Description:
Group theory is the oldest part of algebra that studies the properties of algebraic structures (such as linear spaces, groups, semigroups, rings, algebras and others.). One of the main reasons for the numerous applications of group theory in other areas of mathematics, physics, chemistry and other natural sciences is that groups can be represented through its effect on other objects - as inverse images of sets on himself and inverse linear operators in linear spaces. Theory of representations of groups studying algebraic properties of these acts of abstract and concrete important groups. It is used to obtain new results in the theory of groups, as well as for number of applications in other areas such as geometry, physics, chemistry, crystallography, and even architecture.
Course Aims:
The purpose of this course is to introduce students to the basic theory of group representation and its applications to algebra, coding theory and crystallography. The content of the course gives the students the opportunity to be able to follow other courses that use this theory as well as to read articles and books in this field.
Teaching Methods: lectures, homework, and problem solving tests.
Requirements/Prerequisites: The students should have basics knowledge from Algebra.

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

1. А.И. Кострикин, Введение в алгебру, Москва, „Наука", 1977.
2. S. Lang, Algebra, Third Edition, Addison-Wesley, Reading, Mass. 1993.
3. I.N. Herstein, Noncommutative Rings, Carus Math. Monographs 15, Wiley and Sons, Inc., New York, 1968.
4. C.W. Curtis, I. Reiner, Representation Theory of Finite Groups and Associative Algebras, Reprint of the 1962 original, Providence, RI: AMS Chelsea Publishing, 2006.
5. T.A. Springer, Invariant Theory, Lect. Notes in Math. 585, Springer-Verlag, 1977.

FINITE ALGEBRAIC STRUCTURES

Semester: 4-th semester
Course Type: Lectures
Hours per week: 3 lecture hours / Summer Semester
ECTS credits: 5.0 credits
Lecturer: …….

Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Course description: Main topics:

- Finite groups, semigroups and groupoids;
- Discrete monoids;
- Formal languages and free semigroups;
- Stable varieties;
- Description of the lattice of stable varieties of Semigroups.

Course Aims:
The purpose of this course is to introduce students to the basic properties and applications of finite and discrete algebraic structures in the theoretical and information sciences.
Teaching Methods: lectures, homework, and problem solving tests.
Requirements/Prerequisites: The students should have basics knowledge from Algebra.

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

1. С. И. Адян, Проблема Бернсайда и тождества в групах, Наука, М., 1975.
2. G. Lallement, Semigroups and Combinatorial Applications, NY, 1979.
3. T. Evans, The Lattice of Semigroup Varieties, Semigroup Forum, Vol. 2(1971), 1-43.
4. J.M. Howie, Fundamentals in Semigroup Theory, Oxford, University Press, London, 2003.
5. Sl. Shtrakov, Essential variables and positions in terms, Algebra Universalis, Vol. 61, No. 3-4, (2009), pp. 381-397.
6. Sl. Shtrakov and J. Koppitz, Stable varieties of semigroups and groupoids, Algebra Universalis, (2014) (revised).

INTRODUCTION TO CODING THEORY

Semester: 4-th semester
Course Type: Lectures
Hours per week: 2 lecture hours + lab /Summer Semester
ECTS credits: 5.0 credits
Lecturer: Assist. Prof. Margarita Todorova, PhD
e-mail: todorova@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Course description:

The course starts with introduction of the main notions of the Coding theory – errorcorrecting 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.

Scope of the course:

Obtaining knowledge of the theoretical backgrounds and practical abilities for applications of the Coding theory. 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

References:

1. Notes (www.moi.math.bas.bg/~peter).
2. Hill R. A first course in coding theory, Calderon Press, Oxford, 1986. Additional
3. Elbirt Adam J. Understanding and Applying Cryptography and Data Security, Auerbach Publications,2009 - 416 Page
4. MacWilliams F. J., N. J. A. Sloane, The theory of error-correcting codes, New York, North Holland, 1977 (руски превод Москва, Свьязр 1979).
5. Peterson W., E. Weldon Jr., Error-correcting codes, Second edition, Cambridge (Mass), MIT Press, 1971 (руски превод Москва, Мир, 1976).
6. Roberts Fred, Barry Tesman, Applied Combinatorics, Second Edition, 2009, Chapman and Hall/CRC - 848 Pages,
7. Stinson Douglas R. Cryptography: Theory and Practice, Third Edition, 2005 by Chapman and Hall/CRC - 616 Pages
8. Yehuda Lindell Introduction to Coding Theory Lecture Notes, Department of Computer Science, Bar-Ilan University, Israel, 2010
9. Блейхут Р. Теория и практика кодов, контролирующих ошибки, Москва, Мир, 1986.
10. Fisher T.A. Coding and Cryptography, Michaelmas 2005, http://www.pancratz.org/notes/Coding.pdf
11. Paar Christof, Jan Pelzl, Preneel Bart Understanding Cryptography. A Textbook for Students and Practitioners, Springer-Verlag Berlin Heidelberg, 2010

SPOKEN AND WRITTEN CULTURE

Semester: 4-th semester

Course Type: Lectures

Hours per week: 3 lecture hours /Summer Semester

ECTS credits: 5.0 credits

Lecturer: ……..
e-mail:
Department: South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588557

Course Status: Optional course in the B.S. Curriculum of Mathematics.

Short Description:

The course consists of 30 hours of lectures and the number of extra-curricular hours is 60.
The training is carried out according to a syllabus in one module, which is a lecture. It includes a set of major topics specifically selected in the field of spelling and law in contemporary Bulgarian literary language. It is the obligation of the teacher for each subsequent lesson to set a topic and literary sources related to it, and it is the obligation of the student in the time for extra-curricular employment to prepare independently on the cases of this topic.

