COURSES IN FOREIGN LANGUAGES for ERASMUS INCOMING STUDENTS

at Sofia University - 2023-2024 academic years

Faculty of Mathematics and Informatics

Faculty coordinator: Assoc. Prof. Elissaveta Gurova, PhD, elis@fmi.uni-sofia.bg

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI M 0101 17 / A541E	ALGEBRA 2	English	BA	Winter	5	45	15	0	Prof. Azniv Kasparian, PhD	kasparia@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The course is an introduction to Galois theory. After studying separable field extensions it introduces the Galois group and traces out its interrelations with the structure of the corresponding field extension. It discusses the Galois correspondence between the subgroups of the Galois group and their associated fixed fields with a specific emphasis on the bijective correspondence between the finite solvable Galois groups and the finite radical extensions of a given field. Few of the intended applications are the Abel-Ruffini's Theorem on the insolvability of polynomial equations of degree at least 5 by radicals, some counterexamples to classic compass and straightedge constructions, the correspondence between the unratified coverings of a topological space and the subgroups of its fundamental group, as well as the correspondence between the finite ramified extensions of Riemann surfaces and the finite extensions of their function fields.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basics on groups, rings and polynomials

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Seminars	Practical work		

MI M 2421 16 / A641E	**GROEBNER BASES**	**English**	**MA**	**Winter**	**5**	**45**	**0**	**15**	**Prof. Azniv Kasparian, PhD**	**kasparia@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The course studies the Groebner bases. It discusses the monomial orderings, the division of polynomials of several variables, and affine algebraic varieties. As a first application of Groebner bases, the proof of Hilbert's Basis Theorem is derived from Dickson's Lemma. The course focuses on the reduced Groebner bases and Buchberger's algorithm for their construction. Applications to elimination and extension on affine varieties are under consideration. Hilbert's Nullstellensatz is used for building the correspondence between the polynomial ideals and the affine varieties. Thus, algorithmic computations in quotients of the polynomial rings are related to the regular and rational functions on affine varieties. Applications to robotics and automatic geometric theorem proving are intended. Eventually, the course includes also the projective varieties.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: The listeners are supposed to be familiar with the obligatory bachelor's courses in algebra and calculus. Some knowledge of algebraic geometry is an asset.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI M 0101 16 / A731E	**APPLIED ALGEBRAIC GEOMETRY**	**English**	**BA/MA**	**Winter**	**5**	**45**	**0**	**15**	**Prof. Azniv Kasparian, PhD**	**kasparia@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The course is an introduction to arithmetic algebraic geometry with an application to coding theory. It starts with function fields of one variable, Galois actions on their constant fields, discrete valuations and places. By the time when the geometry comes in, there is a fair amount of abstract algebraic knowledge, to assess the correspondence between algebraic curves and their function fields. After the basics for smooth algebraic curves, their regular and rational maps, the course proceeds with Riemann-Roch Theorem. It is proved from adelic viewpoint. The usual differential forms are also introduced, discussed and related to the duals of the adelic spaces, called Weil differentials. A milestone of the subject is Hasse-Weil Theorem and the Hasse-Weil bound on the number of the rational points of a curve over a finite field. Their proofs, combining a variety of ideas and techniques, deserve to be a goal itself. The aforementioned theoretic considerations are applied for constructing dual algebrogeometric codes. A special attention will be paid to decoding algorithms for codes of residuums, which are based on the properties of the linear systems of divisors. The course is recommended to students with interdisciplinary mathematical interests. The simultaneous invitation to algebraic geometry and Galois Theory is hoped to enhance both, the geometric intuition and the rigorous thinking.

Requirements for enrollment: YES/NO

If any, please describe the specific requirements: The students are supposed to be familiar with the obligatory bachelor's courses in algebra and calculus.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Seminars	Practical work		
MI M 0101 17 / D651E	**DIFFERENTIAL GEOMETRY**	**English**	**BA**	**Winter**	**5**	**45**	**15**	**0**	**Assoc. Prof. Ivan Minchev, PhD**	**minchev@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The course provides the necessary foundational material for students interested in any of the diverse areas of mathematics and physics that require the concepts of differentiable manifolds and linear connections.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Linear Algebra and Analysis

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI M 6221 16 / V603E	**SET THEORY**	**English**	**MA**	**Winter**	**6**	**45**	**30**	**0**	**Prof. Tinko Tinchev**	**tinko@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The course is a solid introduction to the Zermelo-Fraenkel axiomatic set theory (ZFs) as an underlying framework for mathematics. Its aim is to acquaint the students with the ordinal and cardinal arithmetic and the role of the axiom of choice in mathematics. We shall study in detail the transfinite recursion theorem, many equivalents of the axiom of choice, their applications in mathematics and weaker forms of the axiom of choice.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Standard mathematical skills are supposed.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semins	Practical work		
MI M 6221 16 / V602E	**MODEL THEORY**	**English**	**MA**	**Winter**	**6**	**45**	**30**	**0**	**Prof. Tinko Tinchev, PhD Prof. Alexandra Soskova, PhD**	**tinko@fmi.uni-sofia.bg; asoskova@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

Model theory is a branch of mathematical logic which deals with the connections between the formal languages and its interpretations, the interplay of syntactical and semantical notions. The course is devoted to the `classical' model theory of first-order predicate logic which is the simplest language of the main body of mathematics. The properties of the classes of classical structures are studied definable by formulas of the first-order predicate logic. Different techniques are presented based on the classical compactness and omitting types, constructions of elementary chains, characterizations of theories, quantifier eliminations and definability, but some applications of ultra-products and Ehrenfeucht-Fraïssé games as well. Some basic ideas from abstract model theory and Lindström's characterization of first-order logic are also presented.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Some basic knowledge on mathematical logic and on set theory.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI M 0101 16 / V101E	**MATHEMATICAL LOGIC**	**English**	**BA/MA**	**Winter**	**6**	**45**	**30**	**0**	**Assoc. Prof. Hristo Ganchev, PhD**	**ganchev@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The course is an introduction to the field of Mathematical Logic. Its aim is to introduce the students to the first-order predicate calculus. We shall study in detail the notions theorem, proof and axiomatic system. We will prove Gödel's Completeness theorem from which we will derive some basic results in the field of Model theory.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Discrete Mathematics.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI M 0101 16 / V601E	**COMPUTABILITY AND COMPLEXITY**	**English**	**BA/MA**	**Winter**	**6**	**45**	**30**	**0**	**Asst. Prof. Stefan Vatev, PhD**	**stefanv@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The course is an introduction to the theory of computability. The considered computational model is based on unlimited register machines. We present the connections between partial computable and partial recursive functions. We consider certain important computable and computably enumerable problems and describe methods for establishing incomputability The foundations of the theory of computational complexity are presented. We discuss properties of the complexity classes P and NP. We examine certain NP-complete problems and give a proof of Cook's theorem.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Understanding basic concepts of Discrete Mathematics and Mathematical Logic.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI A 0101 16 / C702E	**RANDOM PROCESSES**	**English**	**BA**	**Summer**	**5**	**30**	**30**	**0**	**Prof. M. Bojkova, PhD**	**bojkova@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The special topics considered are: Markov chains in discrete time; Brownian motion, Random walks, Birth and death processes, Poisson processes, Martingales in discrete time, Ito integral, Ito formulae, Model of financial market.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basic course in probability theory and courses in differential and integral calculus.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI A 0101 16 / C832E	BRANCHING PROCESSES	English	BA/MA	Winter	5	30	30	0	Prof. M. Bojkova, PhD	bojkova@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

