COURSES IN FOREIGN LANGUAGES for ERASMUS INCOMING STUDENTS

2021/2022 academic year

Faculty of Mathematics and Informatics

Faculty coordinator: Prof. Maria Nisheva, PhD, marian@fmi.uni-sofia.bg

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI M 101 17 / A541E	**ALGEBRA 2**	**English**	**BA**	**Winter**	**5**	**45**	**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 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

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						Lectures	Exercises/ Seminars	Practical work		
MI M 421 16 / A641E	**GROEBNER BASES**	**English**	**MA**	**Winter**	**5**	**45**		**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI M 101 16 / A731E	**APPLIED ALGEBRAIC GEOMETRY**	**English**	**BA/MA**	**Winter**	**5**	**45**		**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.

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						Lectures	Exercises/ Seminars	Practical work		
MI M 101 17 / D651E	**DIFFERENTIAL GEOMETRY**	**English**	**BA**	**Winter**	**5**	**45**	**15**		**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI M 221 16 / V603E	**SET THEORY**	**English**	**MA**	**Winter**	**6**	**45**	**30**		**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/<u>NO</u>
If any, please describe the specific requirements: Standard mathematical skills are supposed.

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						Lectures	Exercises/ Seminars	Practical work		
MI M 221 16 / V602E	**MODEL THEORY**	**English**	**MA**	**Summer**	**6**	**45**	**30**		**Prof. Tinko Tinchev**	**tinko@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: <u>YES</u>/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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI M 101 16 / V101E	**MATHEMATICAL LOGIC**	**English**	**BA/MA**	**Winter**	**6**	**45**	**30**		**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: <u>YES</u>/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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI M 221 16 / V103E	**MODAL LOGIC**	**English**	**MA**	**Winter**	**5**	**60**			**Prof. Dimitar Vakarelov, Dr. Habil**	**dvak@fmi.uni-sofia.bg**

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

The course "Modal logic" starts with an exposition of intuitionistic and classical propositional logic including axiomatization and completeness theorems. It contains standard material for modal logic: modal languages, Kripke semantics, modal definability and indefinability, Sahlqvist definability theorem, decidability by the method of filtration, axiomatization and completeness via canonical models, extended modal languages. The course is intended for students specializing mathematical logic with applications in computer science and Artificial Intelligence.

Requirements for enrollment: YES/NO

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						Lectures	Exercises/ Seminars	Practical work		
MI M 221 16 / V732E	**APPLIED MODAL LOGIC**	**English**	**MA**	**Summer**	**6**	**75**			**Prof. Dimitar Vakarelov, Dr. Habil**	**dvak@fmi.uni-sofia.bg**

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

The course "Applied modal logic" is a continuation of the course "Modal logic". It applies the methods studied in the preceding course to some modal logics arising from some applied areas. It includes Propositional Dynamic Logic (PDL), Logics of knowledge and believe, Arrow logic, Modal logics for information systems, Modal logics for space relations.

Requirements for enrollment: YES/NO

If any, please describe the specific requirements: The course "Modal Logic" is required

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI M 221 16 / V606E	**LOGICS OF SPACE AND TIME: REGION-BASED APPROACH**	**English**	**MA**	**Summer**	**6**	**75**			**Prof. Dimitar Vakarelov, Dr. Habil**	**dvak@fmi.uni-sofia.bg**
Short description of the course (in the language of instruction): In this course, we develop theories of space and time based on some spatial relations between regions of space. This approach, known also as Region-based theory of space (RBTS), goes back to Whitehead where the base primitive notion is the notion of spatial region and some relations between regions as "contact". An algebraic equivalent of this theory is the notion of contact algebra. We consider several models of contact algebras: topological, proximal and relational and representation theorems of contact algebras in the corresponding models. In the second part of the course, we introduce the notion of dynamic contact algebra which incorporates the notion of time and formalizes regions changing in time. The theory is point free in double sense: neither spatial points nor time points (moments of time) are taken as primitives – they are definable in the theory by the notion of "dynamic region" and some spatio-temporal relations between dynamic regions: "spatial contact", "time contact" and "precedence". The main result of part two is a representation theorem for dynamic contact algebra in certain concrete models of changing regions called "snapshot models".										
Requirements for enrollment: YES/NO										
Course code	**Course title** (in English)	**Language of instruction**	**Course offered to BA/BS, MA/MS, PhD**	**Semester (winter/ summer)**	**ECTS**	**Workload (hours)**			**Lecturer/s's name**	**Lecturer/s's E-mail**
						Lectures	**Exercises /Seminar**	**Practical work**		
MI M 101 16 / V601E	**COMPUTABILITY AND COMPLEXITY**	**English**	**BA/MA**	**Winter**	**6**	**45**	**30**		**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI A 0101 16 / C702E	**RANDOM PROCESSES**	**English**	**BA**	**Summer**	**5**	**30**	**30**		**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI A 0101 16 / C832E	**BRANCHING PROCESSES**	**English**	**BA/MA**	**Winter**	**5**	**30**	**30**		**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI A 6222 17 / P712E	**ACTUARIAL MATHEMATICS**	**English**	**MA**	**Summer**	**5**	**30**		**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.