Course Aims:

To develop in students the ability to use correctly the spelling and legal rules, operating in the contemporary Bulgarian literary language. To form in students the ability to explain the mechanism of the admitted spelling or legal inaccuracy and the reasons that led to it - assimilation or dissimilation process, dialect influence, etc. To cultivate respect for the creative genius of the Bulgarian, embodied in the Bulgarian language.

Expeted results:

Students to master the spelling and legal rules of the modern Bulgarian literary language to the degree that allows them to successfully pass their semester exam in this discipline and to successfully apply this knowledge in the process of their practical realization on the labor market. To master the norms of spelling and jurisprudence in order to realize themselves as full-fledged specialists in the system of every sphere, which requires proper handling of the spelling and legal norms in the modern Bulgarian literary language. Obtain the credits for the discipline.

References:

Basic:

1. Ant. Stoilov. Spelling and spelling. Student Tests. Spelling rules. Essays. 2008.
2. Pashov, P., Hr. First. An orthodox dictionary in the Bulgarian literary language. S., 1979.
3. Official spelling dictionary in modern Bulgarian literary language. S., 2012

Additional:

1. Boyadzhiev, T., V. Radeva, M. Sl. Mladenov. Between dialect and literary. S., 1987.
2. Georgieva, El. Language culture and language training. S., 1990.
3. Georgieva, El., P. Barakova. 101 questions about doublets in Bulgarian. S., 1990.
4. Grammar of SBKE, i. S., 1982.
5. Grammar of SBKE, Vol. S., 1983.
6. Grammar of SBE, Vol. S., 1983. Dobreva, El., Iv. Savova. Problems with the construction of the text. S., 1990.
7. 10. Murdarov, Vl., P. Kostadinov. 101 questions about the emphasis in the Bulgarian language. S., 1988.
8. Nitsolova, R. Contemporary Bulgarian punctuation. S., 1989.
9. Pashov, P., Hr. First. The Bulgarian Jurisprudence. S., 1983.
10. Pashov, P. Practical Bulgarian Grammar. S., 1989.
11. Popov, K. Syntactic harmonization in the Bulgarian language. S., 1988.
12. Tsankov, K. Speech etiquette. S., 1988.

HIGH SCHOOL COURSE IN ALGEBRA AND ANALYSIS

Semester: 5 Semester
Course type: lectures and lab
Hours per week: 3 hours lectures
ECTS credits: 5.0 credits
Assessment: exam
Lecturer: Assoc. Prof. Ph.D. Kostadin Samardzhiev
e-mail: k_samardzhiev@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, SWU "Neofit Rilski" - Blagoevgrad, Phone: 073 / 588 532

Course Status: Compulsory course in the B.S. Curriculum of "Pedagogy of Teaching of Mathematics, Informatics and Information Technology".

Short Description:

The construction and development of the notion of number is difficult both in its mathematical and philosophical aspect, but it is also difficult in its teaching and lecturing aspect. After acquiring the knowledge of basics of arithmetic in the construction of the concept of number, in the course in "High School Algebra", this course begins with the formulation of the basic algebraic laws - commutative, associative, idempotent (neutral) elements in the actions of addition and multiplication, as well as the law of distribution, combining two operations with natural numbers. Based on the actions of addition and multiplication, the relevant regulations are also defined. The basic properties of the linear ordinance emerge – the boundedness of the lower bound of each set of natural numbers, archimedes, etc., as well as the method of mathematical ordinance associated with the two ordinances. All of this is illustrated with specific examples. The question of recording a natural number in different number systems is also considered. Since it is shown that for every two positive integers a, b ε א the equations a + x = b and ax = b in the half-ring of natural numbers א have no solutions, the need to extend the half-ring א to the ring of integers Ž is clarified, the half-field of fractions Q┬, and finally to the field of rational numbers Q. For each of these structures, the validity of the basic properties of the ordinances introduced in the half-ring of natural numbers is emphasized. All of this is illustrated with relevant examples and tasks. Most of the time is dedicated to the field of real numbers and the corresponding tasks in this field - square equations and inequalities, system equations and inequalities, including those with irrational expressions, and such equivalents with the participation of special functions in the form of indicative, logarithmic, trigonometric and others.

Self-study for the course includes homework, coursework, library and computer room work, consultations, preparation for control work, assimilation of lectures and more. n. The ratio of classroom to self-study is 90:135.

Course Objectives:

The course of lectures and exercises reflects the status of the above material taught in the school mathematics course and is based on the known basic algebraic structures. It aims to teach students to know these basic structures and the possible tasks that can be solved in them. With the help of acquired habits and skills, starting with an algebraic expression or a system of such with the help of possible equivalents of transformations allowed in the structure under consideration, the student, subsequently a teacher, will have to bring it to the complete canonical form.

Teaching Methods: lectures, lab, consultations, homework and tests.