Branching processes (BP) are models of many real world phenomena and processes in biology, physics, chemistry, economics, demography and informatics. The asymptotic properties, as well as the moments and limit theorems for proper functional of the following classical models of BP are studied: Galton-Watson BP, Bellman-Harris BP, Markovian BP, multi-type and controlled BP. Computer simulations and demonstrations for statistical inferences are also provided.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basic course in probability theory and courses in differential and integral calculus.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI A 6222 17 / P712E	ACTUARIAL MATHEMATICS	English	MA	Summer	5	30	0	30	Prof. M. Bojkova, PhD	bojkova@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The topics included are typical actuarial probability distributions, compound Poisson process, premium assessment problem, individual and collective risk premium, reinsurance and ruin probabilities, prognosis of the reserves, and optimization of loading. Actuarial principles are illustrated with examples from practice of pensions, life insurance, general insurance, living benefits.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: This course continues the basic one: Introduction in Actuarial mathematics. The requirements include first course on Probability and statistics and Stochastic processes.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI A 6222 16 / P912E	PROBABILITY 2	English	MA	Winter	5	30	30	0	Prof. M. Bojkova, PhD	bojkova@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

Special attention is given to the following important topics: relation between Probability theory and Measure theory, Independence, Conditional Expectation, Martingales in discrete time and Girsanov's theorems, Jordan-Hahn, Lebesgue and Radon-Nikodym theorems, classical results from probability theory, infinitely-divisible distributions.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basic course in probability theory and courses in differential and integral calculus.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI C 0101 17 / F653E	FUNDAMENTALS OF ALGORITHMS	English	BA/MA	Winter	5	30	30	0	Assoc. Prof. Minko Markov, PhD	minkom@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

Further, we introduce the five asymptotic notations O, o, Θ, Ω, ω. We consider SORTING as a fundamental computational problem and present both naïve and sophisticated algorithms for it. In doing so, we introduce binary heaps and priority queues, as well as the Divide-and-Conquer paradigm, recursive algorithms, recurrent relations and methods for solving them. We introduce the concept of lower bounds on computational problems and methods for proving lower bounds. We consider numerous Graph Theory computational problems: graph traversal, topological sorting, cut vertices, minimum spanning trees and shortest paths. We introduce the Greedy paradigm and the Dynamic Programming paradigm, illustrating the latter with numerous examples. We introduce the basics of Computational Complexity and the phenomenon of intractability.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: A course in Discrete Mathematics.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI A 0101 16 / F753E	COMPUTATIONAL COMPLEXITY	English	BA/MA	Winter	5	30	30	0	Assoc. Prof. Minko Markov, PhD	minkom@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

Introduction to Turing machines and Universal Turing Machines. Time and Space Complexity of problems. Nondeterministic Turing machines. Computational Classes P and NP. NP-completeness: Cook's theorem. P versus NP. Ladner's theorem. Complexity class co-NP. Polynomial hierarchy. Space complexity: class PSPACE. Approximation algorithms. Parameterized complexity.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: A course in algorithms.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 6321 19 / S613E	WEB TECHNOLOGIES AND ARCHITECTURES	English	MA	Summer	5	30	30	0	Prof. M. Petrov, PhD	milenp@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The course is designed to help participants to acquire basic knowledge and skills to design and build web applications and web sites.

Web technologies and architectures are discussed and applied to go get hands-on experience.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basic programming skills.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI I 6321 19 / Y627E	**SOFTWARE ARCHITECTURES**	**English**	**MA**	**Winter**	**6**	**30**	**30**	**0**	**Assoc. Prof. A. Dimov, PhD**	**aldi@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

Software architecture results from the design phase of software development process. It focuses on different views of the software system. A view represents a configuration of abstract elements (e.g. modules, layers, processes, etc.) and the interconnections between them, while removing details, like algorithms and source code.
The role of software architecture in the major activities of software engineering is explored, including application conception, design, implementation, and analysis. An architecture-centric perspective on development is explored in this course.
The course explores the conceptions of effective analysis, design, concepts and practices of software architectures. The main building elements – components and connectors are analyzed as well as common issues of analysis and design, evaluation techniques and standards are explored.
We do assume that the students and visitors are generally familiar with the most basic elements of software engineering and programming. As well as this course will be appropriate for professionals in software design and development. This course will be useful for software engineers as well and will help them to have a closer look on advanced ideas in software development process, software architecture frameworks and software architecture as a backbone of the qualify software.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Software Engineering, Object-oriented programming and development, Data structures and algorithms

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 6321 19 / S664E	**ADVANCED WEB PROGRAMMING**	**English**	**MA**	**Winter**	**5**	**30**	**30**	**0**	**Prof. M. Petrov, PhD**	**milenp@fmi.uni-sofia.bg**
Short description of the course (in the language of instruction): **Main goal of the course is to provide students with insights on how web-based frameworks are constructed, upgrading knowledge and skills from course "Network Programming with Java" and to create fundamental knowledge on web programming with Java and JSF framework. Students will use contemporary achievements in Java technologies (JavaEE) and JSF2+ framework. It is assumed that technologies as Servlet and JSP are familiar to the students. Components of JavaEE such as web and application servers, java beans, internationalization and localization, MVC architecture, lifecycle of web application development. Development of convertors, validators and custom messages. Internal and external support of Ajax. Working with database (JDBC).**									
Requirements for enrollment: YES/NO **If any, please describe the specific requirements: Basic programming skills. Students will be expected to have a basic knowledge of both programming and web technologies such as HTML and CSS.**										

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI B 0101 16 / H766E	**PROJECT MANAGEMENT**	**English**	**BA/MA**	**Winter**	**5**	**30**	**30**	**0**	**Prof. K. Kaloyanova, PhD**	**kkaloyanova@fmi.uni-sofia.bg**
Short description of the course (in the language of instruction):										