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						Lectures	Exercises/ Seminars	Practical work		
MI A 6222 16 / P912E	**PROBABILITY 2**	**English**	**MA**	**Winter**	**5**	**30**	**30**		**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI A 6222 17 / P812E	**MATHEMATICAL STATISTISC 2**	**English**	**MA**	**Winter**	**5**	**30**		**30**	**Assoc. Prof. D. Donchev, PhD**	**d.donchev@fmi.uni-sofia.bg**
Short description of the course (in the language of instruction): The goal of the course is to make the students acquainted with the basic methods and ideas of non-parametric statistics. It is a complement to the course of Mathematical Statistics-1, devoted mainly to the parametric tests. It includes rank tests for one and two populations as well as non-parametric analogues of ANOVA and the regression analysis.										
Requirements for enrollment: YES/NO **If any, please describe the specific requirements:** Basic courses on probability and statistics.										
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						Lectures	**Exercises/Seminars**	**Practical work**		
MI A 2321 16 / Z712E	**FINITE ELEMENT METHOD – ALGORITHMIC FOUNDATIONS**	**English**	**MA**	**Winter**	**5**	**30**		**30**	**Prof. Stefka Dimova, D-r Habil,** **Aassist. Prof. Tihomir Ivanov**	**dimova@fmi.uni-sofia.bg** **tbivanov@fmi.uni-sofia.bg**
Short description of the course (in the language of instruction): The course introduces the main notions and ideas of the FEM. It shows how to apply the FEM to the main classes of stationary and non-stationary differential problems, which are mathematical models of variety of real-world phenomena and processes. As a basis of the laboratory exercises the PDE toolbox of MATLAB will be used. The students will use the Graphical user interface for solving different engineering problems in the fields of electrostatics and magnetostatics, diffusion and transfer (of heat and particles), deformation and stresses in elastic bodies.										

Requirements for enrollment: **YES**/NO

If any, please describe the specific requirements: Knowledge in the frame of the courses Mathematical analysis, Linear algebra and Numerical methods. One programming language or one of the systems MATLAB and MATHEMATICA.

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						Lectures	Exercises/ Seminars	Practical work		
MI A 2321 16 / Z812E	**NUMERICAL METHODS FOR DIFFERENTIAL EQUATIONS**	**English**	**MA**	**Summer**	**5**	**30**		**30**	**Prof. Stefka Dimova, D-r Habil,** **Assist. Prof. Tihomir Ivanov**	**dimova@fmi.uni-sofia.bg** **tbivanov@fmi.uni-sofia.bg**

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

The main topics to be considered: Cauchy problem for first order ODE. Physical interpretation, examples. Finite difference methods – one-step and multistep methods. Approximation stability and convergence. Boundary value problem for second order ODE. One-dimensional stationary heat equation, interpretation of the boundary conditions. Finite difference methods, variation methods. One-dimensional nonstationary heat equation, other physical interpretations. Weighted multilevel difference schemes. First order hyperbolic equation, physical interpretations. Characteristics. Finite difference methods, monotonicity. First order hyperbolic nonlinear equation, physical interpretations. Shock waves. Total variation Diminishing difference schemes. Poisson equation, physical interpretations. Finite difference methods. Wave equation. Characteristics. Finite difference methods.