Requirements/Prerequisites: Knowledge of high school algebra.
Assessment: Written exam on the seminars and lectures content.
Registration for the exam: In agreement with the teacher and the department of student education.
References:

Basic:

1. Denecke, Kl., Todorov, K., Fundamentals of Arithmetic, Blagoevgrad, 1999
2. SE Lyapin, MI Baranova, Collection of Problems in Elementary Mathematics, Uchpendgiz, 1963.
3. L. Chakalov et al. Collection of algebra problems.
4. Il.Gudzhenov, K. Samardzhiev, Methodical Guide for Solving Mathematical Problems, 1994, Blagoevgrad
5. Yaroslav Tagamlitsky, Differential Calculus, Science and Art Sofia, 1978.
6. E. Bozhorov, Higher Mathematics, Technika-Sofia, 1975.
7. K. Chimev, A. Petrova-Deneva, Mathematics, Blagoevgrad, 1985.
8. Chimev K., Tasev M. et al., Methodical Guide for Solving Mathematical Problems Blagoevgrad Publishing House, 1988.
9. PA Larichev, Collection of Problems in Algebra Part One, Uchpedgiz 1961, Moscow

Additional:

1. Chimev K., Mirchev I., Shtrakov Sl., Mathematics, Blagoevgrad, 1995
2. Kirkorov I., Nedev A., Collection of problems in higher mathematics part two, Publisher Science and Art, Sofia, 1975
3. Milanov S., Stoyanov N., Deneva A. et al., Higher Mathematics 1, 2, 3, 4, 5 part, State Publishing House Technique, Sofia, 1977

CONSTRUCTIVE THEORY OF FUNCTIONS

Semester: 5-th semester
Course Type: Lectures
Hours per week: 3 lecture hours / Summer Semester
ECTS credits: 5.0 credits
Lecturer: Assoc. Prof. Dr. Vassil Grozdanov
e-mail: vassgroz@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. ++35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Short Description:
The main topics to be considered:

- Uniform approximations
- Quadratic approximations
- Fourier seris

Course Aims: This course develops in details the problems of apprimation of functions
Teaching Methods:

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

Requirements/Prerequisites:

Basic knowledge of courses in mathematical analysis

Assessment: written exam and discussion on the theoretical material from the lectures.

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

Registration for the exam: Students and the lecturer agree on the convenient dates within the announced calendar schedule of examination session.

References:

1. P. Natanson, Constructive theory of functions, State publishing technical – theoretical literature Moskow-Leningrad, 1949.

UNIFORM DISTRIBUTION OF SEQUENCES

Semester: 5-th semester

Course Type: Lectures + lab exercise

Hours per week: 2 lecture hours + 1 lab exercise / Summer Semester

ECTS credits: 5.0 credits

Lecturer: Assoc. Prof. Dr. Vassil Grozdanov

e-mail: vassgroz@swu.bg

Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. ++35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.

Short Description:

The main topics to be considered:

- Criterions for uniformly distribution
- Discrepancy and Diaphony
- Low discrepancy sequences and nets
- Numerical integration and applications.

Course Aims: This course develops in details notions and theorems of the described scientific problems.

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: Basic knowledge of courses in mathematical analysis, theory of the probability, theory of numbers and others.

Assessment: written exam on seminars and discussion on the theoretical material from the lectures.

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

Registration for the exam: Students and the lecturer agree on the convenient dates within the announced calendar schedule of examination session.

References:

1. L. Kuipers, H. Niederreiter, Uniform distribution of sequences, John Wiley & **S**ons, New York, London, Sydney, Toronto, 1974.

NUMERICAL METHODS MONTE CARLO

Semester: 5-th semester
Course Type: Lectures
Hours per week: 2 lecture hours + 1 lab exercise / Summer Semester
ECTS credits: 3.0 credits
Lecturer: Assoc. Prof. Dr. Vassil Grozdanov
e-mail: vassgroz@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. ++35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Short Description: The main topics to be considered:

- Elements of the probability theory;
- Brawnian motion;
- Variance reduction;
- Stochastic methods.

Course Aims: This course develops in details notions and theorems of the described scientific problems.
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:
Basic knowledge of courses in mathematical analysis, theory of the probability, theory of numbers and others.

Assessment: written exam on seminars and discussion on the theoretical material from the lectures.
Registration for the Course: by request at the end of the current semester
Registration for the exam: Students and the lecturer agree on the convenient dates within the announced calendar schedule of examination session.
References:

1. Hui Wang, Monte Carlo Simulations with Applications to Finance, A Chapman & Hall, London, New York, 2012.

HIGH SCHOOL COURSE IN GEOMETRY

Semester: 6 Semester
Course type: lectures
Hours per week: 3 hours lectures
ECTS credits: 5.0 credits
Assessment: exam

Lecturer: Assoc. Prof. Kostadin Samardzhiev, PhD
e-mail: k_samardzhiev@swu.bg
Department: Department of Mathematics, SWU "Neofit Rilski" - Blagoevgrad

Course Status:

Compulsory course in the B.S. Curriculum of "Pedagogy of Teaching of Mathematics, Informatics and Information Technology".

Short Description:

The course covers the following geometric transformations: equality, similarity, affinity. Basic topics include face of a polygon and a tetrahedron.

Course Objectives: Students will acquire the theoretical and practical background needed to teach geometry in schools.
Teaching Methods: lectures, lab, consultations, homework and tests.
Requirements/Prerequisites:

Basic knowledge of geometry, studied during school years.

Assessment: Written exam on seminar exercises and on theoretical material during the lectures.

Registration for the exam: In agreement with the teacher and the department of student education.

References:

Basic:

1. Borisov, A .; A. Langov. Geometry school course. Blagoevgrad, 2007
2. Borisov, A .; A. Langov. A guide to solving problems in a school geometry course. Blagoevgrad, 2011
3. Lozanov, Ch .; G. Yeneva, A. Langov. Synthetic geometry, Sofia, 1994

Additional:

1. Adamar, J. Elementary geometry, parts 1 and 2. Moscow, 1979.
2. Banks, K .; T. Vitanov. Geometry. Sofia, 2003
3. Perepylkin, DI Course in Elementary Geometry, Parts 1 and 2. Sofia, 1965
4. Hilbert, D. Fundamentals of geometry. Sofia, 1978.