The course covers all operational and organizational aspects of project management, namely scope, time, cost, quality, human resources, communication, risk, procurement, stakeholders. Multiple learning formats are used throughout the course, including lectures, practice sessions, homework assignments and classroom presentations. The lectures cover the main aspects of project management following the PMBOK including all process groups and their interactions. During practice sessions students develop real-life PM work products. Homework assignments are performed in an intensive group work environment. Results of the group work are discussed and presented in a predefined format. The learning process includes implementation of various project management practices and techniques.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basic knowledge in programming and software processes.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Seminars	Practical work		
MI I 39 21 16 / Y916E	FUZZY SETS AND APPLICATIONS	English	MA	Winter	5	30	0	30	Prof. O. Georgieva, PhD	o.georgieva@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The introduction of fuzzy sets theory was motivated by the need to propose an effective theoretical and engineering frame addressed to the uncertainty and inaccuracy of the existing information. This theory provides an elegant and simple way to make an inference using vague and/or missing information. The present course acquaints with the basics of the fuzzy sets and fuzzy logic. Additionally the attention is drawn on the contemporary tendencies and implementations of these theories. Specific tasks in the areas of data mining, artificial intelligence, expert system design and process modeling are considered and illustrated with practical examples.

Requirements for enrollment: YES/NO

If any, please describe the specific requirements: Basic knowledge in computer science and mathematics

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 34 21 16 / Y627E	MODELS OF SOFTWARE SYSTEMS	English	MA	Winter	5	30	0	30	Prof. O. Georgieva, PhD	o.georgieva@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The course covers scientific foundations for software engineering based on the use of precise, abstract models for characterizing and reasoning about properties of software systems. This course considers many of the standard models for formal representation of sequential and concurrent systems. The models are based on paradigms such as state machines, algebras, and traces. The course shows how different logics can be used to specify properties of the software systems. Concepts such as composition mechanisms, abstraction, relations, invariants, non-determinism, inductive definitions and denotational descriptions are building themes throughout the course.
The course gives an opportunity to acquire practical skills through elaboration of practical tasks using specific notation.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basic knowledge in computer science and mathematics

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI I 63 21 16 / Y547E	**TECHNOLOGY ENTREPRENEURSHIP**	**English**	**MA**	**Winter/ Summer**	**5**	**30**	**15**	**15**	**Assist. Prof. Sia Tsolova, Ph.D.**	**siyat@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

This course has been put together by the Intel and Berkeley University to provide students with a high-level survey of the field of Entrepreneurship. The course provides students perspectives by prominent entrepreneurs from organizations at various stages of development and representing a broad range of industries and topics. Entrepreneurs speak on how they created their organizations and the lessons they learned. This course is for both aspiring entrepreneurs as well as those simply interested in learning more about the field. It does not teach you how to be an entrepreneur, but it aims to inspire you and give you a perspective on what life as an entrepreneur is like. If you hope to start a company this course will help to prepare to fully-utilize the resources available at Berkeley and maximize your potential for success. At the end of this lecture series you will have a broad understanding of entrepreneurship and how entrepreneurship happens on campus.

Requirements for enrollment: NO

If any, please describe the specific requirements:

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 35 21 17 / Y557E	**INNOVATION AND ENTREPRENEURSHIP (JA PROGRAM)**	**English**	**MA**	**Summer**	**5**	**30**	**15**	**15**	**Assist. Prof. Sia Tsolova, Ph.D.**	**siyat@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

Junior Achievement programs help prepare young people for the real world by showing them how to generate wealth and effectively manage it, how to create jobs which make their communities more robust, and how to apply entrepreneurial thinking to the workplace. Students put these lessons into action and learn the value of contributing to their communities. JA Innovation and Entrepreneurship, a new high school program, focuses on challenging students, through interactive classroom activities, to start their own entrepreneurial venture while still in high school. One of ten JA programs designed with the specific needs of upper grade students in mind, JA Be Entrepreneurial provides useful, practical content to assist students to transition into becoming productive, contributing members of society.
The purpose of the practical course "Student company" is to introduce students with the basics of entrepreneurship in order to build skills for starting their own business. In theory classes there will be presented main features for organization and management of real student company. Students are introduced to basic management skills and organizational functions. During the classes, students register a student company – Joint Stock Company, realize real product or service and realize financial profit. The student company has about 8 members and all students have signed roles and positions. The course is part of the international initiative "Junior Achievement", and student companies compete on local and international competitions.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI I 35 21 17 / Y567E	**TECHNOLOGICAL ENTREPRENEURSHIP IN IT**	**English**	**MA**	**Summer**	**5**	**30**	**15**	**15**	**Assist. Prof. Sia Tsolova, Ph.D.**	**siyat@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

Berkeley University to provide students with a high-level survey of the field of Entrepreneurship. The course provides students perspectives by prominent entrepreneurs from organizations at various stages of development and representing a broad range of industries and topics. Entrepreneurs speak on how they created their organizations and the lessons they learned. This course is for both aspiring entrepreneurs as well as those simply interested in learning more about the field. It does not teach you how to be an entrepreneur, but it aims to inspire you and give you a perspective on what life as an entrepreneur is like. If you hope to start a company this course will help to prepare to fully-utilize the resources available at Berkeley and maximize your potential for success.
At the end of this lecture series you will have a broad understanding of entrepreneurship and how entrepreneurship happens on campus.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 35 21 17 / Y577E	INNOVATION AND INNOVATION MANAGEMENT	English	MA	Summer	5	30	15	15	Assist. Prof. Sia Tsolova, Ph.D.	siyat@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