Requirements for enrollment: **YES**/NO

If any, please describe the specific requirements: Knowledge in the frame of the courses Mathematical analysis, Linear algebra and Numerical analysis. One programming language or one of the systems MATLAB and MATHEMATICA.

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

MI A 2321 16 / Z912E	**MATHEMATICAL MODELS AND COMPUTATIONAL EXPERIMENT**	**English**	**MA**	**Summer**	**5**	**30**		**30**	**Prof. Stefka Dimova, D-r Habil**	**dimova@fmi.uni-sofia.bg**

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

The main topics are: – Construction and investigation of mathematical models: dimensional analysis and scaling. – Hierarchy of mathematical models. – Connection between the symmetry of physical systems and the invariance of the mathematical models: similarity and invariant solutions of differential equations. – Construction of discrete methods that incorporate the invariant properties of the continuous models. The explanation is on the mathematical models of different physical processes. The laboratory exercises are devoted to the numerical analysis of the mathematical models under consideration using MATLAB and specially developed software**.**

Requirements for enrollment: YES/NO

If any, please describe the specific requirements: Basic knowledge on differential equations – ordinary and partial, and on the numerical methods of their solving; one programming language and /or one system as MATLAB and MATEMATICA.

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						Lectures	**Exercises/ Seminars**	**Practical work**		
MI C 0101 17 / F653E	**FUNDAMENTALS OF ALGORITHMS**	**English**	**BA/MA**	**Winter**	**5**	**30**	**30**		**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.

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						Lectures	Exercises/ Seminars	Practical work		
MI A 0101 16 / F753E	**COMPUTATIONAL COMPLEXITY**	**English**	**BA/MA**	**Winter**	**5**	**30**	**30**		**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.										

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						Lectures	Exercises/ Seminars	Practical work		
MI I 6321 19 / S613E	**WEB TECHNOLOGIES AND ARCHITECTURES**	**English**	**MA**	**Summer**	**5**	**30**	**30**		**Assoc. 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. Software Engineering										

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						Lectures	Exercises/ Seminars	Practical work		

MI I 6321 19 / Y627E	**SOFTWARE ARCHITECTURES**	**English**	**MA**	**Winter**	**6**	**30**	**30**		**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 (winter/ summer)**	**ECTS**	**Workload (hours)**			**Lecturer/s's name**	**Lecturer/s's E-mail**
						Lectures	**Exercises/ Seminars**	**Practical work**		
MI I 6321 19 / S664E	**ADVANCED WEB PROGRAMMING**	**English**	**MA**	**Winter**	**5**	**30**	**30**		**Assoc. 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.

Requirements for enrollment: **YES**/NO

If any, please describe the specific requirements: Discrete Mathematics & Mathematical Logic, Programming Languages, Semantics of Programming Languages, Functional and Logic Programming.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI B 0101 16 / H766E	**PROJECT MANAGEMENT**	**English**	**BA/MA**	**Winter**	**5**	**30**	**30**		**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		

MI I 63 21 16 / Y597E	**SOFTWARE DEVELOPMENT LIFE-CYCLE MANAGEMENT (SDLC)**	**English**	**MA**	**Winter/ Summer**	**5**	**30**	**30**		**Prof. Sylvia Ilieva, PhD**	**sylvia@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction):
The SDLC course aims at strenthening the knowledge of Master students on required concepts and methods for large software systems development. It will provide new knowledge on processes and techniques related to development of complex software systems. Additional aim is broad undertanding of software engineering discipline.
The students will have lectures and seminars, also will prepar critical analyses and essays on given subjects.

