MODULES` CATALOGUE

STUDIENPLAN: Computermathematik
Bachelor und Master
BELORUSSISCHE STAATLICHE UNIVERSITÄT

ERSTES JAHR

N	Kod	Module	SWS		Prüfungen		CP		
			1.Sem	2.Sem	LN	MPr	1.Sem	2.Sem	Im Jahr
1	MA	Mathematische Analysis I	4/4/0	4/4/0	1, 2	1, 2	8	8	16
2	AZ	Algebra und Zahlentheorie I	2/2/0	3/3/0	1, 2	1, 2	4	6	10
3	AG	Analytische Geometrie	2/2/0	2/2/0	1, 2	1, 2	4	4	8
4	PI	Programmierung und Informatik I	2/0/2	2/0/2	-	1, 2	4	4	8
5	CM	Computermathematik I	1/0/1	1/0/1	-	2	3	2	5
6	EF	Einführung in die Fachrichtung	2/0/0	-	1	-	3	-	3
7	DM	Diskrete Mathematik	-	2/1/0	2	-	-	2	2
8	CP+ SLFA	Computerpraktikum I + SLFA I	0/2/2	0/2/2	2	2	4	4	8
Im Semester:			**28**	**31**			**30**	**30**	
Im Studienjahr:					**9**	**10**			**60**

Legend zu der Anlage

SWS	Semesterwohenstunden Vorlesung / Übungen / Praktikum, Laborarbeit im Semester mit 17 Wochen
SWS*	Semesterwohenstunden Vorlesung / Übungen / Praktikum, Laborarbeit im Semester 9 mit 14 Wochen
LN	Leistungsnachweis, Semester N
MPr	Modul-Prüfung, Semester N
CP	Kreditpunkte
SLFA	Studentische Lehr +Forschungsarbeit

ZWEITES JAHR

N	Kod	Module	SWS		Prüfungen		CP		
			3.Sem	4.Sem	LN	MPr	3.Sem	4.Sem	Im Jahr
1	MA	Mathematische Analysis II	4/4/0	4/4/0	3, 4	3, 4	8	8	16
2	AZ	Algebra und Zahlentheorie II	2/2/0	2/2/0	3, 4	3, 4	4	4	8
3	PI	Programmierung und Informatik II	2/0/2	2/0/2	3, 4	-	3	3	6
4	CM	Computermathematik II	1/0/1	1/0/1	4	-	2	2	4
5	DGT	Differentialgeometrie und Topologie	2/2/0	3/3/0	3, 4	3, 4	4	4	8
6	DG	Differentialgleichungen	2/2/0	2/2/0	3, 4	3, 4	4	4	8
7	CP+ SLFA+ SA	Computerpraktikum II+ SLFA II + Studien-Arbeit I	0/2/2	0/2/2	4	4, 4	5	5	10
Im Semester:			**28**	**31**			**30**	**30**	
Im Studienjahr:					**9**	**10**			**60**

DRITTES JAHR

N	Kod	Module	SWS		Prüfungen		CP		
			5.Sem	6.Sem	LN	MPr	5.Sem	6.Sem	Im Jahr
1	NM	Numerische Methoden I	1/0/1	1/0/1	5, 6	-	2	2	4
2	VO	Variationsrechnung und Optimierungsmethoden I	2/1/0	-	5	-	3	-	3
3	TFKV	Komplexe Funktionentheorie	2/2/0	2/1/0	5	5, 6	4	3	7
4	FAIG	Funktionalanalysis und Integralgleichungen I	2/2/0	2/2/0	5	5, 6	5	3	8
5	WTS	Wahrscheinlichkeitstheorie und Statistik I	-	2/2/0	6	-	-	4	4
6	GMPh	Gleichungen der mathematischen Physik I	-	2/2/0	6	-	-	4	4
7	Mod	Computermodellierung I	1/0/2	-	-	5	4	-	4
8	AF	Anwendungsfach I	1/0/2	-	5	-	3	-	3
9	CGA	Computergraphik und Animation Ia Computergraphik und Animation Ib	-	2/0/2 1/0/1	-	6 6	-	5	5
10	SAIS	Systemanalysis und Projektierung von Informationssystemen – Methoden I	-	1/0/1	6	-	-	2	2
11	BP	Berufspraktikum I	-	4 Wochen	-	6	-	4	4
12	SLFA+ SA	SLFA III + Studien-Arbeit II	0/2/0	0/2/0	6	6	8	4	12
Im Semester:			**21**	**27**			**29**	**31**	
Im Studienjahr:					**10**	**9**			**60**

VIERTES JAHR

N	Kod	Module	SWS		Prüfungen		CP		
			7.Sem	8.Sem	LN	MPr	7.Sem	8.Sem	Im Jahr
1	CM	Computermathematik III	1/0/1	1/0/1	7, 8	-	2	2	4
2	NM	Numerische Methoden II	2/0/2	2/0/2	7	8	3	4	7
3	FAIG	Funktionalanalysis und Integralgleichungen II	2/2/0	-	-	7	4	-	4
4	WTS	Wahrscheinlichkeits-theorie und Statistik II	2/2/0	-		7	4	-	4
5	GMPh	Gleichungen der mathematischen Physik II	2/2/0	-	-	7	4	-	4
6	TM	Theoretische Mechanik	2/2/0	2/2/0	7	8	3	4	7
7	OF	Operationsforschung	-	2/1/0	-	8	-	3	3
8	ML	Mathematische Logik	-	2/1/0	8	-	-	3	3
9	Mod	Computermodellierung II	1/0/1	1/0/1	8	7	2	2	4
10	CGA	Computergraphik und Animation II	-	2/0/2	8	8	-	4	4
11	SAIS	Systemanalysis und Projektierung von Informationssystemen – Methoden II	1/0/1	1/0/1	8	7	2	2	4
12	SLFA+ BDiss	SLFA IV + Bachelor Thesis	0/2/0	0/2/0	8	8	6	6	12
Im Semester:			**28**	**26**			**30**	**30**	
Im Studienjahr:					**9**	**10**			**60**

FUNFTES JAHR

N	Kd	Module	SWS		Prüfungen		CP		
			9.Sem	10.Sem	LN	MPr	9.Sem	10.Sem	Im Jahr
1	CM	Computermathematik IV	1/0/1	-	9	-	2	-	2
2	VO	Variationsrechnung und Optimierungsmethoden II	2/2/0	-	-	9	4	-	4
3	Ph	Physik	2/1/1	-	9	-	4	-	4
4	Mod	Computermodellierung III	1/0/1	-		9	2	-	2
5	AF	Anwendungsfach II	1/0/1	-	9	-	2	-	2
6	CGA	Computergraphik und Animation III	1/0/1	-	9	-	2	-	2
7	VCM	Vertiefungsgebiet Computermathematik I	2/1/1	-	-	9	4	-	4
8	SAIS	Systemanalysis und Projektierung von Informationssystemen – Methoden III	2/1/1	-	-	9	4	-	4
9	BP	Berufspraktikum II	-	10 Wochen	-	10	-	10	10
10	SV	Staatsprüfungen Vorlesung I	-	1/0/0		10	-	6	6
11	Dip	Diplom Thesis	-	10 Wochen	-	10	6	14	20
Im Semester:			**24**				**30**	**30**	
Im Studienjahr:					**4**	**7**			**60**

SECHSTES JAHR

N	Kod	Module	SWS		Prüfungen		CP		
			11.Sem	12.Sem	LN	MPr	11.Sem	12.Sem	Im Jahr
1	Mod	Computermodellierung IV	1/0/1	-	-	11	5	-	5
2	AF	Anwendungsfach III	2/1/1	-	11	-	5	-	5
3	CGA	Computergraphik und Animation IV	1/0/1	-	11	-	5	-	5
4	VCM	Vertiefungsgebiet ComputermathematikII	2/1/1	-	11	11	8	-	8
5	SAIS	Systemanalysis und Projektierung von Informationssystemen – Methoden IV	2/1/1	-	-	11	7	-	7
6	SV	Staatsprüfungen Vorlesung II		2/0/0	-	12		10	10
7	MDiss	Master Thesis		12 Wochen	-	12		20	20
Im Semester:			**16**				**30**	**30**	
Im Studienjahr:					**3**	**5**			**60**

FIRST YEAR

N	Code	Modules	HPW		Control		ECTS		
			Sem. 1	Sem. 2	CT	EX	Sem. 1	Sem. 2	In year
1	MA	Mathematical analysis I	4/4/0	4/4/0	1, 2	1, 2	8	8	16
2	AZ	Algebra and theory of numbers I	2/2/0	3/3/0	1, 2	1, 2	4	6	10
3	AG	Analytical geometry	2/2/0	2/2/0	1, 2	1, 2	4	4	8
4	PI	Programming and informatics I	2/0/2	2/0/2	-	1, 2	4	4	8
5	CM	Computer mathematics I	1/0/1	1/0/1	-	2	3	2	5
6	EF	Introduction into speciality	2/0/0	-	1	-	3	-	3
7	DM	Discrete mathematics	-	2/1/0	2	-	-	2	2
8	CP+ SLFA	Computer practical training I + ERWS I	0/2/2	0/2/2	2	2	4	4	8
In semester:			**28**	**31**			**30**	**30**	
In year:					**9**	**10**			**60**

Remarks to the plan

HPW	Hours per week Lectures / Practical lessons / Laboratory lessons during the semester of 17 weeks
HPW*	Hours per week Lectures / Practical lessons / Laboratory lessons during the semester 9 of 14 weeks
CT	Credit test, Semester N
EX	Examination, Semester N
ERWS	Educational + research work of a student
ECTS	European Credit Transfer System