DATA PROCESSING AND ANALYSIS IN MSEXEL AND VBA

Semester: 6 Semester
Course type: lectures and labs
Hours per week: 1hour lectures and 2 hours labs
ECTS credits: 5.0 credits

Assessment: exam

Lecturers: Prof. Ph.D. Daniela Tuparova
e-mail: ddureva@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, SWU "Neofit Rilski" - Blagoevgrad, Phone: 073 588 532

Course Status: Elective discipline in the curriculum of the specialty "Pedagogy of Teaching of Mathematics, Informatics and Information Technology"

Short Description:

The course is an introduction to programming with Visual Basic for Application. The basic principles and concepts of event programming, object models of MS Office applications and creation of a graphical user interface are discussed.

Course Objectives:

Students must acquire knowledge of:

- Programming a graphical user interface with VBA.
- Object models of MS Word, MS Excel and MS Power Point.
- Designing and developing interactive applications in MS Office.

Teaching Methods: lectures, labs, discussions and problem solving.
Requirements/Prerequisites: Knowledge of word processing, spreadsheets and computer presentation systems is required.
Assessment: Assessment of course project (35%), ongoing control **(**30%) and written exam (test) (30%). The course is considered to as completed with at least 65% of the total points.
Registration for the course: it is necessary to apply to the department at the end of second semester
Registration for the exam: in agreement with the teacher and the department of student education
References:

1. Radev, E. and the team, Informatics, II-th edition, Thrace-M, 2002.
2. Roman, Stephen, Write Macros in Excel, .Zest Press, 2000
3. Roman, Stephen, Write Macros in Word, .Zest Press, 2000
4. Walkenbach J., Excel® 2010 Power Programming with VBA, Wiley Publishing, 2010
5. Low, J., Word 2003 Visual Basic Programming, Lulu Publishing, 2005

INTRODUCTION TO LATEX-2E

Semester: 6 semester
Type of Course: Lectures and tutorials in computer lab.
Hours per week: 2 hours lectures and 1 hour tutorials in computer lab / Summer Semester.
ECTS credits: 5.0 credits

Lecturers: Assit. Prof. Ivo Damyanov, PhD
e-mail: damianov@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Short Description:
The course includes the following sections:

- Scripts and visual word;
- Classes of documents, packages and styles;
- A set of mathematical formulas;
- Mathematical graphics in LATeX 2e;
- Settings of LATeX 2e;
- BEAMER class for presentations in LATeX 2e.

The course focuses on the practical utilization of the material on the basis of numerous examples.
Course Aims:
The course aims to provide knowledge to students in philosophy and history of LATeX 2e, a computer program created by Donald Knuth and intended for processing text and mathematical formulas.
Teaching Methods: Lectures, tutorials, homework, problem-solving tests.
Requirements/Prerequisites: Knowledge in Operating Systems, Programming Basics, Discrete Mathematics.
Exam: final exam
Registration for the Course: by request at the end of the current semester
Registration for the Exam: coordinated with the lecturer and the Student Service Office

References

1. Leslie Lamport, A document Preparation System LATEX user's guide and reference manual, Addison-Wesley, 1998.
2. Till Tantau, Joseph Wright, Vedran Miletić (2010) User's guide – The BEAMER class, manual for version 3.07, http://www.ctan.org/tex-archive/macros/latex/contrib/beamer/doc/beameruserguide.pdf
3. Norm Matloff', Quick Tutorial on the Beamer Package for Slide Making in LaTeX, http://heather.cs.ucdavis.edu/~matloff/beamer.html
4. T. Oetiker, H. Partl, I. Hyna, E. Schlegel, Не много кратко въведение в LATEX 2e, 2004, http://www.download.bg/?cls=program&id=446489,
5. http://fmi.uni-sofia.bg/fmi/or/TeX/LaTeXBG.pdf

GRAPHIC DESIGN OF PRINTED AND PROMOTIONAL MATERIALS

Semester: 6 semester
Type of Course: Seminars and tutorials in computer lab.
Hours per week: 1 hour seminar and 2 hours tutorials in computer lab / Summer Semester.
ECTS credits: 5,0 credits

Lecturers: Assoc. Prof. Radoslava Kraleva, PhD
e-mail: rady_kraleva@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,t el. +35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Course Description:
The course is a practical introduction to desktop publishing systems. Students learn the best practices in the development of print and electronic materials, such as brochures, leaflets, posters, magazines, newspapers and more. Studied are the principles of working with the software used in publishing. Discussed are typical problems in the field of publishing and advertising activities. The course prepares students for the future development of different types of designs of promotional materials, web sites and more.
Course Objectives:
This course aims to provide students with knowledge and additional training in the theory and practice of publishing systems. They will learn about the methods of digital image processing, how to create vector graphics and prepress of promotional materials with different purpose.
Teaching Methods: Lectures, demonstrations, work on project and teamwork.
Requirements: Needed basic knowledge of operating systems, information technology, graphics editors and working with multimedia files.