Innovations are the engine of the modern economy, and the companies' capacity to launch new products and services is one of the major factors for their further success and sustainable development. The aim of the course "Innovation and innovation management" is to present the fundamentals, stages and methods for innovation management combining both theory and practice.
The course has three parts.
The first part focuses on introducing some of the basic concepts, frameworks and theories of technological change and evolution of the industry, including: technological and industrial life cycles, technological gaps, paradigms and processes; emergence of dominant designs; dependencies and network effects; drilling theory of innovation.
In the second part it applies the knowledge acquired in the first part in the implementation of existing theories and frameworks of analysis of changes in the industry as technology, pattern recognition, including 1) identifying early signals of technological change, 2) analyses of the potential of competitive opportunities based on the effect on the emergence and adoption of new technologies, 3) analyses of strategic solutions for companies affected by the current technological changes and \ or industrial evolution, and 4) analyses of non-market forces, technological development and change by government regulation, standardization.
The third part focuses on the introduction of scientific methods and analysis tools of technology. This final section will give students the opportunity to perform analyses of technologies and their changes over time.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Seminars	Practical work		
MI I 35 21 16 / Y527E	**MARKETING MANAGEMENT**	**English**	**MA**	**Summer**	**5**	**30**	**15**	**15**	**Assist. Prof. Sia Tsolova, Ph.D.**	**siyat@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The curriculum in Marketing Management is designed for Master Program "Technological Entrepreneurship and Innovation in IT," Informatics, Faculty of Mathematics and Informatics, Sofia University "St. Kliment Ohridski".
The Syllabus of Marketing Management aims at shaping an entrepreneurial culture and competence in the field of Marketing, as well as personal qualities that are important for the further successful professional activity of students, regardless of whether they work as independent employees in the field of technology and in particular ICT or employees in a changing labor market.
The basis of the course is the interdisciplinary connections. Educational content of Marketing Management is consistent with the training courses: Strategic Management, Technological Entrepreneurship, Technological Entrepreneurship in IT, Innovation Management, Entrepreneurship "Student Company". The course has general and specific focus, such specifics are mainly targeted at digital marketing management and to the specificities of marketing management in ICT technology.
An active participation of students in the learning process is recommended as combination of teaching and learning by lectures, case studies, discussions, situational analysis, debates, role plays, scenarios methods, project works, self-study meetings with entrepreneurs and professional representatives of the study field.
Examination and evaluation of the knowledge and skills of the students is numerical, subject to the requirements of Regulation № 3 of the Ministry of Education and Science of the evaluation system in Bulgaria. Students must be familiar with the evaluation criteria and methods of evaluation at the beginning of the academic year.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Computer literacy, English language level minimum B1

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		

MI I 33 21 16 / T514E	**CISCO ACADEMY 1 - INTRODUCTION TO NETWORKS**	**English**	**MA**	**Winter**	**5**	**30**	**15**	**30**	**Prof. K. Stefanov. PhD**	**krassen@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The goal of this course is to introduce to the student the fundamental networking concepts and technologies. The online course materials will assist students in developing the skills necessary to plan and implement small networks across a range of applications. The specific skills covered in each chapter are mastered through the applied tasks and cases.
The principles of IP addressing and fundamentals of Ethernet concepts, media, and operations are introduced to provide a foundation for the curriculum.
By the end of the course, students will be able to build simple LANs, perform basic configurations for routers and switches, and implement IP addressing schemes.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI I 33 21 16 / T524E	**CISCO ACADEMY 2 - CCNA R&S: ROUTING AND SWITCHING ESSENTIALS**	**English**	**MA**	**Winter**	**5**	**15**	**15**	**45**	**Prof. K. Stefanov. PhD**	**krassen@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The course follows Cisco course "CCNA R&S: Routing and Switching Essentials". The content of the course covers following topics: WAN and Routers; Introduction to routes; Configuring routers; Managing Cisco network operating system; Distance vector routing protocol; Basic routers troubleshooting; Access control lists (ACLs), VLANs and routing between them, dynamic routing protocols, distance vector and link-state routing protocols, Dynamic Host Configuration Protocol (DHCP), Network Address Translation (NAT).

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 33 21 16 / T534E	**CISCO ACADEMY 3 - SCALING NETWORKS**	**English**	**MA**	**Winter**	**5**	**15**	**15**	**45**	**Prof. K. Stefanov. PhD**	**krassen@fmi.uni-sofia.bg**
Short description of the course (in the language of instruction): **The course follows Cisco course CCNA3: Scaling Networks. The content of the course covers following topics: Classless routing, Routing protocol OSPF, Routing protocol EIGRP, Rapid Spanning Tree Protocol (RSTP), Per VLAN Spanning Tree Plus Protocol (PVST+), EtherChannel, first hop redundancy protocols (HSRP), wireless routers and wireless clients, Segmenting networks in Virtual local networks (VLANs), Virtual trunking protocol.**										
Requirements for enrollment: YES/NO **If any, please describe the specific requirements: Introduction to Networks; Routing and Switching Essentials**										

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI I 33 21 16 / T544E	**CISCO ACADEMY 4 - CONNECTING NETWORKS**	**English**	**MA**	**Winter**	**5**	**15**	**15**	**45**	**Prof. K. Stefanov. PhD**	**krassen@fmi.uni-sofia.bg**
Short description of the course (in the language of instruction): **The course follows Cisco course CCNA4: Connecting Networks. The content of the course covers following topics: Network address translation (NAT) and port address translation (PAT), WAN technologies, Virtual private networks (VPNs), tunneling and tunneling operations, serial and broadband connections, Using syslog, SNMP and NetFlow, Borderless networks, Data centers and virtualization.**										
Requirements for enrollment: YES/NO **If any, please describe the specific requirements: Introduction to Networks; Routing and Switching Essentials**										

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 40 21 17 / H776E	**PROJECT RISK MANAGEMENT**	**English**	**MA**	**Winter**	**5**	**30**	**15**	**15**	**Assoc. Prof. Prof. Ioannis Patias, PhD**	**patias@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The course covers different aspects of project risk management. The lectures cover the main concepts of project management following the PMI methodology. The student understands the basics of project risk identification, analysis, assessment, and management. The course devotes significant time to the Project Management Institute's PMBOK methodology for project risk management.
The project assignment aims to provide the student with the opportunity to work on real life problem, and apply the methodology learned in real situations.
Students passed successfully the course will have
• Knowledge about the project risk management concepts, methods and frameworks;
• Practical skills for project risk management PMI's methodology.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basic knowledge in project management

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI I 40 21 17 / H786E	**DESIGN OF ROBOTICS SYSTEMS**	**English**	**MA**	**Winter**	**5**	**30**	**15**	**15**	**Assoc. Prof. Ioannis Patias, PhD**	**patias@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

Robotics has several specific requirements in terms of design. Each robotic system requires tight integration of planning, sensor subsystems for monitoring, control and modeling, and the robot must take into account the interactions between themselves and their environment to operate in resolving its task. The more intelligent robot more stable is to be a complete system against deviations that may arise. In other words, one

such robotic system consisting of subsystems, where many of the subsystems are not even under direct control of the robot itself as subsystems contain agents that have their own behavior.
The aim of this course is to develop the quality of students in building real applications of embedded systems, which systems are expected to constitute an essential element of many applications.
The program focuses on basic tools and their application to solve real problems.
Through lectures, case studies, exercises, test examples and tasks students will acquire both basic knowledge and understanding of the key factors for successful implementation of applications of embedded systems.
Within the course project, students will have to demonstrate practical skills through the realization of a working example of the application of embedded system.
As a result, students will be able to handle cases related to the implementation of complex projects related to the applications of embedded systems.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basic knowledge in Embedded and Autonomous Systems