SECOND YEAR

N	Code	Modules	HPW		Control		ECTS		
			Sem. 3	Sem. 4	CT	EX	Sem.3	Sem. 4	In year
1	MA	Mathematical analysis II	4/4/0	4/4/0	3, 4	3, 4	8	8	16
2	AZ	Algebra and theory of numbers II	2/2/0	2/2/0	3, 4	3, 4	4	4	8
3	PI	Programming and informatics II	2/0/2	2/0/2	3, 4	-	3	3	6
4	CM	Computer mathematics II	1/0/1	1/0/1	4	-	2	2	4
5	DGT	Differential geometry and topology	2/2/0	3/3/0	3, 4	3, 4	4	4	8
6	DG	Differential equations	2/2/0	2/2/0	3, 4	3, 4	4	4	8
7	CP+ SLFA+ SA	Computer practical training II + ERWS II + Research project I	0/2/2	0/2/2	4	4, 4	5	5	10
In semester:			**28**	**31**			**30**	**30**	
In year:					**9**	**10**			**60**

THIRD YEAR

N	Code	Modules	HPW		Control		ECTS		
			Sem. 5	Sem. 6	CT	EX	Sem.5	Sem. 6	In year
1	NM	Methods of computations I	1/0/1	1/0/1	5, 6	-	2	2	4
2	VO	Variation calculus and methods of optimization I	2/1/0	-	5	-	3	-	3
3	TFKV	Theory of functions of complex variable	2/2/0	2/1/0	5	5, 6	4	3	7
4	FAIG	Functional analysis and integral equations I	2/2/0	2/2/0	5	5, 6	5	3	8
5	WTS	Theory of probabilities and mathematical statistics I	-	2/2/0	6	-	-	4	4
6	GMPh	Equations of mathematical physics I	-	2/2/0	6	-	-	4	4
7	Mod	Computer modeling I	1/0/2	-	-	5	4	-	4
8	AF	Natural-science discipline I	1/0/2	-	5	-	3	-	3
9	CGA	Computer graphics and animation Ia Computer graphics and animation Ib	-	2/0/2 1/0/1	-	6 6	-	5	5
10	SAIS	Methods of system analysis and informational systems designing I	-	1/0/1	6	-	-	2	2
11	BP	Practical training I	-	4 Weeks	-	6	-	4	4
12	SLFA+ SA	ERWS III + Research project II	0/2/0	0/2/0	6	6	8	4	12
In semester:			**21**	**27**			**29**	**31**	
In year:					**10**	**9**			**60**

FOURTH YEAR

c	Code	Modules	HPW		Control		ECTS		
			Sem. 7	Sem. 8	CT	EX	Sem.7	Sem. 8	In year
1	CM	Computer mathematics III	1/0/1	1/0/1	7, 8	-	2	2	4
2	NM	Methods of computations II	2/0/2	2/0/2	7	8	3	4	7
3	FAIG	Functional analysis and integral equations III	2/2/0	-	-	7	4	-	4
4	WTS	Theory of probabilities and mathematical statistics II	2/2/0	-		7	4	-	4
5	GMPh	Equations of mathematical physics II	2/2/0	-	-	7	4	-	4
6	TM	Theoretical mechanics	2/2/0	2/2/0	7	8	3	4	7
7	OF	Operation research	-	2/1/0	-	8	-	3	3
8	ML	Mathematical logic	-	2/1/0	8	-	-	3	3
9	Mod	Computer modeling II	1/0/1	1/0/1	8	7	2	2	4
10	CGA	Computer graphics and animation II	-	2/0/2	8	8	-	4	4
11	SAIS	Methods of system analysis and informational systems designing III	1/0/1	1/0/1	8	7	2	2	4
12	SLFA+ BDiss	ERWS IV + Bachelor thesis	0/2/0	0/2/0	8	8	6	6	12
In semester:			**28**	**26**			**30**	**30**	
In year:					**9**	**10**			**60**

FIFTH YEAR

N	Code	Modules	HPW*		Control		ECTS		
			Sem. 9	Sem. 10	CT	EX	Sem.9	Sem.10	In year
1	CM	Computer mathematics IV	1/0/1	-	9	-	2	-	2
2	VO	Variation calculus and methods of optimization II	2/2/0	-	-	9	4	-	4
3	Ph	Physics	2/1/1	-	9	-	4	-	4
4	Mod	Computer modeling III	1/0/1	-		9	2	-	2
5	AF	Natural-science discipline II	1/0/1	-	9	-	2	-	2
6	CGA	Computer graphics and animation III	1/0/1	-	9	-	2	-	2
7	VCM	Advanced computer mathematics I	2/1/1	-	-	9	4	-	4
8	SAIS	Methods of system analysis and informational systems designing III	2/1/1	-	-	9	4	-	4
9	BP	Practical training II	-	10 Weeks	-	10	-	10	10
10	SV	Graduate examination I	-	1/0/0		10	-	6	6
11	Dip	Graduation thesis	-	10 Weeks	-	10	6	14	20
In semester:			**24**				**30**	**30**	
In year:					**4**	**7**			**60**

SIXTH YEAR

N	Code	Modules	HPW		Control		ECTS		
			Sem.11	Sem.12	CT	EX	Sem.11	Sem.12	In year
1	Mod	Computer modeling IV	1/0/1	-	-	11	5	-	5
2	AF	Natural-science discipline III	2/1/1	-	11	-	5	-	5
3	CGA	Computer graphics and animation IV	1/0/1	-	11	-	5	-	5
4	VCM	Advanced computer mathematics II	2/1/1	-	11	11	8	-	8
5	SAIS	Methods of system analysis and informational systems designing IV	2/1/1	-	-	11	7	-	7
6	SV	Graduate examination II		2/0/0	-	12		10	10
7	MDiss	Master thesis		12 Weeks	-	12		20	20
In semester:			**16**				**30**	**30**	
In year:					**3**	**5**			**60**

Lectures: 68 **Practical:** 68 **Laboratory:** 0	**MA.1**	**Mathematical analysis I**	**ECTS:** 8
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of function theory Dubatovskaja M. V.		
Goal	Basis creation for mastering basic concepts and methods of modern mathematics. Mastering of the course «Mathematical analysis» allows students to solve theoretical and applied problems of modern analysis independently.		
Precedence	Foundations of algebra and analysis principles within the framework of secondary school.		
Contents	1. Elements of logistics and the set theory 2. The conception of real numbers 3. Limit 4. Continuity of one-variable functions 5. Differential calculus of functions of one real variable		
Teaching methods	Lectures and practical training, independent tests (laboratory work)		
Literature	1. Zorich V.A. Mathematical analysis. – M., Nauka, volume 1 – 1981; 2. Demidovich B.P. Collection of tasks and exercises in mathematical analysis. – M., Nauka – 1977 ; 3. Rudin U. Foundations of mathematical analysis. – M., Mir. - 1976		
Examination	Colloquium , credit test , examination		
Recommended for	First year students of the specialization Computer mathematics		
Notes	The given literature is required during the whole course.		

Lectures: 68 **Practical:** 68 **Laboratory:** 0	**MA.2**	**Mathematical analysis I**	**ECTS:** 8
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of function theory Dubatovskaja M. V.		
Goal	Basis creation for mastering the basic concepts and methods of modern mathematics. Mastering of the course «Mathematical analysis» allows students to solve theoretical and applied problems of modern analysis independently.		
Precedence	Theory of limit, differential calculus, foundations of set theory and analytic geometry.		
Contents	6. Indefinite integral 7. Define Riemann integral 8. Improper integral 9. Usage of a define Riemann integral 10. Curvilinear integral 11. Differential calculus of multivariable functions		
Teaching methods	Lectures and practical training , independent tests (laboratory work)		
Literature	1. Zorich V.A. Mathematical analysis. – M., Nauka, volume 1 – 1981; 2. Demidovich B.P. Collection of tasks and exercises in mathematical analysis. – M., Nauka – 1977 ; 3. Rudin U. Foundations of mathematical analysis. – M., Mir. - 1976		
Examination	Colloquium , credit test , examination		
Recommended for	First year students of the specialization Computer mathematics		
Notes	The given literature is required during the whole course.		

Lectures: 68 **Practical:** 68 **Laboratory:** 0	**MA.3**	**Mathematical analysis II**	**ECTS:** 8
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of function theory Dubatovskaja M. V.		
Goal	Basis creation for mastering the basic concepts and methods of modern mathematics. Mastering of the course «Mathematical analysis» allows students to solve theoretical and applied problems of modern analysis independently.		
Precedence	Differential calculus of multivariable functions, the theory of limits, set theory, integral calculus of one-variable functions.		
Contents	12. Implicit reflections 13. Extremums of multidimensional functions 14. Number series 15. Functional sequences and series, power series 16. Improper parameter-dependent integrals 17. Fourier series theory		
Teaching methods	Lectures and practical training , independent tests (laboratory work)		
Literature	4. Zorich V.A. Mathematical analysis. – M., Nauka, volume 1 – 1981; 5. Demidovich B.P. Collection of tasks and exercises in mathematical analysis. – M., Nauka – 1977 ; 6. Rudin U. Foundations of mathematical analysis. – M., Mir. - 1976		
Examination	Colloquium , credit test , examination		
Recommended for	First year students of the specialization Computer mathematics		
Notes	The given literature is required during the whole course.		

Lectures: 68 **Practical:** 68 **Laboratory:** 0	**MA.4**	**Mathematical analysis II**	**ECTS:** 8
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of function theory Dubatovskaja M. V.		
Goal	Basis creation for mastering the basic concepts and methods of modern mathematics. Mastering of the course «Mathematical analysis» allows students to solve theoretical and applied problems of modern analysis independently.		
Precedence	Integral calculus of one-variable functions, differential calculus of multivariable functions, the basic concepts of differential geometry and topology.		
Contents	18. Integral calculus of multivariable functions 19. Field theory 20. Differential forms calculus		
Teaching methods	Lectures and practical training , independent tests (laboratory work)		
Literature	7. Zorich V.A. Mathematical analysis. – M., Nauka, volume 1 – 1981; 8. Demidovich B.P. Collection of tasks and exercises in mathematical analysis. – M., Nauka – 1977 ; 9. Rudin U. Foundations of mathematical analysis. – M., Mir. - 1976		
Examination	Colloquium , credit test , examination		
Recommended for	First year students of the specialization Computer mathematics		
Notes	The given literature is required during the whole course.		