Assessment:
Evaluating the student shall be carried out in the sixth grad scale – 2, 3, 4, 5, 6. Evaluation of current control is obtained by taking the average of the assessment of coursework and paper. Students who have a minimum average estimate /3/ of the current control is not allowed to test the regular session. They must present additional development and evaluation after receiving at least medium /3/ be admitted to the written examination of supplementary or liquidation session. The final estimate is derived from the average of the current control and evaluation of the written exam.
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:

1. Rebecca Gagen, Kim Golombisky, White Space is Not Your Enemy: A Beginner's Guide to Communicating Visually through Graphic, Web and Multimedia Design, Focal Press, 2010
2. John McWade, Before & after graphics for Business, Peachpit Press, 2005
3. Roger C. Parker, Design to Sell: Use Microsoft® Publisher to Plan, Write and Design Great Marketing Pieces, Microsoft Press, 2006
4. Brian P. Lawler, Official Adobe Print Publishing Guide, Second Edition: The Essential Resource for Design, Production, and Prepress, Adobe Press, 2005
5. http://194.141.86.222/lecture/rkraleva/
6. SCRIBUS: Open Source Desktop Publishing, http://www.scribus.net/canvas/Scribus, 2012
7. GIMP: GNU Image Manipulation Program, http://www.gimp.org/, 2012
8. INSCAPE: Open Source Scalable Vector Graphics Editor, http://inkscape.org/, 2012

DIFFERENTIAL MANIFOLDS

Semester: 7 semester
Course Type: lectures
Hours per Week: 3 lecture hours per week /Fall Semester
ECTS Credits: 5.0 credits
Lecturer: Assoc. Prof. Nikolay Kitanov, PhD
e-mail: nkitanov@swu.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Optional course in Mathematics B.C. Curriculum.
Short Description:
The course includes studying of the basic topics of the Differential Manifolds and Riemannian Differential Geometry.
Course Aims:
The students have to obtain knowledge and skills for applications of the differential geometry methods for learning of geometric objects.
Teaching Methods: lectures, homeworks and tests.
Requirements/Prerequisites: Mathematical Analysis, Differential Equations, Differential Geometry.
Assessment: written exam on topics from lectures.
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:
Basic Titles
1. Gallot, S., D. Hulin, J. Lafontaine. Riemannian Geometry. Second edition, Berlin, Springer- Verlag, 1990.
2. Ivanova-Karatopraklieva, I. "Differential Geometry", University Press"S. Kl. Ohridski " , Sofia, 1994 (in Bulgarian)
3. Stanilov, G. "Differential Geometry", Sofia, 1997 (in Bulgarian)
Additional Titles
1. Kobayashy, S., K. Nomizu. Foundations of Differential Geometry. Vol. I, 1963; Vol. II, 1969, Interscience Publishers, New York – London.

OPERATIONAL RESEARCH

Semester: 7 semester
Course Type: lectures, seminars
Hours per week: 2 lecture; 1 seminar exercise / Fall Semester
ECTS credits: 5.0 credits
Lecturer:. Prof. Peter Milanov, PhD
e-mail: milanov@swu.bg

Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics
Course Description:
The aim of the research operation is quantitative analysis and finds a solution by management system.
Course Aims: Students should obtain knowledge and skills to find the optimal solution in the analyzing problem**.**
Teaching Methods: lectures, demonstrations and work on project
Requirements/Prerequisites: Linear algebra, Computer languages. optimization theory.
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:

1. H. A. Eiselt, Operations Research: A Model-Based Approach (Springer Texts in Business and Economics), 2012, Springer Heidelberg NY.
2. Hamdy A. Taha, Operations Research: An Introduction, 2010 Springer,
3. Ravi Ravindran, Donald P. Warsing Jr.Supply Chain Engineering: Models and Applications (Operations Research Series), 2012, Jonson and Son,
4. Венцель И. Исследования операции. Москва, 1970.
5. Vagner G. Operational research Vol I-III 1998.
6. Зайченко Ю. Исследования операции. Москва, 1988

APPLIED STATISTIC

Semester: 7 semester
Type of Course: Lectures, seminars and tutorials in computer lab
Hours per week: 1 hour lectures, 1 hour seminars and 1 hour tutorials in computer lab /Fall Semester
ECTS credits: 5.0 credits
Lecturer: Assoc. Prof. Elena Karashtranova, PhD
e-mail: helen@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532
Course Status: Optional course in the B.S. Curriculum of Mathematics.
Course description:
The course is introduction in nonparametric statistic and possibility to apply new IT in this area.
Objectives: The students should obtain knowledge of:

- To apply the methods of nonparametric statistics in practice
- To realize concrete applications with tools of IT.

Methods of teaching: seminars, tutorials, discussions, project based method.
Pre- requirements: Probability and Statistics, Information Technology
Assessment and Evaluation

Project- 30%
Final Test- 70%

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

References:
Basic Titles

1. Karastranova E. Interactive Probability Training and Statistics, SWU, 2010
2. K. Kalinov, Statistical Methods in Behavioral and Social Sciences, NBU, 2010
3. P. Kopanov, V. Noncheva, S. Hristova, Probabilities and statistics, manual for solving problems, Paisii Hilendarski University Publishing House, 2012, ISBN 978-954-423-796-7
4. G. Freiman, Exploratory data analysis, J., Isr.Math, 2002

Additional Titles:

1. http://www.teststat.hit.bg

NUMERICAL ANALYSIS FOR EXTREMUM PROBLEMS

Semester: 7 semester
Course Type: lectures, seminars
Hours per week: 2 lecture; 1 seminar exercise / Fall Semester
ECTS credits: 5.0 credits

Lecturer: Assoc. Prof. Stefan Stefanov
e-mail: stefm@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad,
tel. +35973588532