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 39 21 18/Y4589E	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	English	MA	Summer	5	30		30	Prof. Ivan Koychev PhD	koychev@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The goal of this class is to familiarize the students with the basic principles of Artificial Intelligence (AI). The course provides a survey of AI techniques and underlying theory. The students will learn some basic AI techniques, the problems for which they are applicable, and their limitations. Topics covered include basic search, heuristic search, game search, constraint satisfaction, knowledge representation, expert systems, probabilistic modelling, including machine learning and natural language processing. This course provides a useful foundation for courses on specific topics of AI and its applications, which become quite widespread last decade.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements: Basics on data structures and algorithms and programming skills.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 72 21 19/O721E	**ROBOT MODELING USING 3D PRINTING TECHNOLOGY**	**English**	**MA**	**Summer**	**6**	**3**			**Assoc. Prof. Ivan Chavdarov, PhD**	**ivannc@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

There are new prototyping conceptions (RAPID PROTOTYPING) which has the possibility for creating different mechanical design on a lower price. Models could be in real scales or minimized copies of the idea. In recent years a lot of revolution changes were made in 3D printing technologies and this revolution development goes really fast and covers new areas. Using these technologies makes creating models and prototypes really easy. The details made by 3D printing are with more complex geometry, lighter, better optimized, with better reflection on the environment. The wastes are minimal or there are no wastes at all and sometimes they could be recycled.
This discipline aims to show students the fundamentals of robot modelling. The students will learn the fundamentals of design, 3D modelling and 3D printing of robot models. They will also be familiar with the methods of quality optimizations by kinematic and kinetostatic analyses. Experiments will be made.
The knowledge and the skills of the students will be confirmed by laboratory exercises and course tasks.
The modern methods of mechanical design are based on specialized CAD products. Exercises with 3D printers will be realized.
In the lecture course students will learn about methods of synthesis of manipulation and mobile robots, different types of end effectors for several technological operations. Topics about synthesis and analysis of kinematic structures; metric, kinematic, force analysis; choice optimization of driven mechanisms, control and sensors of robot's models are included.
The aims of the laboratory exercises are: making students familiar with new technologies for rapid prototyping, introducing the modern methods for modelling, design, computer simulations and programming of the robots.
This course will be useful for better understanding of the material in Mathematics, Mechanics and Physics. Practical application of the theoretical knowledge is shown. Robotics is getting part of the human life more and more so this course will be useful for width area of students.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:
Familiarity with algebra, analytical geometry, mathematical analyse.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 72 21 19/O611E	**ROBOT MECHANICAL COMPONENT PROJECTING BY CAD SYSTEMS**	**English**	**MA**	**Winter**	**6**	**3**			**Assoc. Prof. Ivan Chavdarov, PhD**	**ivannc@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):

The main topic of robotics is creating machines which possibilities are the same or even bigger than the human's. For solving this complex task, robotics uses the biggest achievements in different areas of the human knowledge. For that reason, the robotics as science is a combination of mechanics, electro mechanics, hydraulics, electronics, mathematics, informatics, etc.
This discipline aims to give the students the fundamental principles of manipulation systems of robotics design. The students will learn about the structural synthesis of kinematic joints of manipulation and mobile robots. Methods for examine their qualities by kinematic, kinetostatic and dynamic analysis will be studied.
The knowledge and the skills of the students will be confirmed by laboratory exercises and individual course tasks.
The modern methods of mechanical design are based on specialized CAD products. Exercises with these products will be realized – 3D conceptual design and simulation optimizations of the quality parameters of the mechanisms.
In the lecture course students will learn about methods of synthesis of manipulation and mobile robots, different types of end effectors for several technological operations. Topics about synthesis and analysis of kinematic structures; metric, kinematic, force analysis; choice optimization of driven mechanisms, control and sensors of robot's models are included.
The aims of the laboratory exercises are: making students familiar with some modern methods in simulations and CAD products which could be applied in computer analysis, synthesis, design and modelling of robots and also robot's programming.
This course will be useful for better understanding of the material in Mathematics, Mechanics and Physics. Practical application of the theoretical knowledge is shown. Robotics is getting part of the human life more and more so this course will be useful for width area of students.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Familiarity with algebra, analytical geometry, mathematical analyse.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O210E	DYNAMICS	English	MA	Summer	6	3	3		Prof. George Boiadjiev, PhD	george@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The foundation of Newton classical mechanics are introduced – for a material point, systems of material points and rigid body. Both the system of forces and movements combination (translations and rotations) are modelled by vectors corresponding to the first and the second (inverse) task of the dynamics. The general theorems of the dynamics are proved and the equations of motion in general coordinates are derived.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Familiarity with algebra, analytical geometry, mathematical analyse, ordinary differential equations.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 72 21 19/O722E	HYBRID SYSTEM DYNAMICS BASED ON THE GRAPH THEORY AND THE ORTHOGONALLITY PRINCIPLE	English	MA	Summer	6	3			Prof. George Boiadjiev, PhD	george@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

Using the Orthogonality Principle the hybrid systems dynamics can be modelled. They are the systems which receive, modify and return different type energy – electrical, mechanical, thermal etc.
Mutual influence can be seen for the methods developed to describe the phenomena in the concrete specific area. There are known the efforts to spread out the classical mechanics methods to another fields – for instance electromechanical analogues or addition of electrical parameters in the Lagrange function. Sometimes that meets problems and it is even impossible to study this way some specific systems as sliding contacts,

volume currents and so on. From the other side by methods well developed in the electro techniques the efforts are made to explain purely mechanical phenomena. Such example is the method using the graph theory. Very close to it is th Orthogonality Principle which is just a kind of mathematical record of the energy conservation law.
Tellegen (B.D.H. Tellegen, A General network theorem, with applications, Philips Research Reports 7 , 1952, p. 259-269) first formulates the principle as a theorem concerning electrical networks. In 1961 the book of Koenig and Blackwell appears (H. Koenig, W. Blackwell, Electromechanical System Theory, McGrow Hill Book Company INC, New York, Toronto, London, 1961) where lots of electromechanical systems are considered having complex electrical parameters but concerning the mechanical ones there are studied only mass points or the bodies with fixed angular velocity axes. In 1977 Andrews formulates the Orthogonality Principle for material points having motion in a plane (G. Andrews, Dynamics Using Vektor-Network Techniques, Waterloo, Ontario, N2L 3GL, Canada, 1977) . He proves that the principle of the virtual work is corollary of the Orthogonality Principle. Later the Orthogonality Principle spreads out for arbitrary multi body system dynamics (Boiadjiev G. Dynamics of Electromechanical systems, PhD Thesis (In Bulgarian), Sofia University "St. Kliment Ohridski", Sofia, 1991 and Bojadjiev G., Lilov L. Dynamics of Multicomponent Systems Based on the Orthogonality Principle. Journal of Theoretical and Applied Mechanics, Year XXIV, No 1, Sofia, 1993, pp. 11-26).
It must be underlined the main advantage of the method – its ideas allow to investigate the phenomena with different physical nature by common mathematical apparatus, from common point of view. In this course the attention is mostly paid to its application to manipulation systems dynamics and especially their mechanical part.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Familiarity with algebra, analytical geometry, mathematical analyse, ordinary differential equations.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/U602E	IMAGE PROCESSING	English	MA	Winter	5	2		2	Assoc. Prof. Kaloyan Yovchev, PhD	k.yovchev@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