Lectures: 34 **Practical:** 34 **Laboratory:**0	**AZ.1**	**Algebra and number theory I**	**ECTS:**4
Lecturer	Candidate of physics and mathematics sciences, associate professor of the department of higher algebra Kursov V. V.		
Goal	Systematical exposition of the basic facts, concerning algebraic objects and comprising the basic knowledge, which is necessary for studying the most of other mathematical disciplines as well as presenting the specific examples of the methods of investigation of real problems, which are based on the process of transition to abstract concepts.		
Precedence	Foundations of algebra within the framework of secondary school.		
Contents	1. Divisibility of integers 2. The theory of congruences 3. Complex field 4. Permutations and substitutions 5. Algebraic structures 6. Polynomial in one variable 7. Polynomial in several variables		
Teaching methods	Lectures and practical training, tests.		
Literature	1) Milovanov M.V., Tyshkevich R.I., Fedenko A.S., Algebra and analytic geometry. P.1, Minsk, 1984. Milovanov M.V., Tolkachev M.M., Tyshkevich R.I., Fedenko A.S., ., Algebra and analytic geometry. P.2, Minsk, 1987. 2) Kurosh A.G. The course of higher algebra. M.: "Nauka", 1965 (and later editions). 3) Faddeev D.K. The lectures on algebra. M., "Nauka", 1984.		
Examination	tests, final test, examination		
Recommended for	First year students of the specialization Computer mathematics		
Notes	The given literature is necessary during the whole course		

Lectures: 51 **Practical:** 51 **Laboratory:** 0	**AZ.2**	**Algebra and number theory I**	**ECTS:** 6
Lecturer	Candidate of physics and mathematics sciences, associate professor of the department of higher algebra Kursov V. V.		
Goal	Systematical exposition of the basic facts, concerning algebraic objects and comprising the basic knowledge, which is necessary for studying the most of other mathematical disciplines as well as presenting the specific examples of the methods of investigation of real problems, which are based on the process of transition to abstract concepts.		
Precedence	Vectors and operations on them, the conception of basis, algebraic structures		
Contents	1) Determinants 2) Vector spaces 3) Subspaces 4) Linear mapping of vector spaces 5) The system of linear equations 6) Isomorphism of vector spaces 7) Invariant subspaces. Eigenvectors and eigenvalues. 8) Jordan normal form.		
Teaching methods	Lectures and practical training, tests.		
Literature	1) Milovanov M.V., Tyshkevich R.I., Fedenko A.S., Algebra and analytic geometry. P.1, Minsk, 1984. Milovanov M.V., Tolkachev M.M., Tyshkevich R.I., Fedenko A.S., ., Algebra and analytic geometry. P.2, Minsk, 1987. 2) Kurosh A.G. The course of higher algebra. M.: "Nauka", 1965 (and later editions). 3) Faddeev D.K. The lectures on algebra. M., "Nauka", 1984.		
Examination	tests, final test, examination		
Recommended for	First year students of the specialization Computer mathematics		
Notes	The given literature is necessary during the whole course		

Lectures: 34 **Practical:** 34 **Laboratory:**0	**AZ.3**	**Algebra and number theory II**	**ECTS**: 4
Lecturer	Candidate of physics and mathematics sciences, associate professor of the department of higher algebra Kursov V. V.		
Goal	Systematical exposition of the basic facts, concerning algebraic objects and comprising the basic knowledge, which is necessary for studying the most of other mathematical disciplines as well as presenting the specific examples of the methods of investigation of real problems, which are based on the process of transition to abstract concepts.		
Precedence	Matrices and operations on them, the concept of determinant, vector subspaces, linear mapping of vector spaces, the concept of space $E.^{n}$		
Contents	9) Bilinear and quadratic forms. 10) Euclidean and unitary spaces. 11) Linear operators of Euclidean and unitary spaces.		
Teaching methods	Lectures and practical training, tests.		
Literature	4) Milovanov M.V., Tyshkevich R.I., Fedenko A.S., Algebra and analytic geometry. P.1, Minsk, 1984. Milovanov M.V., Tolkachev M.M., Tyshkevich R.I., Fedenko A.S., ., Algebra and analytic geometry. P.2, Minsk, 1987. 5) Kurosh A.G. The course of higher algebra. M.: "Nauka", 1965 (and later editions). 6) Faddeev D.K. The lectures on algebra. M., "Nauka", 1984.		
Examination	tests, final test,examination		
Recommended for	Second year students of the specialization Computer mathematics		
Notes	The given literature is necessary during the whole course		

Lectures: 34 **Practical:** 34 **Laboratory:**0	**AZ.4**	**Algebra and number theory II**	**ECTS:** 4
Lecturer	Candidate of physics and mathematics sciences, associate professor of the department of higher algebra Kursov V. V..		
Goal	Systematical exposition of the basic facts, concerning algebraic objects and comprising the basic knowledge, which is necessary for studying the most of other mathematical disciplines as well as presenting the specific examples of the methods of investigation of real problems, which are based on the process of transition to abstract concepts.		
Precedence	Foundations of theory of numbers, algebraic structures (groups, a ring, a field)		
Contents	12) Groups and theirs primary properties. 13) Theorems about group homomorphism 14) The theory of rings 15) The theory of fields.		
Teaching methods	Lectures and practical training, tests.		
Literature	7) Milovanov M.V., Tyshkevich R.I., Fedenko A.S., Algebra and analytic geometry. P.1, Minsk, 1984. Milovanov M.V., Tolkachev M.M., Tyshkevich R.I., Fedenko A.S., ., Algebra and analytic geometry. P.2, Minsk, 1987. 8) Kurosh A.G. The course of higher algebra. M.: "Nauka", 1965 (and later editions). 9) Faddeev D.K. The lectures on algebra. M., "Nauka", 1984.		
Examination	tests, final test, examination		
Recommended for	Second year students of the specialization Computer mathematics		
Notes	The given literature is necessary during the whole course		

Lectures: 34 **Practical:** 34 **Laboratory:** 0	**AG.1**	**Analytic geometry**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of geometry, topology and teaching methods Kononov S. G.		
Goal	1. Studying of vectors in E^3 space as classes of equivalent directed segments and their application for the study of straight lines and planes 2. Familiarization with the basic method in analytical geometry, i.e. the coordinates method 3. Studying of new geometric objects – the second order figures on a E^2 plane and in E^3 space		
Precedence	Foundations of geometry and algebra within the framework of secondary school.		
Contents	1. Vectors and coordinates 2. Straight line on a Euclidean plane. A plane and a straight line in a three-dimensional Euclidean space 3. Second order figures on a Euclidean plane and in three-dimensional Euclidean space		
Teaching methods	Lectures and practical training		
Literature	1. Kostrikin A.I., Manin U.I. Linear algebra and geometry. , M:Nauka, 1986. 320p. 2. Milovanov M.V., Tolkachev M.M., Tyshkevich R.I., Fedenko A.S. Algebra and analytic geometry. Mn. :Vyshejshaja shkola,1984.P.1, 302p.; 1987.P.2, 269p. 3. Modenov P.S., Parhomenko A.S. Collection of tasks and exercises in analytic geometry . M:Nauka, 1976. 384p.		
Examination	Credit test , examination		
Recommended for	First year students of the specialization Computer mathematics		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:** 0	**AG.2**	**Analytic geometry**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of geometry, topology and teaching methods Kononov S. G.		
Goal	1. Familiarization with new in comparison with elementary geometry spaces: multidimensional Euclidean, affine, projective, and study of figures typical for these spaces: linear (κ-dimensional planes) and quadratic 2. To master the basic method of investigation in analytic geometry – the coordinates method 3. Systematic study of geometric transformations, carrying out group-theoretical view on geometry		
Precedence	Vectors and operations on them, figures of the first and the second order on a plane and in space		
Contents	1. Affine transformations of a E^2 plane and E^3 space 2. Affine n-dimensional space A^n 3. Point n-dimensional Euclidean space E^n 4. Quadrics in affine space 5. Quadrics in Euclidean space 6. Projective plane and projective space		
Teaching methods	Lectures and practical training		
Literature	4. Kostrikin A.I., Manin U.I. Linear algebra and geometry. , M:Nauka, 1986. 320p. 5. Milovanov M.V., Tolkachev M.M., Tyshkevich R.I., Fedenko A.S. Algebra and analytic geometry. Mn. :Vyshejshaja shkola,1984.P.1, 302p.; 1987.P.2, 269p. 6. Modenov P.S., Parhomenko A.S. Collection of tasks and exercises in analytic geometry . M:Nauka, 1976. 384p.		
Examination	Credit test , examination		
Recommended for	First year students of the specialization Computer mathematics		
Notes			

Lectures: 34 **Practical:** 0 **Laboratory:** 34	**PI.1**	**Programming and the Information Theory I**	**ECTS:** 4
Lecturer	Candidate of physics and mathematics sciences, associate professor of the department of numerical methods and programming Alenskiy N.A.		
Goal	Teaching the methods of solving scientific, technical and information problems, acquisition by the students the skills of work on contemporary computing systems, the study of new information technologies.		
Basic courses	Section "Foundations of algorithmization and programming" of school course "Information science".		
Contents	Algorithms and the basis of language C++. Modern Integrated Development Environment systems. Functions. The basic concepts of the Object Oriented Programming. Simple data types. Arrays (without pointers).		
Teaching methods	Lectures and laboratory lessons.		
Literature	1. Kernigan B. and other. Language of programming C. M.: Finances and statistics, 1992. 2. Podbel'skiy V.V., Fomin S.S. Programming in the language C, M.: Finances and statistics, 1999. 600 p. 3. Shildt H. Self-study of C++. 3d edition. St. Petersburg: BKHV, 2002. 688 p.		
Examination	Examination.		
Recommended for	students of the first year, specialization Computer mathematics.		
Remarks			