Course Status: Optional Course in the Mathematics B.S. Curriculum
Course Description:
The discipline Numerical Methods for Extreme Problems involves studying the basic numerical methods for solving different classes of optimization (extreme) problems: one-dimensional minimization - the splitting method, the gold section method, the Fibonacci method, the Newton method, the parabolic method; unconditional optimization - zero-order methods (Coordinate descent method, Hook and Jeeves method, Rosenbrock method), first order (gradient methods: fastest descent method), second order (Newton method, method modifications), and conjugate methods (conjugate gradient method: Fletcher - Reeves method, Pollock method - Ribera; quasi-Newtonian methods: Davidson-Fletcher-Powell method); conditional optimization - methods of possible directions (of Zoitendijk, of Rosen, of the reduced gradient), methods of penal (fining) and barrier functions; non-smooth analysis and methods of non-differentiable (non-smooth) optimization; stochastic optimization; separable optimization; dynamic optimization and R. Belman principle; vector (multicriteria) Pareto optimization.

Course Objectives: Students should gain knowledge of the basic methods for numerically solving optimization problems.
Teaching Methods: lectures, tutorials and homework projects.

Requirements/Prerequisites: Basic knowledge of mathematical analysis, linear algebra, analytical geometry, mathematical optimization is required.
Assessment: written final exam
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. Yu. P. Zaichenko - "Operations Research", Higher School, Kiev, 1988.
2. VG Karmanov - "Mathematical Programming", Science, Moscow, 1986.
3. M. S. Bazaraa, H. D. Sherali, and C. M. Shetty - "Nonlinear Programming. Theory and Algorithms ", John Wiley & Sons, Inc., New York, 2nd ed., 1993. (There is a Russian translation of the first edition: M. Bazaar, K. Shetty -" Nonlinear Programming. Theory and Algorithms ", World, Moscow , 1982).

Additional:

1. Stefan M. Stefanov - "Separable Programming. Theory and Methods ", Kluwer Academic Publishers, Dordrecht - Boston - London, 2001.
2. Stefan M. Stefanov - "Quantitative Methods in Management", Heron Press, Sofia, 2003.

DECISION MAKING SUPPORT ALGORITHMS IN ECONOMICS AND MANAGEMENT

Semester: 7 semester
Course Type: lectures, tutorials
Hours per week: 2 hours lectures and 1hour tutorials / Fall Semester
ECTS credits: 5.0

Lecturer: Assoc. Prof. Nikolay Kitanov, PhD
e-mail: nkitanov@abv.bg
Department: Department of Mathematics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Optional Course in the Mathematics B.S. Curriculum
Course Description:
The course Decision making support algorithms in economics and management includes four basic topics:
The first topic is dedicated to decision making methods by voting. Some basic voting algorithms and methods are considered;
The second topic includes basic methods and algorithms for solving of multi-objective (vector) problems;
The third topic is dedicated to the application of game theory in optimal decision making;
The fourth topic includes some methods and algorithms for decision making in risk conditions, and uncomplete information.
Course Objectives:

Student should obtain knowledge and skills for some basic methods and algorithms supporting decision making.
Teaching Methods: lectures, tutorials and homework projects.
Requirements/Prerequisites: Basic knowledge in Mathematical analysis, Linear algebra, Analytic geometry, Mathematical programming , Probability Theory.

Assessment: written final exam (grade weight is 60 %); two homework projects (grade weight 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. V. A. Abchuk. "7:1 The Alphabet of the Solutions" – Tehnika, Sofia, 1986. (in Bulgarian)
2. T. R. Gichev, Z. K. Karamiteva. "Game Theory" – Nauka I Izkustvo , Sofia, 1980. (in Bulgarian)
3. G. H. Ivanov and coll. "Guide for Methematical Programing Problem Solving", UNI, Sofia, 1989 (in Bulgarian).
4. E. S. Venttzel. "Operation Research "– Nauka, Moscow, 1988 (in Russian).
5. Yu. I. Degtyarev. "Operation Research" – Higher School, Kiev, 1986 (in Russian).
6. Yu. K. Mashunin. "Vector Optimization – Methods and Models" – Nauka, Moscow, 1986 (in Russian).
7. Vira Chankong, Yacov Y. Haimes. Multiobjective Decision Making: Theory and Methodology Series Volume 8 – North-Holland, New York, Amsterdam, Oxford
8. D. Dochev, J. Petkov. Decision Making Theory. Varna, Nauka i Ikonomika, 2008.
9. K. Tenekedjiev, N. Nikolov, D. Dimitrakieva. Theory and Practics of the Riscs Decisions. MASR, 2002.

FUNDAMENTALS OF COMPUTER GRAPHICS

Semester: 7 semester
Course Type: Lectures and tutorials
Hours per week: 2 lecture hours and 1 tutorial hours /Fall Semester
ECTS credits: 5.0 credits

Lecturer: Assoc. Prof. Ivan Trenchev, PhD
e-mail: trenchev@swu.bg
Department: Department of EEE, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Short Description:
The program a syllabus contains an extension of the subjects:

1. Linear transformations – collineations, affinities, similitudes, identities and their classifications in the plane and in the space.
2. Fundamental methods of representation of the space on the plane – axonometry and perspective.

Course Aims: The students have to obtain knowledge and skills for an application of the transformations in the computer programs of the computer graph.
Teaching Methods: Lectures, tutorials, home works, problem solving tests.
Requirements/ Prerequisites: Analitic Geometry, Linear Algebra and School course of Geometry.

Assessment: Written exam on topics from tutorials and on topics from lectures.
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. Borisov, A; A.Langov. Geometry. Blagoevgrad, Univ.Publ."Neofit Rilski", 2006.
2. Langov, A. Descriptiv Geometry. Sofia, Nauka and Izkustvo, 1979.