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 (winter/ summer)**	**ECTS**	**Workload (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**		**30**	**Assoc. 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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 34 21 16 / Y627E	**MODELS OF SOFTWARE SYSTEMS**	**English**	**MA**	**Winter**	**5**	**30**		**30**	**Assoc. 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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 63 21 16 / Y547E	**TECHNOLOGY ENTREPRENEURSHIP**	**English**	**MA**	**Winter/ Summer**	**5**	**30**	**15**	**15**	**Assoc. Prof. P. Ruskov, PhD** **Assist. Prof. SiaTsolova, Ph.D.**	**petkor@fmi.uni-sofia.bg** **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: YES/NO

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

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

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

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

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

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

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

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 40 21 17 / H776E	**PROJECT RISK MANAGEMENT**	**English**	**MA**	**Winter**	**5**	**30**	**15**	**15**	**Chief Assist. 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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 40 21 17 / H786E	**DESIGN OF ROBOTICS SYSTEMS**	**English**	**MA**	**Winter**	**5**	**30**	**15**	**15**	**Chief Assist. 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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ 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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O721E	**ROBOT MODELING USING 3D PRINTING TECHNOLOGY**	**English**	**MA**	**Summer**	**6**	**45**			**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O606E	**BIOMEDICAL ROBOTICS**	**English**	**MA**	**Summer**	**5**	**30**		**30**	**Prof. Kamen Delchev, PhD**	**kkdelchev@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction): Medical robotics is related to mechanical engineering, electronics, electrical engineering, computer systems and information technology. Each of these areas has its own scientific theory and practice. Therefore, these lectures present the main concepts, basic characteristics, methods and applications of medical robotics. A common classification of medical robots, including biomedical robots, rehabilitation robots, surgical robots and „hand-held" robots has been considered. Some major uses of prostheses, rehabilitation robots and surgical robots, such as LOCOMAT robotic system, Da Vinchi tele-operated robot, CyberKnife robot are also explored. CAD models of biomedical robots and prototypes of ODRO „hand-held" robot are being studied in this course.

Requirements for enrollment: **YES**/NO
If any, please describe the specific requirements: Basic knowledge of Geometry and Algebra, and computer programing from the bachelor programs at the faculties of mathematics and informatics, and at the technical universities.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O611E	**ROBOT MECHANICAL COMPONENT PROJECTING BY CAD SYSTEMS**	**English**	**MA**	**Winter**	**6**	**45**			**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 (winter/ summer)**	**ECTS**	**Workload (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**	**45**	**45**		**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ 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**	**45**			**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 (winter/ summer)	ECTS	Workload (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**	**30**		**30**	**Prof. George Boiadjiev, PhD**	**george@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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O100E	**KINEMATICS**	**English**	**MA**	**Winter**	**5**	**30**	**30**		**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O212E	**PLANNING OF MOTION IN COMPLEX ENVIRONMENT**	**English**	**MA**	**Summer**	**5**	**30**		**30**	**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI I 72 21 19/O603E	**PROGRAMMABLE LOGIC CONTROLLERS**	**English**	**MA**	**Winter**	**5**	**30**	**15**		**Prof. Kamen Delchev, PhD**	**kkdelchev@fmi.uni-sofia.bg**

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

Programmable logic controllers (PLC) are a key factor in industrial automation. Programmable (industrial) controllers are called programmable electronic systems designed for use as industrial equipment for the logical control of various machines, equipment and process, through digital or analogue inputs and outputs. This course is intended to explain the PLC, their interface to peripheral devices and the international standard for their IEC-1131 programming. The IEC 1131 standard defines syntax, semantics, and various programming language applications in industrial automation systems (including PLC programming languages), regardless of the basic hardware structure and the built-in operating system used by the manufacturer. This makes it possible to use once-taught language with a wide range of PLC systems based on the standard. The course acquaints you with the basic features of PLC's world-wide series: SIEMENS SIMATIC S7, AlenBradly MicroLogix and Modicon. The programming of SIEMENS SIMATIC S7 200 and SIEMENS SIMATIC S7 1200 PLC is mainly studied in this course.