Lectures: 34 **Practical:** 0 **Laboratory:** 34	**PI.2**	**Programming and the Information Theory I**	**ECTS:** 4
Lecturer	Candidate of physics and mathematics sciences, associate professor of the department of numerical methods and programming Alenskiy N.A.		
Goal	Teaching the methods of solving scientific, technical and information problems, acquisition by the students the skills of work on contemporary computing systems, the study of new information technologies.		
Basic courses	Types of algorithms and their realization in language C++, operations and operators in C++ language, algorithms for work with one-dimensional arrays and matrices, programming by using independent functions and classes.		
Contents	Structured types of data. Pointers. Input, output, operations with files. Pointers and dynamic memory. Modern technologies and methods of programming.		
Teaching methods	Lectures and laboratory studies.		
Literature	1. Kernigan B. and other. Language of programming C. M.: Finances and statistics, 1992. 2. Bases of algorithmization and programming. Language C: Textbook for the students BGUIR/Demidovich Ye. N. Mn., 2001. 440p. 3. Podbel'skiy V.V. Language C++: Teaching aid. M.: Finances and statistics, 2000. 560 p		
Examination	Examination.		
Recommended for	students of the first year, specialization Computer mathematics.		
Remarks			

Lectures: 34 **Practical:** 0 **Laboratory:** 34	**PI.3**	**Programming and the information theory II**	**ECTS:** 3
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of numerical methods and programming Romanchik V.S.		
Goal	Teaching the methods of solving scientific, technical and information problems, acquisition by the students the skills of work on contemporary computing systems, the study of new information technologies.		
Basic courses	Pointers and their relationship with arrays, structures and other data types, work with dynamic memory.		
Contents	Object-oriented programming. A general characteristic of system C++ Builder. Input/output. The console application. Operating components. Work with the text. Graphic opportunities. Work with local databases. The distributed applications and sockets.		
Teaching methods	Lectures and laboratory studies.		
Literature	1. Alenskiy N.A. Bases of programming in language C++: textbook/ GUO "APO". - Mn.: APO, 2005. - 148 p. 2. K.Arnold, J. Gosling, D.Holms. Language of programming Java. 3d ed. M:"Viliams", 2001. - 624 p. 3. C. Arnush. Master independently in Borland C++5. M.: Binomial, 1997. 719 p.		
Examination	Final test		
Recommended for	students of the second year, specialization Computer mathematics.		
Remarks	For the control of knowledge intermediate and final testing is used.		

Lectures: 34 **Practical**: 0 **Laboratory**: 34	**PI.4**	**Programming and the Information Theory II**	**ECTS:** 3
Lecturer	Candidate of physics- mathematics sciences, associate professor of the department of numerical methods and programming Romanchik V.S.		
Goal	Teaching the methods of solving scientific, technical and information problems, acquisition by the students the skills of work on contemporary computing systems, the study of new information technologies.		
Basic courses	Object-oriented programming, bases of algorithmization, basic knowledge of Internet technologies.		
Contents	The organization of computer networks and the Internet. Protocols. Addressing. Work with the Internet. Browsers. E-mail. Hypertext documents. HTML language. Java language. Applets and applications. Basic types and classes. Processing of events. Use of packages of classes of Java language. Creation of interactive Web-pages. Technology of the development of Internet-applications.		
Teaching methods	Lectures and laboratory lessons.		
Literature	1. Blinov I.N., Romanchik V.S. Java 2. Practical manual. Mn., University press. - 2005, 400 p 2. Nouton, Shildt. Java 2. 2000 3. K.Arnolds, J. Gosling, D. Holms. Language of programming Java. 3d ed. M: "Viliams", 2001. 624 p		
Examination	Final test.		
Recommended for	students of the second year, specialization Computer mathematics.		
Remarks	For the control of knowledge intermediate and final testing is used.		

Lectures: 17 **Practical**: 0 **Laboratory**: 17	**CM.1**	**Computer Mathematics I**	**ECTS:** 3
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of differential equations Shcheglova N.L.		
Goal	The skills of work in the environment of operational system Windows, development of the skills to organize educational and research work using modern numerical and symbolical mathematical packages		
Basic courses	The bases of computer science within the limits of a course of high school: the minimal configuration of a personal computer, its modern technical characteristics, the concept of the software		
Contents	*Introduction in computer technologies* Operational system Windows: the object-oriented approach, the basic technological mechanisms. Teamwork of Appendices. A technique of acquaintance with new Appendices. The typical operating procedure with Documents. Processing the text information. Work with spreadsheets. *Numerical mathematical package MathCAD* The interface. Structure of the Document. Input, editing, formatting of expressions. Ways of defining and calculating variables and functions. Work with files, vectors, matrices. The solution of the equations and systems. Symbolical calculations: commands and operators. Drawing and animation. Elements of programming. *Symbolical mathematical package MapleV* The interface, structure. Expression as basis of symbolical packages. The basic types of expressions: an atom, a list, a set, a function. Work with parts of an expression. Local substitutions. The built-in functions of transformation of the expressions, the solutions of the equations and systems. Functions of the user. The elementary procedures. Means of programming. Methods of debugging the programs. Specialized packages. Drawing and animation		
Teaching methods	Lectures, laboratory lessons		
Literature	1. Yu. Shafrin. ABC of computer technologies. M.: Publishing of the Institute of the Psychotherapy, 2000 2. A.I. Pliss, N.A. Slivina. Mathcad: Mathematical practical book.. M.: Finance and statistics, 2003 3. A.Heck. Introduction to Maple. Springer, 2003.		
Examination	Test, presentation of the laboratory works.		
Recommended for	students of the first year specializing in Computer mathematics		
Remarks			

Lectures: 17 **Practical**: 0 **Laboratory**: 17	**CM.2**	**Computer Mathematics I**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of differential equations Shcheglova N.L.		
Goal	The development of the skill to independently acquire and extend computer and mathematical knowledge with its further use during analysis of mathematical models of wide range of research and applied problems.		
Basic Courses	Computer mathematics: the basics of computer technologies.		
Contents	*Symbolic mathematical package Mathematica.* The structure of the package. The peculiarities of the interface. Help system. The scenario of work: accumulation of knowledge during the Session, their storing between the Sessions. Notepad metaphor. Cells as the main objects of Notepad. Everything is an expression. Types of expressions. The analysis of structure of the expression. Patterns as the expressions, describing the sets of expressions. A symbol as the basic means of calculations. Properties and attributes of a symbol. Global rules of transformations. The different possibilities of their association with a symbol. Conditions of executing these rules, or options of a symbol. The functions determined by the user. Local transformation rules. Programming based on the local transformation rules. Functional programming. Pure and anonymous functions. Operator Apply and the set of operators Map. The possibilities of successive application of function to the result of its operation. Constructions controlling the course of computation: branching and iteration. The order of computation of the expression. The main cycle of the package. The principles of localization of the variables. Contexts. Packages. Graphics and animation.		
Teaching methods	Lectures, laboratory lessons.		
Literature	1. Stephen Wolfram. The Mathematica Book. Fourth Edition. Cambridge, Universitiy Press, 1999. 2. E.M. Vorobiev. Introduction to «Mathematica». M.: Finance statistics, 1998. 3. L.L. Goloubeva, A.E. Malevich, N.L. Scheglova. Computer mathematics. Symbolic mathematical package *Mathematica*. A series of lectures. Mn., BSU, 2005.		
Examination	CIW, presentation of laboratory works, examination.		
Recommended for	students of the first year specializing in Computer mathematics.		
Remarks			

Lectures: 17 **Practical:** 0 **Laboratory:** 17	**CM.3**	**Computer mathematics II**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of differential equations Goloubeva L.L.		
Goal	Development of the skill to independently acquire and extend computer and mathematical knowledge with its further use during analysis of mathematical models of wide range of research and applied problems		
Basic Courses	Computer mathematics, Algebra and theory of numbers		
Contents	*Numeric package MATLAB*. Structure of the package. Interface of the system. Command window. Workspace. History command. Current directory. Editor-debugger of files. Figures. Help system. Real time work. Everything is an array. Types of data. Hierarchy of data. Data presentation. Vectors, matrices, tensors. Operations with data. Symbolic arrays, structures, cells. Programming of M-scripts and M-functions. Functions, determined by the user. Types of functions. Primary functions, subfunctions, private functions. Local and global variables. Object-oriented programming, classes and objects. Classes, determined by the user. Constructor. Properties and methods. Basic methods included in the MATLAB canonical classes. The basics of high-level and descriptive graphics. Handle graphics objects. Hierarchy of graphics objects. Determining the values of a graphics object property. Data input and output. Exporting data to MAT-files. Importing data from MAT-files. Binary data. ASCII data. Reading formatted data from a file. Writing formatted data to a file. Creating graphical user interfaces (GUIs) using GUIDE, the MATLAB graphical user interface development environment. Programming callbacks events for GUI components. Setting component properties, i.e. the property inspector. The Layout Editor. GUIDE templates. Interaction of MATLAB environment with external applications.		
Teaching methods	Lectures, Laboratory lessons.		
Literature	1. Potemkin V.G. MATLAB 5.x. – the system of engineering and scientific computation. 2 v. Volume 1, Volume 2. M.: DIALOG– MIFI, 1999. 2. Martynov N.N. Introduction to MATLAB 6. KUDIT-IMAGE, 2002. 3. Rudra Pratap. Getting started with MATLAB: version 6. – Oxford: Oxford Univ. Press, 2002		
Examination	CIW, presentation of laboratory works, final test.		
Recommended for	students of the second year specializing in mathematics, Computer mathematics		
Remarks			