This course is an introduction to image processing principles, tools, techniques, and algorithms.
In this course, we concern the digital images processing. We will consider how digital images may be acquired, stored, enhanced and corrected, manipulated, segmented, and compressed. The aim of this course to teach students how to use the techniques and algorithms for the various operations mentioned above, and will learn how to implement them using OpenCV or Matlab.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Familiarity with programming, algebra, mathematical analyse.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 72 21 19/O100E	KINEMATICS	English	MA	Winter	5	2	2		Assoc. Prof. Ivan Chavdarov, PhD	ivannc@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

In this class the students will learn about the description of the object movements – material point, absolute solid body by using vector methods which are applied in Newton's Mechanics. The topics will show different types of the movement – translational and rotational and their fundamental characteristics: trajectories, velocities and accelerations. The conditions on which vector systems are related will be proven in a way to create models of the movement of some objects as material points and absolute solid bodies.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Familiarity with algebra, analytical geometry, mathematical analyse.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Seminars	Practical work		
MI I 72 21 19/O212E	PLANNING OF MOTION IN COMPLEX ENVIRONMENT	English	MA	Summer	5	2		2	Assoc. Prof. Ivan Chavdarov, PhD	ivannc@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The course introduces tasks concerning the mobile agent motion planning in a field with obstacles . These tasks are solved both before the motion (off-line) and during the motion (on-line). The situation of static and dynamic obstacles is considered as well as the problem of motion

synchronization of several acting agents. Some facts of computational geometry are presented aiming fast and effective find out of potential conflicts.
In the practical classes simulation software will be considered. Analogues between some tasks of the computer graphics will be studied namely 3D geometrical modelling and mobile object work space modelling – for instance two-digit class of working space description of mobile object (BSP) and the artist algorithm. Some basements of kinematics of a rigid body (for example Denavid and Hartenberg parameters) will also be considered having application in 3D computer graphics and animations.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Familiarity with algebra, analytical geometry, mathematical analyse, algorithms and programming.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/F609E	PROGRAMMING IN C#.NET	English	MA	Winter	5	3		2	Prof. Evgeniy Krastev, PhD	eck@fmi.uni-sofia,bg

Short description of the course (in the language of instruction):

This course is designed for students M.Sc. degree of study in Mechatronics and Robotics, where software development is an essential requirement upon graduation. The course considers programming in the .NET Framework employing the C# language. in the environment of Visual Studio 2017. It emphasizes on writing efficient program code through proven techniques in Object oriented Programming (OOP). The course starts by an introduction to the C# language in the context of object oriented analysis design concepts making use of UML. Special attention is devoted to implementing OOP fundamental concepts (encapsulation, inheritance and polymorphism) in program solutions. It allows students to get advanced knowledge in building the GUI and event handling with Windows Presentation Foundation. Other major topics in this course include development of user defined components, data structures with application in PLINQ and the Task Parallel Library, multithread programming, processing of data streams and object serialization, using WCF for the purpose of developing applications with SOAP and RESTful Web Services in .NET. The course topics provide the necessary foundation of knowledge in OOP with C# allowing students compete successfully on the job market for positions in software development, as well as, apply programming skills in higher stages of their education.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Familiarity C/C++ programming and modern operating systems is strongly recommended

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/U610E	EMBEDDED AND AUTONOMOUS SYSTEMS	English	MA	Winter	5	3			Prof. Vasil Georgiev, PhD	v.georgiev@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

This course is intended for training of students of the MSc program on embedded systems and presents the main principles of design and application of embedded systems and real-time processing systems. The system design is oriented to autonomous computer-based modules for management in the transport, autonomous robotics, mobile personal communications systems, interactive multimedia, intelligent sensors, thin and embedded clients, intelligent embedded systems, etc.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Prerequisites for this course are the courses from the Bachelor program Programming and Data Structures, Computer Architectures, Computer Networks.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 64 21 19/T611E	NETWORK PROGRAMMING WITH JAVA	English	MA	Summer	6	2		2	Prof. M. Petrov, PhD	milemp@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):
Course discusses topics, related to network programming, by using Java programming language. In course students use net.java package for network communication. Creating of client-server applications, using JavaMail API, JDBC for working with databases. Work with servlets and jsp mechanizms for network and web use is covered.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Core knowledge in Java and object-oriented programming, and data structures as well.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 64 21 19/U621E	OBJECT-ORIENTED PROGRAMMING	English	MA	Summer	6	2		2	Prof. M. Petrov, PhD	milemp@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The course aims to enrich students' knowledge of the latest achievements in OOP with Java programming language, Java Virtual Machine (JVM), Integrated Development Environment, compiler and other tools; If Students have never been used object-oriented language - course will introduce them into a modern and currently most widely used multiplatform object-oriented language for multi-purpose software development. The course will also help students with some of the major challenges for students and IT professionals - to maintain a high level of knowledge and skills, on the one hand, being the knowledge and application of modern advances in programming languages and, on the other, the application of modern technologies, tools, methods and tools for application development.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

No requirements for Java knowledge; It is good to have knowledge in fundamentals of programming in some language or any other object-oriented language.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 64 21 19/Y615E	HIGHLY SECURE SOFTWARE	English	MA	Winter	6	2		2	Prof. M. Petrov, PhD	milemp@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The course Highly Secure Software addresses security issues in every phase of the software development life cycle (SDLC). The course explains all the necessary concepts of security engineering, security testing, development methodologies and a risk-management approach to identify priorities. Successful learners in this course typically have completed secure development strategies, installing and using security testing tools, an approach toward application security testing and secure development practices.

Requirements for enrollment: YES/NO

If any, please describe the specific requirements:

Knowledge of software architectures and software design and development of software systems.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 41 21 21/H011E	ETHICAL DESIGN FOR TRUSTWORTHY SOLUTIONS	English	BA	Winter/ Summer	5,5	30	15	15	Assoc. Prof. Ioannis Patias, PhD	patias@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The use and the impact of Embedded and Autonomous Systems increase, and many institutions are trying to establish societal and policy guidelines for their ethical principles, to ensure that they will operate in a beneficial to the people and the environment way. Techno-scientific communities need to go beyond simple functional and technical solutions, and build trust between people and technology.
We need to develop a positive, non-dogmatic way when include human values in Artificial Intelligence applications, and solutions. We need to include ethical practices assuring human well-being at individual and collective level in the Embedded and Autonomous Systems design.