Requirements for enrollment: YES/NO

If any, please describe the specific requirements: Basic knowledge of computer programing from the bachelor programs at the faculties of mathematics and informatics, and at the technical universities. Laptop.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Semin	Practical work		
MI I 72 21 19/F609E	**PROGRAMMING IN C#.NET**	**English**	**MA**	**Winter**	**5**	**45**		**30**	**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O214E	**ROBOT CONTROL**	**English**	**MA**	**Summer**	**5**	**45**	**15**		**Prof. Kamen Delchev, PhD**	**kkdelchev@fmi.uni-sofia.bg**

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

General design of robot control system (master control system, subsystem for trajectory planning, subsystem for solving the inverse kinematic problem, servo controllers, sensors etc.) is considered. The general methods for servo control are presented: classical P, PD and PID control laws, and robot-dynamics based control laws. The basic concepts of Lyapunov theory for analyzing stability of the control system are discussed. Optimization of dynamics based control and in particular the adaptive control algorithms and iterative learning control of robotic manipulators are considered as well.

Requirements for enrollment: YES/NO

If any, please describe the specific requirements: Basic knowledge of Geometry and Algebra, and computer programing from the bachelor programs at the faculties of mathematics and informatics, and at the technical universities.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O211E	**KINEMATICS AND DYNAMICS OF ROBOTS**	**English**	**MA**	**Summer**	**5**	**45**			**Prof. Kamen Delchev, PhD**	**kkdelchev@fmi.uni-sofia.bg**

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

These lectures present basic theory, methods and applications of the kinematics and dynamics of robotic manipulators. The main concepts of robot kinematic systems are considered. The kinematic equations of motion of robots (positions, velocities and accelerations) are derived using the Denavit-Hartenberg method. Forward and inverse kinematic problems are defined and basic methods for solving the inverse kinematic problem are presented.

The dynamical equations of motion based on the Lagrange's formulation are derived as well. The basic methods for identification of the dynamical parameters and the full dynamic-model of PUMA 560 robot are given.

Requirements for enrollment: **YES**/NO

If any, please describe the specific requirements: Basic knowledge of Geometry and Algebra, and computer programing from the bachelor programs at the faculties of mathematics and informatics, and at the technical universities

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/Seminars	Practical work		
MI I 72 21 19/O101E	**SENSORS**	**English**	**MA**	**Summer**	**5**	**30**	**30**		**Assoc. Prof. Todor Partalin, PhD**	**topart@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction): The purpose of a sensor is to respond to some kind of an input physical property, to convert it into an electrical quantity which is compatible with electronic circuits and that's how to convert into information. It may be said that a sensor is a translator of a generally nonelectrical value into an electrical value, which means a signal which can be channeled, amplified, and modified by electronic devices. The sensor's output signal may be in the form of voltage, current, or charge and further described in terms of amplitude, frequency, phase, or digital code. Sensor's work is based on physical (Acoustic, Electric, Magnetic, Optical, Mechanical, Radiation, Thermal) or chemical phenomenon and effects. In the course are included topics about sensor devices used mainly in robotics. This course aims to show the strong interconnection between Mechanics, Physics, Electronics and Informatics in the Robotics. In the course students will learn about typical constructions, applications and interfacing of sensors.

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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O723E	**ROBOT APPLICATION IN THE ORTHOPAEDIC SURGERY**	**English**	**MA**	**Summer**	**5**	**30**	**15**	**15**	**Prof. George Boiadjiev, PhD**	**george@fmi.uni-sofia.bg**

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

The robot application in the orthopaedic surgery allows to achieve such a surgical precision and accuracy which are impossible by their handily execution. This leads to develop the idea of minimal invasive surgery, i.e. the intervention effect to be minimal which reflects to faster postoperative patient recovery.

The most popular orthopaedic robots are considered. The advanced tendencies in this field are presented.

The orthopaedic manipulation "bone drilling" is the most executed one in the orthopaedic surgery practice. Its successful automatic execution by robot systems will increase the surgical intervention quality and will have very high social meaning.

The orthopaedic drilling robot ODRO is presented in details. There are described Its subsystems, functionality and application. Experiments and their results are presented. The robot advantages are underlined.