Lectures: 17 **Practical**: 0 **Laboratory**: 17	**CM.4**	**Computer mathematics II**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of differential equations Malevich A.E.		
Goal	Modeling. Mathematical and computer modeling. Computer systems of mathematical modeling. Matlab, Simulink, Stateflow, VRML.		
Basic Courses	Mathematical analysis, Linear Algebra and analytic geometry, Computer mathematics, Matlab.		
Contents	System. Model. Modeling. Dynamic system. Phase space. The computer package for modeling dynamic systems Simulink. Operational environment and user interface. Datum, signal, block. The library of blocks. Scientific, mathematical and computer models. Continuous and discrete dynamic systems. Transformation of a scientific model into a mathematical model and vice versa. Units of measure and "the theory of dimensions". Dynamic systems with control. Events. The event response of the system. Controlling signal. Enabled blocks. Triggered blocks. Complicated systems. Subsystem. System hierarchy. Decomposition of the system into relatively independent subsystems. Interaction of the subsystems. Assembling the model of the complicated system from the (sub)models of its subsystems. Concealing the internal structure of the submodel. The means of extension of the library of standard blocks. Finite state machine. State diagram. Event, state, switch (change). Introduction to the unified modeling language UML. The computer package Stateflow. User interface and basic skills needed to work with the package Stateflow. Its connection to Simulink and Matlab. The language describing the systems controlled by the events accepted in Stateflow. Debugging the model in Stateflow. Virtual reality. Virtual reality modeling language VRML / X3D. Description, projection and creation of the three-dimensional scenes. Basic nodes and event routing in VRML. Script usage in VRML. Usage of VRML in Simulink. Virtual Reality Toolbox. User interface. Projection and development of user interface. Three-dimensional interface.		
Teaching methods	Lectures and laboratory works.		
Literature	1. Benkovich E.S. and others. Practical modeling of dynamic systems. SPb.: BHV-Petersburg 2. Cherny I.V. SIMULINK: the environment for creating the engineering applications. M.: DIALOG-MIFI 3. Rambo J., Jacobson A., Buch G. UML: special reference book. SPb.: Piter		
Examination	Examination + Reports on 7 laboratory works.		
Recommended for	students of the second year of the specialization Computer mathematics		
Remarks			

Lectures: 17 **Practical:** 0 **Laboratory:** 17	**CM.7**	**Computer Mathematics III**	**ECTS:** 2
Lecturer	Doctor of physics-mathematics sciences , professor of the department of differential equations Sadovsky A.P.		
Goal	Acquiring the basic concepts of the polynomial ideals' theory, Groubner basis and methods of calculating the ideals' manifolds, ideals' radicals by means of computer algebra.		
Basic courses	Algebra and the theory of numbers, analytical geometry, mathematical analysis, fundamentals of the theory of function of complex variable, ordinary differential equations.		
Contents	Affine manifolds and ideals. Monomial ordering. The algorithm of division in a polynomial domain with many variables. Monomial ideals. Gilbert's theorem of basis. Groubner basis and its properties. Bukhberger's criterion. Bukhberger's algorithm of calculation of Groubner basis. Minimal Groubner basis. Reduced Groubner basis. Syzygies of ideal's basis. Excluding ideals. The theorem of exclusion. Resultants. Generalized resultants. The theorem of continuation. Gilbert's theorem of noughts. Radical ideals. Radicals of ideals. Correspondence between affine manifolds and ideals.		
Teaching methods	Lectures, laboratory works.		
Literature	1. Cox D., Littell J., O'shy D. Ideals, manifolds and algorithms. An introduction into calculus aspects of algebraical geometry and commutative algebra. M.: Mir, 2000, 687 p. 2. Adams W., Loustaunau P. An introduction to Grobner Bases. American Mathematical Society.- Providence, 1994, 289 p. 3. Prosolov V.V. Polynomials. – MCNMO, 2000, 336 p		
Examination	Test + presentation of laboratory works.		
Recommended for	students of the fourth year of MMF.		
Remarks			

Lectures: 17 **Practical:** 0 **Laboratory:** 17	**CM.8**	**Computer mathematics III**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, doctor of technical sciences, professor of the department of differential equations Lipnitskij V. A.		
Goal	Studying the main regulations of the theory of Galois fields and applying it in the theory of antijamming codes and cryptography.		
Basic courses	Algebra and number theory		
Contents	Rings. Polynomials and fields. Rings. Devisors of zero and inverse elements. Ideals and operations on them. Principal and maximal ideals. Factor rings. Polynomial ring and its properties. The basics of the field theory. Field characteristics. Minimal fields. Extensions of fields. The theory of finite fields. Homomorphism and automorphism of fields. Galois group. Norm and trace. Equations in finite fields. Linear noise combating codes. Hamming metric and code distance. Methods of decoding noise combating codes. Cryptosystems AES, McElience, McElience-Sidelnikov.		
Teaching methods	Lectures and practical training.		
Literature	1. V.A. Lipnitsky. "Modern applied algebra. Mathematical basics of information security: noise and unauthorized access" 2005. 2. A.V. Cheremushkin "The lectures on the arithmetic algorithms in cryptography". 2002 3. R.Merlos-Saragosa "The art of noise combating coding. Methods, algorithms, application". 2005		
Examination	Final test		
Recommended for	students of the fourth year, specializing in Computer Mathematics.		
Remarks			

Lectures: 14 **Practical**: 0 **Laboratory**: 14	**CM.9**	**Computer mathematics IV**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of differential equations Malevich A.E.		
Goal	Mathematical and computer modeling of complicated systems. The further forming of the skills of abstract mathematical thinking and the ability to apply it to the specific problems.		
Basic Courses	Algebra and number theory, Analysis. Differential equations. Differential geometry and topology. Discrete mathematics. Computer mathematics.		
Contents	Computer systems as the means of intensification of mathematical research. Computer systems for preparing mathematical manuscripts: LaTeX, Mathematica. Analysis and modeling of complicated systems. Abstraction of main parameters. Nonlinear dynamic systems. Specific features and bifurcations. Stability and the domain of application of models. The mathematical theory of the growth of the Earth population. Neural networks. Neuron models. Networks architecture. Training of the network. Back-propagation algorithm. Genetic algorithms. The presentation of genetic information. Genetic operators. Haploid and diploid populations. The systems of automatic control. Fuzzy logic.		
Teaching methods	Lectures, independent work.		
Literature	4. Arnold V.I., Rigid and soft mathematical models, M., MCNMO, 2004 5. Haykin S., Neural networks: full course, M., Williams, 2006 6. Hrennikov A.Y. Modeling of the thinking processes in the p-adic coordinate systems, M., Fizmatlit, 2004		
Examination	Examination + Reports on 7 laboratory works.		
Recommended for	students of the fifth year		
Remarks			

Lectures: 34 **Practical lessons:** 0 **Laboratory lessons:**0	**EF.1**	**Introduction to specialty**	**ECTS:** 3
Lecturer	Candidate of physics-mathematics sciences, associate professor of the chair of differential equations Malevich A.E.		
Goals	To study set and rate theory, algebraically structures, to teach the means of representing mathematical objects in computer programs and solution algorithms of routine problems.		
Basic Courses			
Contents	Features of mathematics as science. Its maintenance and methods of research. Objective and virtual realities. A computer as means of intensifying scientific work. Computer mathematical packages and computer mathematics. Empty set, universal set. Operations on sets: association, crossing, difference. Addition of sets. The Cartesian product of sets. The Cartesian product of the family of sets. Binary relations. Properties of reflexivity, symmetry, antisymmetry, transitivity of binary relations. The relation of equivalence, classes of equivalent elements, factor set. Images and prototypes of elements and subsets. A composition of mappings (complex function), property of associatively of a composition of mappings. Injective, surjective, bijective mappings. Inverse mappings, unidirectional inverse mappings. Algebras with one operation: a semigroup, a monoid, a group. Algebras with two operations: a ring, a field. Vector space. Matroid. System of independent subsets. Greedy algorithms. Coding. Huffman code.		
Teaching methods	lectures		
Literature	1. Novikov F.A. Discrete mathematics for programmers. Spb.: Piter, 2000. 2. Kononov S.G.,Tyshkevich R.I., Yanchevskiy V.I. Introduction into mathematics. Mn. P. 1-3. 2003. 3. Corman T., Laserson Ch., Riwest R. Algorithms: construction and analysis. M.: MCNMO, 1999.		
Examination methods	credit test		
Recommended for	the first year students specializing in computer mathematics.		
Remarks			