The basic course materials are on the one hand The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems ("The IEEE Global Initiative") Ethically Aligned Design, First Edition and on the other the European Commission High-Level Expert Group on Artificial Intelligence (AI HLEG). They both focus on the provision of Guidelines and Policy and Investment Recommendations, to serve technologists, educators and policymakers.
The aim of this course is to develop the quality of students in applying in real systems, and applications design, the scientific analysis, resources, high-level principles, and actionable recommendations, which will ensure their Ethics Readiness.

The program focuses on pragmatic tools and their application to solve real problems.

Requirements for enrollment: YES/NO
If any, please describe the specific requirements:

Basic knowledge in Embedded and Autonomous Systems.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 35 21 16 / Y605	Creative Thinking and Innovation	English	MA	Winter	5	39	15	15	Assist. Prof. Sia Tsolova PhD	siyat@fmi.uni-sofia.bg
Short description of the course (in the language of instruction): **The aim of the course is to acquaint students with the specifics of starting the most unstructured phase of the innovation process - feasibility phase. Specific attention in the discipline is paid to innovation in ICT technology. The course presents the modern methods to support individual, team and organizational creativity. The information obtained will help students to accelerate the process of creative solutions to unstructured problems and tasks that can be applied when working on innovative projects in the field of ICT technology in all other disciplines in the field of training and then in the further realization of students.** **The lectures are based on significant sources of proven international experts. They cover all widely applied in the world practice methods. The issues are selected according to the needs of persons performing innovations in the field of informatics and information and communication technologies.** **The seminars are strictly practical. These details are considered the most common practical methods to maintain the creative process in the initial phase of the innovation process. Each method is illustrated with concrete examples or case studies. They include discussion of the applicability of each method in making innovations in modern software practices.** **At the end of the course each student develop practical coursework in which to form a concept for the application of freely chosen by the practical method to maintain the creative process in the initial phase of the innovation process. The achieved in the course work is also an important part of the assessment of student discipline**									
Requirements for enrollment: NO **If any, please describe the specific requirements:**										

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 35 21 16 / Y601	Organisational Behaviour and Leadership	English	MA	Winter	5	30	15	15	Assist. Prof. Sia Tsolova PhD	siyat@fmi.uni-sofia.bg
Short description of the course (in the language of instruction):										

The purpose of the course "Organizational Behavior and Leadership" is to acquaint students with the main problems of relationships between people in organizations and the methods of analyzing and overcoming them. These problems are manifested both at the individual and group, as well as at the organizational level, and their in-depth understanding requires a combination of knowledge and methods of psychology, sociology and organizational theory.
As a result of the training, students should acquire good working knowledge related to basic aspects of organizational dynamics, including motivation, group/team dynamics, leadership, organizational culture.
From a methodological point of view, an important emphasis of the discipline is building teamwork skills.

Requirements for enrollment: NO
If any, please describe the specific requirements:

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 66 21 23 / @511	HPC Architectures	English	MA	Winter	6	30	30	0	Prof. Ana Proykova, DSc	anap@phys.uni-sofia.bg

Short description of the course (in the language of instruction):

The course introduces the ways that can be used to solve computational science problems using High Performance Computing (HPC).

The main areas in which scientific computing is applicable and the basic concepts related to parallel computing are considered. Special attention is paid to the hardware architectures and hardware design of modern HPC computers. The main methods for evaluating the efficiency and characteristics of sequential and parallel computing are reviewed. Through concrete computing networks (Grid technologies), the basics of administration, the portability of codes between different platforms, data management, and the distribution of hardware resources between individual applications are studied. Cloud technologies for high-performance computing are also presented, albeit more generally, with an emphasis on modern approaches to their application.

The course is based on traditional lectures, hands-on sessions in a computer laboratory and implementation of cloud configurations, as well as informal discussions with professors. During the semester, tests are done and the results obtained are demonstrated independently. It ends with an exam in which a developed project is presented on one of the topics.

Requirements for enrollment: NO
If any, please describe the specific requirements:

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 66 21 23 / T512	Operating Systems and Computer networks	English	MA	Winter	6	30	30	0	Prof. K. Stefanov PhD, Prof/ M. Petrov PhD	krassen@fmi.uni-sofia.bg; milenp@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

In this course, we will present the advances that have led to the state-of-the-art operating system that we know today, covering variety of platforms -- cell phones, multi-core, parallel systems, distributed systems, and cloud computing. The focus will be on OS components specific for contemporary HPC clusters.
This course will discuss fundamentals of what comprises an HPC cluster, and how we can take advantage of such systems using the relevant OS components to solve large-scale problems in wide ranging applications like computational fluid dynamics, image processing, machine learning and analytics.
Strong emphasis will be given to computer networks and communications, security and privacy

Requirements for enrollment: YES
If any, please describe the specific requirements:
Students are expected to have taken an undergraduate OS course, or have some experience in industry. They must also be comfortable with Linux OS and basic OS scripting and programming

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 66 21 23 / T513	Computer and Network Security	English	MA	Winter	6	30	30	0	Prof. K. Stefanov PhD, Prof/ M. Petrov PhD	krassen@fmi.uni-sofia.bg; milenp@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):
Course outline:
Today's organizations are challenged with rapidly expanding computer and network security threats. Security personnel configure and monitor various computer, OS and network security threat mitigation measures, such as device hardening, intrusion prevention systems, antivirus protection and firewalls, to protect data assets and network systems from attack. The purpose of this course is to provide skills and

knowledge in the field of computer and network security. Learners in this course are exposed to the foundational knowledge required to respond to computer and network security threats through various threat mitigation measures.
The goals of this course are as follows:

- **Provide an in-depth, theoretical understanding of computer and network security**
- **Provide students with the knowledge and skills necessary to design and support computer, data and network security**
- **Provide an experience-oriented course that employs industry-relevant instructional approaches to prepare students for entry-level jobs in the industry**
- **Enable students to have significant hands-on interaction with IT equipment to prepare them for career opportunities**

The course emphasize critical thinking, problem solving, collaboration, and the practical application of skills.
Rich multimedia content, including activities, videos, and quizzes, addresses a variety of learning styles, helps stimulate learning, and increases knowledge retention.