Requirements for enrollment: **YES**/NO

If any, please describe the specific requirements: Familiarity with mathematics, mechanics, electronics, programming.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O213E	**MATERIALS, SMART-MATERIALS AND PIEZO-ACTUATORS**	**English**	**MA**	**Summer**	**4**	**30**	**15**		**Assoc. Prof. Todor Partalin, PhD**	**topart@fmi.uni-sofia.bg**

Short description of the course (in the language of instruction): From the course students will learn about the properties and the use of the different materials from which elements, details, nodes, units, structures of mechatronic systems and robots are made. Metals, non-metals, organic materials and composites are covered. Attention is drawn to modern materials and their specific application. It discusses the piezo-drive that finds place in the robot and manipulator mechanisms, the components of the scientific apparatus and the medical equipment and the high-tech production - microchips for the electronics.

Requirements for enrollment: **YES**/NO

If any, please describe the specific requirements: Knowledge of mathematics from bachelor's programs, Knowledge of chemistry and physics from secondary school.

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

MI I 72 21 19/T661E	**COMPUTATIONAL GEOMETRY AND MORPHOLOGY**	**English**	**MA**	**Winter**	**5**	**45**		**15**	**Assoc. Prof. Boyko Bantchev, PhD**	**boykobb@gmail.com**

Short description of the course (in the language of instruction): The course introduces to computational geometry (CG). It starts with a novel exposition of vector algebra and elements of analytical geometry, which serve as an algebraic and computational device for the formulation and implementation of geometric algorithms. The rest of the course aims at acquainting with the problem domain of computational geometry and fundamental approaches, techniques, and data structures pertaining to CG. Algorithms are presented and evaluated for a number of specific problem classes, such as hull construction, partitioning and subdivision, point location, searching, intersections, optimal path construction, etc. Attention is paid to reasoning about the time and space complexity of the algorithms under discussion.
Students' programming practice throughout the course is aided by software, specially designed for the course by the lecturer.

Requirements for enrollment: **YES**/NO
If any, please describe the specific requirements: Familiarity with geometry at higher-school beginner's level, basic algorithmization and programming skills.

Course code	**Course title** (in English)	**Language of instruction**	**Course offered to BA/BS, MA/MS, PhD**	**Semester (winter/ summer)**	**ECTS**	**Workload (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**	**45**			**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 (winter/ summer)	ECTS	Workload (hours)			Lecturer/s's name	Lecturer/s's E-mail
						Lectures	Exercises/ Seminars	Practical work		
MI I 72 21 19/O724E	**ELECTRONIC SYSTEMS IN ROBOTICS**	**English**	**MA**	**Summer**	**5**	**30**	**15**	**15**	**Assoc. Prof. Tony Boiadjiev PhD**	**george@fmi.uni-sofia.bg**

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

Robotics is an interdisciplinary field where different knowledge of mathematics, mechanics, electronics, informatics etc. is involved. Therefore everyone who deals with robotics needs skills in such areas and especially in their common objects. In this sense the proposed course introduces to the students basic concepts and principles of electronics and some of main components and elements which are applied in the robot considered as complex system having subsystems as mechanical, sensor, drive and control ones. Various electronic elements are considered – passive and active, bipolar and pole transistors, optoelectronic elements, logical elements, integral schemes, logical schemes and their application. The focus falls on step and brushless (BLDC) motors, their principles of motion and technical characteristics as well as the criteria of motors choice for specific robotized device. Also the main principles of servo-drives control, encoders and controllers are considered and especially the ones concerning the step and BLDC motors and their kind of programming. The electronic components and the system where they are incorporated in are illustrated by the robot ODRO. This way the students could face practically both the separate electronic components (drives, sensors, controllers) and the communication between them as well as the kind of programming and the interface with the operator.

Requirements for enrollment: **YES**/NO

If any, please describe the specific requirements: Familiarity with mathematics, mechanics, electronics, programming.

Course code	Course title (in English)	Language of instruction	Course offered to BA/BS, MA/MS, PhD	Semester (winter/ summer)	ECTS	Workload (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**	**30**		**30**	**Assoc. Prof. M. Petrov**	**milenp@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 (winter/ summer)	ECTS	Workload (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**	**30**		**30**	**Assoc. Prof. M. Petrov**	**milenp@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 (winter/ summer)	ECTS	Workload (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**	**30**		**30**	**Assoc. Prof. M. Petrov**	**milenp@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 (winter/ summer)	ECTS	Workload (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. 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.