Lectures: 34 **Practical:** 17 **Laboratory:**0	**DM.2**	**Discrete mathematics**	**ECTS:** 2
Lecturer	The candidate of physical and mathematical sciences, associate professor of the department of the equations of mathematical physics of the faculty of Mechanics and Mathematics BSU Metelsky J.M.		
Goal	Introduction to basic sections of discrete mathematics and its applications		
Precedence	Introduction to mathematics (the principles of the set theory and the theory of mappings)		
Contents	*Introduction into combinatorial analysis.* Rules of sum and product. Permutations and combinations. Binomial theorem. The properties of binomial coefficients. Polynomial theorem. Method of inclusion and exclusion. Recurrence relations. Fibonacci numbers. Systems of different representatives. Hall theorem. Systems of general representatives. *Introduction into the theory of graphs.* Isomorphism of graphs. Labeled graphs. Connection between the number of points, ribs and the components of a graph. Bipartite graphs. Kening theorem. Wave algorithm. Trees. Finding the framework of minimal weight. Independence and coverings. Estimation of the independence number. Apical and rib coverings. Matching in bipartite graphs. Euler graphs. Criterion of Euler graphs. Hamiltonian graphs. Sufficient conditions of the graph to be Hamiltonian. Apical and rib coloration of graphs. *Elements of the coding theory.* The concept of coding. General scheme. Alphabetical coding. Makarov theorem about one-for-one alphabetical coding. Self-correcting code .		
Teaching methods	Lectures and laboratory classes.		
Literature	1. Emelichev V.A., Melnikov O.I., Sarvanov V.I., Tyshkevich R.I. Lectures on graph theory. M.: Nauka, 1990. 2. Rybnikov K.A. Introduction to combinatorial analysis. M.: Publishing house MSU, 1972. 3. Yablonsky S.V. Introduction to discrete mathematics. M.: Nauka, 1986.		
Examination	Credit test		
Recommended for	First year students of the faculty of Mechanics and Mathematics, BSU		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:**0	**DGT.3**	**Differential geometry and topology**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of geometry, topology and mathematical teaching methods Timohovich V.L.		
Goal	Mastering the fundamental notions of metric and topological spaces, compactness, connectivity, fundamental group, curves, surfaces and invariants, connected to them (curvatures of different kinds), the bases of the theory of smooth manifolds. Mastering the basic topological and geometrical methods of solving problems.		
Precedence	Algebra and the theory of numbers (concept of basic algebraic structures) Analytic geometry (notion of a vector, basis, reference, motions) Mathematical analysis (differentiability, derivatives of multivariable functions, Taylor expansion)		
Contents	Parametrized curves in E (E^n). Natural parametrization. Curves. Tangent. Osculating plane. Curve orientation. Curvature and the vector of curvature. Frene basis and reference. Torsion. Natural equation of a curve. Invariants of curves in E^n. Parametrized surfaces in E^3 (E^n). Surfaces. Local (curvilinear) coordinates on a surface. Curves on a surface. Tangent space to a surface, tangent plane, normal line. Surface orientation. First fundamental form of a surface. Normal curvature. Second fundamental form of a surface. Basic functional of a surface and its properties. Euler formula. Principal directions. Principle curvatures. Types of points on a surface. Asymptotic directions on a surface. Inner geometry of a surface. Lines of curvature. Geodesic lines and their properties. Riemann metric on a surface. Lobachevski plane. The definition of smooth manifold. Open submanifolds. Diffeomorphism. Tangent plane to a manifold. Smooth vector fields on a manifold. Module of a vector field. Lie algebra of vector fields. Lie groups. Lie groups of transformations of classic spaces (affine group, group of motions).		
Teaching methods	Lectures , practical studies.		
Literature	4. Belko I.V., Burdun A.A., Vedernikov V.I., Fedenko A.S. Differential geometry (edited by A.S. Fedenko). - Mn. Publishing house of BSU, 1982. 5. Collection of tasks in differential geometry (edited by A.S. Fedenko). - M., Nauka, 1979. 6. Mischenko A.S, Fomenko A.T. The course of defferential geometry and topology. – M., Publishing house of MSU, 1980. Postnikov M.M. Linear algebra and differential geometry. - M., Nauka, 1979.		
Examination	test , examination		
Recommended for	Students of the second year, specialization Computer mathematics		
Notes			

Lectures: 51 **Practical:** 51 **Laboratory:**0	**DGT.4**	**Differential geometry and topology**	**ECTS**: 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of geometry, topology and mathematical teaching methods Timohovich V.L.		
Goal	Mastering the fundamental notions of metric and topological spaces, compactness, connectivity, fundamental group, curves, surfaces and invariants connected to them (curvatures of different kinds), the bases of the theory of smooth manifolds. Mastering the basic topological and geometrical methods of solving problems.		
Precedence	Algebra and the theory of numbers (concept of basic algebraic structures) Analytic geometry (notions of a vector, basis, reference, motion) Mathematical analysis (differentiability, derivatives of multivariable functions, Taylor expansion)		
Contents	Metric space. Topological space. Comparison of topologies. Subspace and induced topology. Closed sets and closure. Boundary and interior of a set. Converging sequences. Separation axioms. Continuous mapping and its properties. Homeomorphism. Product of spaces. Continuous mapping in a product. Concept of bundle space. Converging sequences in a product. Concept of a topological group. Compact topological space and its elementary properties. Compactness criteria of a metric space. Complete metric space and its elementary properties. Compactness criterion of a complete metric space. Completion of a metric space. Connected space and its elementary properties. Connected components. Irreducibility. Noether spaces. Factor spaces and factor topology, elementary constructions. Topological groups of transformations. Concept of homotopy. Fundamental group and its elementary properties.		
Teaching methods	Lectures , practical studies.		
Literature	7. Kononov S.G., Prasolov A.V., Timohovich V.L. Trale A.E., Fedenko A.S. Topology. - Mn.: Vyshejshaya shkola, 1990. 8. Aleksandryan R.A., Mirzahanyan E.A. General topology. - M.: Vysshaya shkola, 1979. 9. Sinyukov N.S., Matveenko T.I. Topology. - Kiev: Vischa shkola, 1984. 10. Borisovich Y.G., Bliznyakov N.M., Israilevich Y.A., Fomenko T.N. Introduction to topology. - M.: Vysshaya shkola, 1980. 11. Massi U., Stolings G. Algebraic topology: Introduction. - M.: Mir, 1977.		
Examination	test, examination		
Recommended for	Students of the second year, specialization Computer mathematics		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:** 0	**DG.3**	**Differential Equations**	**ECTS:** 4
Lecturer	Doctor of physics-mathematics sciences, professor of the department of differential equations Gromak V.I.		
Goal	Studying the basic types of differential equations and methods of their integration, obtaining the skills of construction and analysis of mathematical models based on the theory of differential equations, learning the basic analytical, qualitative and asymptotical methods of the theory of differential equations.		
Basic courses	Algebra and number theory, analytical geometry, mathematical analysis, foundations of the theory of complex variable functions and functional analysis.		
Contents	Introduction into the theory of differential equations. Differential equations of the first order. Differential equations of higher orders. Normal systems of differential equations. Problems of solutions existence Normal systems of differential equations. General properties of the solutions of the systems of differential equations. Partial differential equations of the first order.		
Teaching methods	Lectures and practical training.		
Literature	1. Bibikov Yu.N. The course of ordinary differential equations. M.: «Vys'shaya schkola», 1991. 2. Matveev N.M. The methods of integration of ordinary differential equations. Minsk: «Vysheyshaya schkola», 1974. 3. Fedoruk M.V. Ordinary differential equations. M.: «Nauka», 1985.		
Examination	Final test + examination.		
Recommended for	Second year students of mechanics and mathematics faculty.		
Remarks			

Lectures: 34 **Practical:** 34 **Laboratory:** 0	**DG.4**	**Differential Equations**	**ECTS:** 4
Lecturer	Doctor of physics-mathematics sciences, professor of the department of differential equations Gromak V.I.		
Goal	Studying the basic types of differential equations and methods of their integration, obtaining the skills of construction and analysis of mathematical models based on the theory of differential equations, learning the basic analytical, qualitative and asymptotical methods of the theory of differential equations.		
Basic courses	Algebra and number theory, analytical geometry, mathematical analysis, foundations of the theory of complex variable functions and functional analysis.		
Contents	Linear differential equations. Linear differential systems. Lyapunov stability of solutions of differential equations. Autonomous systems of differential equations.		
Teaching methods	Lectures and practical training.		
Literature	4. Bibikov Yu.N. The course of ordinary differential equations. M.: «Vys'shaya schkola», 1991. 5. Matveev N.M. The methods of integration of ordinary differential equations. Minsk: «Vysheyshaya schkola», 1974. 6. Fedoruk M.V. Ordinary differential equations. M.: «Nauka», 1985.		
Examination	Final test + examination.		
Recommended for	second year students of mechanics and mathematics faculty.		
Remarks			

Lectures: 17 **Practical:** 0 **Laboratory:** 17	**NM.5**	**Numerical Methods I**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, associate professor of the Department of Numerical Methods and Programming Ignatenko M. V.		
Goal	Construction of mathematical models, determination of their role and significance; knowledge of the basic principles of the development of numerical methods for typical and new mathematical models; study and development of the theory and applications of numerical methods, their computer realizations; analysis of reliability of numerical results, their interpretation and introducing.		
Basic courses	Studying of the discipline is based on the knowledge of university courses on algebra, geometry, the mathematical analysis, functional analysis, ordinary, partial derivative and the integral equations.		
Contents	Introduction. On some problems of numerical mathematics. On the contents and purpose of calculating experiment in interpretation of A. A. Samarskij.Interpolation and approximation of functions. Chebyshev's system of functions. Interpolating by using generalized polynomials. Algebraic interpolation. Construction of interpolating polynomial in Lagrange form. Finite differences. Newton's interpolating polynomial. Chebyshev's polynomials. Trigonometric interpolation. Fourier transformations. Spline interpolation. Numerical differentiation. Approximate calculation of integrals.		
Teaching methods	Lectures, laboratory lessons.		
Literature	1. Bakhvalov N.S., Zhidkov N.P., Kobelkov G.M. Numerical methods.– M.: Nauka, 1987, 597 p. 2. Krylov V.I., Bobkov V.V., Monastyrnyj P.I. Calculating methods.– V. 1.– M.: Nauk, 1976. Calculating methods – V. 2.– M.: Nauka, 1977. 3. Krylov V.I., Bobkov V.V., Monastyrnyj P.I. The elements of calculating methods. Differential equations.– Minsk: Nauka i Tehnika, 1982, 286 p. The elements of calculating methods.– Partial differential equations. Minsk: Nauka i Tehnika, 1986, 311 p		
Examination	Final test.		
Recommended for	students of the third year of specialization Computer mathematics, Mathematical methods in economics, industrial and pedagogical departments.		
Remarks			

Lectures: 17 **Practical:** 0 **Laboratory:** 17	**NM.6**	**Numerical Methods I**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, associate professor of the Department of Numerical Methods and Programming Ignatenko M. V.		
Goal	Construction of mathematical models, determination of their role and significance; knowledge of the basic principles of development of numerical methods for typical and new mathematical models; study and development of theory and applications of numerical methods, their computer realizations; analysis of reliability of numerical results, their interpretation and introducing.		
Basic courses	Studying of the discipline is based on the knowledge of university courses on algebra, geometry, the mathematical analysis, functional analysis, ordinary differential, partial and integral equations.		
Contents	General view of interpolating quadrature formulas. Newton-Kotes quadrature formulas. Composite quadrature formulas. Gauss' quadrature formulas. Monte-Carlo method.		
Teaching methods	Lectures, laboratory lessons.		
Literature	4. Bakhvalov N.S., Zhidkov N.P., Kobelkov G.M. Numerical methods.– M.: Nauka, 1987, 597 p. 5. Krylov V.I., Bobkov V.V., Monastyrnyj P.I. Calculating methods.– V. 1.– M.: Nauk, 1976. Calculating methods – V. 2.– M.: Nauka, 1977. 6. Krylov V.I., Bobkov V.V., Monastyrnyj P.I. The elements of calculating methods. Differential equations.– Minsk: Nauka i Tehnika, 1982, 286 p. The elements of calculating methods.– Partial differential equations. Minsk: Nauka i Tehnika, 1986, 311 p		
Examination	Final test.		
Recommended for	students of the third year of specialization Computer mathematics, Mathematical methods in economics, industrial and pedagogical departments.		
Remarks			