Requirements for enrollment: YES
If any, please describe the specific requirements:

While there are no set prerequisites for the course, it is RECOMMENDED that students have the following skills and knowledge:

- **PC and internet navigation skills**
- **Basic understanding of computer organization and operating systems**
- **Basic understanding of computer networks**

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 66 21 23 / U511	Parallel Programming	English	MA	Winter	6	30	30	15	Assoc. Prof. P. Armyanov; Assos. Rof. I. Hristov	parmyanov@fmi.uni-sofia.bg ivanh@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):
The aim of the course is developing knowledge and practical skills in the field of parallel programming. In this scope several topics are involved – system programming, computer architecture, algorithms and data structures, as well as basic principles of parallel and concurrent programming. The course will cover basic topics in the field, but also actual practical problems and modern approaches.
There will be a special accent on the skills of decomposing a task to parallelizable parts when solving a given problem, as well as the skill of programming and analyzing parallel algorithms. The parallelizing technics used in the course will cover internally parallel instructions, such as SIMD, multithreaded programming with shared memory, but also an introduction to massively parallel programming with a message passing approach and using general purpose GPUs as parallel execution hardware.
With the practical approach planned, the students will gain hands on experience of trace and debug parallel programs, analyze their performance and successfully profile and optimize them.

Requirements for enrollment: YES
If any, please describe the specific requirements:
Basic knowledge of operating systems and computer architecture.
At least medium level of practical knowledge in programming in the C++ language – syntax, using pointers and memory. Knowledge of the syntax and conceptions of the standard library. Ability to work with an IDE and fluent usage of the integrated tools – compiler arguments, debugger, build and configuration systems.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 66 21 23 / T621	Virtualization and Cloud Computing	English	MA	Summer	5	30	0	30	Assist. Prod. G. Georgiev	georgog@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The course is optional for students in the High Performance Computing master's program of the Informatics professional field. The course introduces students to Cloud Computing and virtualization products, which are the technological basis of Cloud Computing. The course provides students with specific knowledge and skills for installing, maintenance and management of main virtualization components available in the Cloud.

Requirements for enrollment: YES
If any, please describe the specific requirements:
Basic knowledge in Computer networks and Operating Systems

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 66 21 23 / U712	Parallel and Distributed Processing	English	MA	Summer	6	45	30	0	Prof. V. Tsunizhev, PhD	v.georgiev@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

This course presents the principles of organization of parallel and distributed processing of three aspects.
1. Advanced computer architectures – parallel and distributed systems for concurrent processing with multiple processes:
1.1. organization of nodes and communcations, performance and parallelism parameters;
1.2. management of processes, memory and communications;

1.3. main frameworks for high-performance processing – multiprocessors, supercomputers and multicomputers (clusters, farms, grid and cloud).
2. Parallel processing:
2.1. methods for decomposition of the parallel application – classification, cases, features, performance parameters;
2.2. process and memory management – load balancing and fault tolerance methods;
2.3. benchmark algorithms for parallel processing; experimental and analytical methods for performance evaluation.
3. Distributed processing:
3.1. principles and services in the organization of the distributed system by the model Client-server and by Peer-to-Peer (p2p);
3.2. methods for decomposition of the distributed application – models, specification, application domain;
3.3. process and communication management – synchronization, application-oriented frameworks.
The exercises consist of considering complementary classes of parallel and distributed applications, as well as developing and documenting a program project in order to experimentally study processing parameters.

Requirements for enrollment: YES
If any, please describe the specific requirements:

Basic courses in Computer architectures, Computer networks, Object-oriented programming, Functional programming

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 66 21 23 / @711	Parallel Programming with MPI	English	MA	Summer	5	30	0	30	Prof. Ana Proykova, DSc	anap@phys.uni-sofia.bg

Short description of the course (in the language of instruction):

The course gives basic knowledge in programming distributed memory machines using the Message Passing Interface (MPI) industry standard.
After a short introduction to the foundations of HPC and the areas of their application the MPI standard is introduced and some techniques for profiling and debugging of parallel applications are discussed. After thar a detailed presentation of the MPI standard is given, focusing on its implementation for the development of parallel programs. Some specific profiling and fine tuning techniques are introduced.
A practical hands-on tutirial on a real 8-node Linux cluster is included. The assessment consists of two tests and one final course project.
MPI is very important industrial standard in the domain of High Performance Computing (HPC). The knowledge and skills obtained from students during the course will enable students to use it in real industrial settings, including the following software platforms involving MPI implementations: Sun SunFire, IBM SP2, SGI, Cray T3, HPC clusters, Grids, etc.

Requirements for enrollment: YES
If any, please describe the specific requirements:

Basic knowledge of parallel architectures, Unix-like environments, C or Fortran

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 01 01 13 / L021	Introduction to Programming (C++)	English	BA	Winter	6	45	30	15	Assoc. Prof. A. Dimov, PhD	aldi@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):

The course introduces the fundamentals of procedural programming through the use of C++. It is based on the structural programming method. Scalar and composite data types are presented, common for most structural programming languages, as well as other, specific for C++. Algorithms and the realization of procedural programs are thoroughly discussed. Basic structures for managing processes are taught, as well as their realization in C++. Special attention is paid to mechanisms such as recursion and verification of procedural programs. During the course are discussed and implemented various practical applications of procedural programming languages, based on arrays and structures. In addition, historical and social aspects of programming and informatics are presented too. The C++ Visual Studio IDE is used for labs and exercises.

Requirements for enrollment: YES
If any, please describe the specific requirements:

Understanding the basics of procedural programming.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester	ECTS	Number of hours			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 35 21 17 / Y202	Financial Management and Risk Capital	English	MA	Summer	7,5	30	15	15	Assist. Prof. Sia Tsolova PhD	siyat@fmi.uni-sofia.bg

Short description of the course (in the language of instruction):
The purpose of the study discipline "Financial Management and Risk Capital" is to present the challenges, tools and practices for financing new businesses. For this purpose, the concepts of value, price, investment, risk capital in a narrow and broad sense are introduced and discussed, as well as the accompanying institutional constructs. To develop competences in this area, popular case studies of financing young companies from the IT region are considered, paying particular attention to practical skills in identifying investment needs. For this purpose, the most popular methods for establishing the value of the company are described and practiced. The different sources of funding are considered, and these are compared against the parameters of the start-up company.

The discipline develops students' skills to critically analyze and discuss the financial aspects of entrepreneurship. As a result, they will be able to competently and effectively model the financing needs of start-up companies, search for and evaluate financing opportunities and instruments, and use scenarios for decision-making in this direction. At the end of the course, students will independently prepare a detailed financial model of their own entrepreneurial project. **The main objectives are:** **1. To understand the basic concepts of financial management and risk capital.** **2. To examine the role of the regulators in business** **3. To understand the different approaches for assessment of projects and companies** **4. To examine the elements and role of business plans** **5. To be familiar with different source of risk capital**
Requirements for enrollment: NO **If any, please describe the specific requirements:**