Additional Titles:

1. Borisov A; I.Gyudzhenov. Linear Algebra and Analitic Geometry. Blagoevgrad, Univ. Publ. "Neofit Rilski", 1999.
2. Losanov, Ch., A. Langov, G. Eneva. Syntetic Geometry. Sofia, Univ. Publ. "S.Kl. Ohridski", 1994.

MATHEMATICAL THEORY OF DATABASE

Semester: 7 semester
Course Type: Lectures and tutorials
Hours per week: 2 lecture hours and 1 tutorial hours /Summer Semester
ECTS credits: 5.0 credits

Lecturer: Prof. Peter Milanov, PhD
e-mail: milanov@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532

Course Status: Optional course in the B.S. Curriculum of Mathematics.
Course Description:
In this course we present the differences between the traditional, no database approach to information system design and the database approach.
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:

1. Henry H. Liu, Oracle Database Performance and Scalability A Quantitative Approach, 2011 A Jon Wiley and Son, US
2. Alapati and Bill Padfield, Expert Indexing in Oracle Database, 2011, New York Press,
3. Toby J. Teorey , Sam S. Lightstone , Tom Nadeau, H.V. Jagadish, Database Modeling and Design Database Modeling and Design, 2012, Morgan Kaufmann Press
4. Vidya Vrat Agarwal, Beginning C Sharp 5 0 Databases, 2012 New York Press,
5. Павел Азълов. Бази от данни. Релационен и обектен подход, техника, 1991 г.
6. Юлиана Пенева, Бази от данни. I част. София, ИК "Регалия " 6, 2002 г.
7. Shepherd J.C. Database management: Theory and Application. Irwin Inc.,USA 1990.
8. Мейер Д.р Теория релационных баз данных. Издательство "Мир". 1987.

PROGRAMING WITH OBJECT PASCAL AND DELPHI

Semester: 7 semester
Type of Course: lectures and labs
Hours per week: 2 lectures + 1 labs per week / Summer Semester
ECTS credits: 5.0 credits
Lecturers: …….
e-mail:
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532
Course Status: Optional course in the B.S. Curriculum of Mathematics.
Course description:
In the course students are introduced with methods and means of Object-oriented programing in integrated development interface for visual programing - Delphi. The students should have a basic knowledge on programming with Pascal. Suppouse that students are successablity passed courses in Programming and Data structures and Object-oriented programming (in SWU this courses are basic on program language C++) and students are known for fundamental skils in programming. In the course students develop programs using different platform and language - Object Pascal and Dlephi.
Objectives: Basic objectives and tasks:

- The students give knowledge for algorithum thinking;
- to give knowledge for Data stuctures, that can process with computer;
- to give knowledge for methods and skils in Object-oriented programming in integrated development environment for visual programming;
- to give knowledge for syntax of another program language (Object Pascal and Delphi);
- to give knowledge for good style in programming;
- to give knowledge for basic principles when develop applications.

Methods of teaching: lectures and labs
Pre-requirements: Basic knowledge in "Programming and Data structures".
Exam: two course projects and 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 the lecturer and the Student Service Office

References:

1. Frank Ehler Delphi 6. Infodar, 2001.
2. Hristo Krushkov Programming with Delphi. Plovdiv, Macros, 2004.
3. Martin Garden Delphi - Creating Components. AmPress, 1999.
4. Javier Pacheco, Steve Teicher Delphi 5, Volume 1, Volume 2, Volume 3, InfoDar, 1999
5. Javier Pacheco, Steve Teicher Delphi 5 - Advanced Guide. InfoDAR, 1999.
6. Marco Cantu, Mastering Delphi 6, Volume 1, Volume 2, SoftPress, 2002

PROGRAMING WITH C++ BUILDER

Semester: 7 semester
Type of Course: lectures and labs
Hours per week: 2 lectures + 1 labs per week / Summer Semester
ECTS credits: 5.0 credits
Lecturers: ……
e-mail:
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532
Course Status: Optional course in the B.S. Curriculum of Mathematics.
Course description:
In the course students are introduced with methods and means of Object-oriented programming in integrated development interface for visual programming – C++ Builder. The students should have a basic knowledge on programming. Suppose that students are success passed courses in Programming and Data structures and Object-oriented programming (in SWU this courses are basic on program language C++) and students are known for fundamental skills in programming. In the course students develop programs using different platform – C++ Builder.
Objectives: Basic objectives and tasks:

- The students give knowledge for algorithm thinking;
- to give knowledge for Data structures, that can process with computer;
- to give knowledge for methods and skills in Object-oriented programming in integrated development environment for visual programming;
- to give knowledge for good style in programming;
- to give knowledge for basic principles when develop applications.

Methods of teaching: lectures and labs
Pre- requirements: Basic knowledge in „Programming and Data structures" and „Objectoriented programming".
Exam: two course projects and 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 the lecturer and the Student Service Office

References:

1. Richard Kaiser, A.v. Biljon, C.Y. Crocker, and P. Lietmeyer. C++ with Borland C++Builder: An Introduction to the ANSI/ISO Standard and Object-Oriented Windows Programming, 2008

2. Jarrod Hollingworth, Bob Swart, Mark Cashman, and Paul Gustavson. Borland C++ Builder 6 Developer's Guide, 2002
3. Satya Sai Kolachina. C++ Builder 6 Developers Guide with CDR (Wordware Delphi developer's library), 2002
4. Borland C++ Builder: The Complete Reference by Herbert Schildt and Gregory L. Guntle (Paperback - April 25, 2001)
5. John Miano, Thomas Cabanski, and Harold Howe. Borland C++ Builder: the Definitive C++ Builder Problem Solver, 1997
6. Kent Reisdorph and Ken Henderson. Sams Teach Yourself Borland C++ Builder in 21 Days, 1997.