Lectures: 34 **Practical:** 0 **Laboratory:** 34	**NM.7**	**Numerical methods II**	**ECTS:** 3
Lecturer	Candidate of physics-mathematics sciences, associate professor of the Department of Numerical Methods and Programming Kravchuk A.I.		
Goal	Construction of mathematical models, determination of their role and significance; knowledge of the basic principles of development of numerical methods for typical and new mathematical models; study and the development of the theory and applications of numerical methods, their computer realizations; analysis of reliability of numerical results, their interpretation and introducing.		
Basic courses	Study of the discipline is based on the knowledge of university courses on algebra, geometry, mathematical analysis, functional analysis, ordinary differential, partial and integral equations.		
Contents	Vector norms. Matrix norms. Convergence of matrix geometrical progression. Direct methods of solution of linear algebraic systems. Gauss method. Square root method or Cholesky method. Iteration methods of the solution of the systems of linear algebraic equations. General concepts of the theory of iteration methods. Simple iteration method. Iteration methods of the solution of systems of linear algebraic equations. General implicit method of simple iteration. Simple iteration method for systems of linear algebraic equations with matrices having diagonal prevalence. Seidel method. Consecutive relaxation method. Double layer iteration methods of variation type. Calculation of eigenvalues of a matrix. Power method of calculating maximal by absolute value eigenvalue of a matrix. Power method of calculating the second by absolute value eigenvalue of the matrix. Triangular power method. Iteration method of rotation for the complete problem of eigenvalues (method of Yakobi). Method of A.M. Danilevsky. Problem statement. Simple iteration method for the solution of the systems of non-linear equations. Newton method of the solution of systems of linear algebraic equations.		
Teaching methods	Lectures, colloquiums, laboratory lessons.		
Literature	1. Bakhvalov N.S., Zhidkov N.P., Kobelkov G.M. Numerical methods.– M.: Nauka, 1987, 597 p. 2. Kalitkin N.N. Numerical methods.– M.: Nauka, 1978, 512 p. 3. Krylov V.I., Bobkov V.V., Monastyrnyj P.I. Calculating methods.– V. 1.– M.: Nauk, 1976. Calculating methods – V. 2.– M.: Nauka, 1977.		
Examination	Final test.		
Recommended for	students of the fourth year of specialization Computer mathematics, Mathematical methods in economics, industrial and pedagogical departments.		
Remarks			

Lectures: 34 **Practical:** 0 **Laboratory:** 34	**NM.8**	**Numerical Methods II**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of numerical methods and programming Kravchuk A.I.		
Goal	Construction of mathematical models, determination of their role and significance; knowledge of the basic principles of development of numerical methods for typical and new mathematical models; study and development of the theory and applications of numerical methods, their computer realizations; analysis of reliability of numerical results, their interpretation and introducing.		
Basic courses	Study of the discipline is based on the knowledge of university courses on algebra, geometry, mathematical analysis, functional analysis, ordinary differential, partial and integral equations.		
Contents	Nets and net functions. General theory of difference equations. Methods of the solution of Cauchy problem. Introductory notices. Euler's method of the solution of Cauchy problem for systems of ordinary differential equations of the 1st order. Runge-Kutta method of the solution of Cauchy problem for systems of ordinary differential equations of the 1st order. On multi-step methods. Net methods for the solution of boundary problems for ordinary differential equations. Integration-interpolation method. Difference sweep method. Setting up the problem. General concepts in the theory of difference schemes: on choosing a net, on net functions space and net norms, on the replacement of differential operator by difference operator; on convergence and precision of difference schemes; on stability of difference schemes. Construction and investigation of difference approximations for equations of parabolic type. Two point scheme with parameter. Approximation, stability, convergence, A.A. Samarsky theorem on the link between convergence, approximation and stability. A.A. Samarsky theorem on stability of double-layer difference schemes with parameter. Construction and investigation of difference approximations for the equations of hyperbolic type. Difference scheme with parameter.		
Teaching methods	Lectures, colloquiums, laboratory lessons.		
Literature	1. Bakhvalov N.S., Zhidkov N.P., Kobelkov G.M. Numerical methods.– M.: Nauka, 1987, 597 p. 2. Kalitkin N.N. Numerical methods.– M.: Nauka, 1978, 512 p. 3. Krylov V.I., Bobkov V.V., Monastyrnyj P.I. Calculating methods.– V. 1.– M.: Nauk, 1976. Calculating methods – V. 2.– M.: Nauka, 1977.		
Examination	Examination.		
Recommended for	students of the fourth year of specialization Computer mathematics, Mathematical methods in economics, industrial and pedagogical departments.		
Remarks			

Lectures: 34 **Practical:** 17 **Laboratory:** 0	**VO.5**	**Variation Calculus and Methods of Optimization I**	**ECTS:** 3
Lecturer	Doctor of physics-mathematics sciences, associate professor of the department of the theory of mathematical methods of management Lebedev A.V.		
Goal	Familiarizing of students with methods of optimization, formation of their skills in solving optimization problems. Optimization theory gives some techniques for the construction of adequate mathematical models and solving actual problems.		
Basic courses	Studying the discipline is based on the knowledge of university courses in algebra, geometry, mathematical analysis, functional analysis and differential equations.		
Contents	Introduction to the theory of extremum problems. Linear extremum tasks. Nonlinear tasks of optimization.		
Teaching methodology	Lectures, practical lessons.		
Literature	1. Galiev E. M. , Tihomirov V.M. Summary of the extremal problems theory.M.:MSU,1989. 2. Vasiliev F.P. Calculus of approximations of extremal problems. M.:Nauka,1980. 3. K.-H. Elster , Introduction in nonlinear programming. M.:Nauka,1985.		
Examination procedure	Final test.		
Recommended for	third year students specializing in computer mathematics, mathematical methods in economics, industrial and pedagogical departments.		
Remarks			

Lectures: 28 **Practical:** 28 **Laboratory:** 0	**VO.9**	**Variation Calculus and Methods of Optimization II**	**ECTS:** 4
Lecturer	Doctor of physics-mathematics sciences, professor of the department of the theory of mathematical methods of management Lebedev A.V.		
Goal	Goal of the course is to familiarize students with methods of optimization, form their skills in solving optimization problems. Optimization theory gives some techniques for the construction of adequate mathematical models and solving actual problems.		
Basic courses	Studying the discipline is based on the knowledge of university courses in algebra, geometry, mathematical analysis, functional analysis and differential equations.		
Contents	Calculus of variations. Elements of differential calculus in normalized spaces. Optimal control.		
Teaching methods	Lectures, practical lessons.		
Literature	4. Galiev E. M. , Tikhomirov V.M. Summary of the extremal problems theory.M.:MSU,1989. 5. Vasiliev F.P. Calculus of approximations of extremal problems. M.:Nauka,1980. 6. K.-H. Elster , Introduction in nonlinear programming. M.:Nauka,1985.		
Examination	Examination.		
Recommended for	fifth year students specializing in computer mathematics, mathematical methods in economics, industrial and pedagogical departments.		
Remarks			

Lectures: 34 **Practical:** 34 **Laboratory:** 0	**TFKV.5**	**Theory of Function of Complex Variable**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of the theory of functions Zhorovina T.N.		
Goal	Mastering the theory of conformal mappings of simply connected domains, the theory of residues and its application to solving integrals, analytic continuation. Acquaintance with the theory of Riemann surfaces.		
Basic courses	Mathematical analysis (differential and integral calculus, the theory of series); Topology (open, closed sets, connection, compactness); algebra, geometry.		
Contents	Introduction, object of TFKV. Complex numbers, fundamental definitions and formulas. Expanded complex plane, stereographical projection. Topology of complex plane, of region, of region with border. Complex sequences and series, convergence. Functions of complex variable, univalence, limit and continuity. Differentiability of functions of complex variable, conditions of Cauchy-Riemann, analyticity. Geometric sense of the argument and the absolute value of the derivative. Harmonic functions and their connection to analytic functions. Conformal mapping, basic principles and tasks of the theory of conformal mapping, the Riemann theorem. Elementary analytical functions, properties and conformal maps: linear and linear fractional maps, power and general power functions, Joukowski function, exponential and logarithmical functions, trigonometrical and hyperbolical functions of complex variable. Curvilinear integrals on the complex plane, properties. Integral Cauchy theorem for singly connected and multilinked domain and consequence. The existence of antiderivative analytical function. Cauchy integral formula, integral of Cauchy type, analytical properties of integral of Cauchy type.		
Teaching methods	Lectures and laboratory studies, controlled independent work.		
Literature	1. Y.V. Sidorov, M.F. Fedoryuk, M.I Shabunin. Lectures on TFCV. M., Nauka, 1989. 2. Shabat B.V. Introduction to the theory of functions and complex analysis. Part I. M.: Nauka, 1976. 3. Lavrentiev M.A., Shabat B.V. Methods of the theory of functions of complex variable. M.: Nauka, 1973.		
Examination	Final test, examination.		
Recommended for	students of the third and fifth years specializing in Computer mathematics, mathematical methods in economics, industrial and pedagogical departments.		
Remarks			