MATHEMATICAL MODELS OF ECONOMICS

Semester: 8 semester
Course Type: Lectures and tutorials
Hours per week: 2 lecture hours and 1 tutorial hours /Summer Semester
ECTS credits: 5.0 credits
Lecturer: Assoc. Prof. Mihail Kolev, PhD
e-mail: mkkolev@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532
Course Status: Optional course in the B.S. Curriculum of Mathematics.
Course Description:
Mathematical models in economics are a new topic in mathematics. In this course we present some element of the optimization theory, discrete optimization and probability theory.
Course Aims: Students should obtain knowledge and skills for matroid theory.
Teaching Methods: lectures, demonstrations and work on project
Requirements/Prerequisites: Linear algebra.
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:

1. H. A. Eiselt, Operations Research: A Model-Based Approach (Springer Texts in Business and Economics), 2012, Springer Heidelberg NY.
2. Лекции по теория на игрите 2012, www.gametheory.net
3. Rob Kaas, Marc Goovaerts, Modern Actuarial Risk Theory Using R, 2008, Springer,
4. Аласдър Смит. Математическо въведение в икономиката. Изд. „Кл. Охридски" 2000
5. Кендеров П., Христов Г., Дончев А., Математическо оптимиране. София, Изд. "Климент Охридски" 1989;
6. Ковалев М.М., Дискритна оптимизация, Минск 1977 г. Издателство БГУ.
7. Вейль. Г. Элементарная теория выпуклых многогранников. В кн. Матричые игры. М: Физматгиз, 1966

INTRODUCTION TO CRYPTOGRAPHY

Semester: 8-th semester
Course Type: Lectures and lab exercies
Hours per week: 2 lecture hours + 1 lab exercies per week /Summer Semester
ECTS credits: 5.0 credits
Lecturer: Assist. Prof. Margarita Todorova, PhD
e-mail: todorova@swu.bg
Department: Department of Informatics, Faculty of Mathematics and Natural Sciences, South-West University "Neofit Rilski" – Blagoevgrad, tel. +35973588532
Course Status: Optional course in the B.S. Curriculum of Mathematics.
Course description:
The course introduce basic concepts of cryptography – cryptographic system, encryption and decryption keys, classic crypto attacks. In part symmetrical cryptography is considered the basic blocks and stream codes. Consider the necessary basis of number theory and discuss the basic tasks of asymmetric cryptography. Presented are modern asymmetric cryptographic systems, electronic signature and key exchange.
Scope of the course:
Obtaining knowledge of the theoretical backgrounds and practical abilities for applications of the Cryptography. Development of abilities for work with concrete cryptographic systems, to underline the basic strengths and weaknesses, as well as methods of crypto attacks.
Methods: lectures, discussions, practical exercises
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. Bruce Schneier, Applied Cryptography, 2 ed, Wiley, 1996 (ISBN 0-471-11709-9).
4. J. Menezes, P. C. van Oorschot, S. A. Vanstone, Handbook of Applied Cryptography, 1996, ISBN 0-8493-8523-7
2. Douglas Stinson, Cryptography: Theory and Practice, 2005, ISBN 1-58488-508-4.
3. Lecture notes in Internet.

COMBINATORIAL RING THEORY

Semester: 8-th semester
Course Type: Lectures
Hours per week: 3 lecture hours per week
ECTS credits: 5.0 credits
Lecturer: Acad. Prof. Dr.Sc. Veselin Drenski
e-mail: drensky@math.bas.bg
Department: Bulgarian Academy of Sciences

Course Status: Optional course in the B.S. Curriculum of Mathematics.

Short Description:

Combinatorial theory of the Rings is an area of modern algebra, which is extremely active in the second half of the XX century and in which many people work today both in Bulgaria and in many famous mathematical centers abroad. The theory has applications in many other mathematical disciplines, as well as in other areas of natural sciences - theoretical physics, chemistry.

Course Aims:

The purpose of this course is to introduce students to the basic theory of combinatorial ring theory and its applications to computer algebra. The content of the course gives the students the opportunity to be able to follow other courses that use this theory as well as to read articles and books in this field.

Teaching Methods: lectures, homework, and problem solving tests.

Requirements/Prerequisites: The students should have basics knowledge from Algebra.

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

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:

1. W.W. Adams, P. Loustaunau, An Introduction to Grőbner Bases, Graduate Studies in Math. 3, AMS, Providence, R.I., 1994.
2. T.A. Springer, Invariant Theory, Lect. Notes in Math. 585, Springer-Verlag, 1977
3. V.A. Ufnarovsky, Combinatorial and asymptotic methods in algebra, in A.I. Kostrikin, I.R. Shafarevich (Eds.), "Algebra VI", Encyclopaedia of Mathematical Sciences 57, Springer-Verlag, 1995, 1-196.
4. G.R. Krause, T.H. Lenegan, Growth of Algebras and Gelfand-Kirillov Dimension, Pitman Publ., London, 1985 (Second edition by AMS).
5. I.N. Herstein, Noncommutative Rings, Carus Math. Monographs 15, Wiley and Sons, Inc., New York, 1968 (има руски превод).
6. V. Drensky, Free Algebras and PI-Algebras, Springer, Singapore, 1999.