Lectures: 34 **Practical:** 17 **Laboratory:** 0	**TFKV.6**	**Theory of function of Complex Variable**	**ECTS:** 3
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of the theory of functions Zhorovina T.N.		
Goal	Mastering the theory of conformal mappings of simply connected domains, the theory of residues and its application to solving integrals, analytic continuation. Acquaintance with the theory of Riemann surfaces.		
Basic courses	Mathematical analysis (differential and integral calculus, the theory of series), topology (open, closed sets, connection, compactness).		
Contents	Series of functions of complex variables. Properties of series sum of analytical functions. Expansion of analytic function in series. Cauchy inequality for series coefficients. Liuvilles theorem. Some properties of analytical functions: infinite differentiability, Morery theorem, Weierstrass theorem on uniformly convergent series. Analytical functions approach, Runge theorem. Zeros of analytic function, uniqueness theorem. Laurent series, its convergence domain. Laurent expansion of analytic function, Cauchy inequalities for series coefficients. Isolated singular points of analytical functions, classification, Sokhotsky and Picard theorems. Entire and meromorphic functions, properties. Residues and their calculations. The main theorem about residues, theorem on total sum of residues. Jordan lemma. Different residues theory applications to integral calculus. Analytic continuation. Simple cases of analytic continuation. Complete analytical function. Theorem on monodromy. The notion of Riemann surface of complete analytical function. The main elementary many-valued functions of complex variables. Singular points of complete analytical function. Analytic continuation across the domain boundary. Riemann-Schwarts symmetry principle. Principles of conservation of domain, boundaries. Polygonal domain reflection. Cristophel- Schwarts formula.		
Teaching methods	Lectures and laboratory lessons, controlled independent work.		
Literature	1. Shabat B.V. Introduction to the theory of functions and complex analysis. Part I. M.: Nauka, 1976. 2. Lavrentiev M.A., Shabat B.V. Methods of the theory of functions of complex variable. M.: Nauka, 1973. 3. L.I. Volkovyssky, G.L. Lunts, I.G. Aramanovich. Collected problems on the theory of functions of complex variable. M., Nauka, 1970.		
Examination	Examination.		
Recommended for	students of the third and fifth years specializing in Computer mathematics, mathematical methods in economics, industrial and pedagogical departments.		
Remarks			

Lectures: 34 **Practical:** 34 **Laboratory:**0	**FAIG.5**	**Functional analysis and integral equations I**	**ECTS:** 5
Lecturer	Doctor of physics-mathematics sciences, professor of the department of functional analysis Antonevich A. B.		
Goal	The purpose of the course "Functional analysis and integral equations" is to acquaint students with general principles of functional analysis and examples of their applications. Educational purpose is to state the basis of measure theory, Lebesgue integral and the theory of linear operators in Banach spaces and application of the general theory to integral equations. The developing purpose is further formation of students` skills of abstract mathematical thought and ability to apply it in specific problems.		
Precedence	It is obligatory for students to know such fields of mathematics as linear algebra, topology, mathematical analysis and differential equations.		
Contents	Theme 1: Measure theory. Preliminary information on the set theory. Rings and semirings of sets. The necessity to reconsider the concept of integral. General notion of measure. Continuation of measure by Lebesgue. Lebesgue measure on a straight line. Lebesgue-Stieltjes measures. Theme 2: Lesbegue integral. Measurable functions. Definition and elementary properties of Lebesgue integral. Limiting transition under the sign of Lebesgue integral. Comparison of Lebesgue integral with Riemann integral. Charges. Radon-Nikodym theorem. Product of measures. Fubini theorem.		
Teaching methods	Lectures, laboratory and practical training.		
Literature	1. Antonevich A.B., Radyno Y.V. "Functional analysis and integral equations " Minsk, BSU, 2003 2. Kolmogorov A.N. , Fomin S.V. "Elements of the theory of functions and functional analysis" Moscow, Nauka, 1972		
Examination	test , examination.		
Recommended for	the third and fourth year students		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:**0	**FAIG.6**	**Functional analysis and integral equations I**	**ECTS:** 3
Lecturer	Doctor of physics-mathematics sciences, professor of the department of functional analysis Antonevich A. B.		
Goal	The purpose of the course "Functional analysis and integral equations" is to present students the general principles of functional analysis and the examples of their applications. Educational purpose is to introduce the basis of the measure theory, the Lebesgue integral and the theory of linear operators in Banach spaces and application of the general theory to integral equations. The developing purpose is further formation of students` skills of abstract mathematical and ability to apply it to specific problems.		
Precedence	It is obligatory for students to know such fields of mathematics as linear algebra, topology, mathematical analysis and differential equations.		
Contents	Theme 3: Metric spaces. Definition and examples of metric spaces. Topology of metric spaces. Complete metric spaces. Completion of metric spaces. Extension theorems. Space L1(T,μ). Space Lp(T,μ). The principle of compressing mappings. Integral equations. Application of the principle of compressing mappings to the integral equations. Compact metric spaces and their properties. Theme 4: Normalized vector spaces. Normalized metric spaces. Banach spaces. Linear operators in normalized spaces. Criterion of finite dimensionality of normalized spaces. Equivalent norms. Hilbert spaces. Orthogonality. Projection theorem. Decomposition on orthonormal systems. Complete orthonormal systems in concrete spaces.		
Teaching methods	Lectures, laboratory and practical training.		
Literature	3. Antonevich A.B., Radyno Y.V. "Functional analysis and integral equations " Minsk, BSU, 2003 4. Kolmogorov A.N. , Fomin S.V. "Elements of the theory of functions and functional analysis" Moscow, Nauka, 1972		
Examination	test ,examination.		
Recommended for	the third and fourth year students		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:**0	**FAIG.7**	**Functional analysis and integral equations II**	**ECTS:** 4
Lecturer	Doctor of physics-mathematics sciences, professor of the department of functional analysis Antonevich A. B.		
Goal	The purpose of the course "Functional analysis and integral equations" is to present students the general principles of functional analysis and the examples of their applications. Educational purpose is to present the basis of the measure theory, the Lebesgue integral and the theory of linear operators in Banach spaces and application of the general theory to integral equations. The developing purpose is further formation of students` skills of abstract mathematical and ability to apply it to specific problems.		
Precedence	It is obligatory for students to know such fields of mathematics as linear algebra, topology, mathematical analysis and differential equations.		
Contents	Theme 5: Linear operators. Spaces of linear limited operators. Strong convergence of the operators. Banach-Shteingauz theorem. Inverse operators. Closed graph theorem. Applications to integral equations. Fourier transform of the functions from the space L1(R). Fourier transform in space L2(R). Theme6: Conjugate spaces and conjugate operators. Linear limited functionals. Khan-Banach theorem. General form of linear limited functionals in concrete spaces. Conjugate operators. Examples of conjugate operators. Spectrum of the operator. Weak convergence. Reflexive property. Theme7: Equations with compact operators. Compact operators and their properties. Compactness of integral equations. The Riss-Shauder theory of the equations with compact operators. Fredholm operators. Fredholm integral equations. Conjugate and self-conjugate operators in Hilbert space. Spectrum expansion of compact self-conjugate operator.		
Teaching methods	Lectures, laboratory and practical training.		
Literature	5. Antonevich A.B., Radyno Y.V. "Functional analysis and integral equations " Minsk, BSU, 2003 6. Kolmogorov A.N. , Fomin S.V. "Elements of the theory of functions and functional analysis" Moscow, Nauka, 1972		
Examination	test , examination.		
Recommended for	the third and fourth year students		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:**0	**WTS.6**	**Probability theory and mathematical statistics I**	**ECTS:** 4
Lecturer	Doctor of physics-mathematics sciences, professor of department of functional analysis Lazakovich N. V.		
Goal	Introduction into the main principles of the theory of probability and its usage. Forming the students' mathematical fundamental skills and ability to apply them in practical tasks.		
Precedence	Algebra and number theory, Discrete mathematics, Analytic geometry, Mathematical analysis, Differential equations, Theory of function of complex variable and functional analysis.		
Contents	1. Probabilistic spaces: Terminology of the probability theory. Kolmogorov axiomatics. Examples of probabilistic spaces. 2. Independence: Conditional probabilities. Independence of events. Independence of tests. Limit theorems in Bernoulli scheme. 3. Variates: variates and their random distribution. The variates classification. Multidimensional random variates. Variates independence. 4. Numerical characteristics of variates: Average of distribution and its properties. Moments of random variates. Inequalities. Coefficient of correlation. Conditional expectations.		
Teaching methods	Lectures ,laboratory training		
Literature	1. Borovkov A. A. Theory of probability. M.: Nauka, 1986. 2. Ventcel A.D. The theory of random processes. M: Nauka, 1978. 3. Meshalkin L.D. Collection of the theory of probability tasks. M: MSU, 1963.		
Examination	Credit test , laboratory works presentation		
Recommended for	The third year students of the following specializations G 31 03 01 mathematics, G 31 03 03 mechanics, G 31 03 01 04 mathematical electronics.		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:**0	**WTS.7**	**Probability theory and mathematical statistics II**	**ECTS:** 4
Lecturer	Doctor of physics-mathematics sciences, professor of department of functional analysis Lazakovich N. V.		
Goal	Introduction into the main principles of the theory of probability and its usage. Forming the students' mathematical fundamental skills and ability to apply them in practical tasks.		
Precedence	Algebra and number theory, Discrete mathematics, Analytic geometry, Mathematical analysis, Differential equations, Theory of function of complex variable and functional analysis.		
Contents	5. Characteristic functions: Definition and elementary properties. Inversion formulas for characteristic functions. Continuity of correspondence between the set of distribution functions and the set of characteristic functions. 6. Limit theorems: Central limit theorem. Convergence of random variates. Law of large numbers. 7. Fundamentals of the theory of random processes: Random process definition. Random processes with independent increments. Correlation theory of random processes. Markov random processes. 8. Elements of the mathematical statistics. Basic concepts and elements of the sampling theory. Estimation of unknown parameters. Verification of statistical hypothesizes. Parametric hypothesizes. Linear regression and least-squares methods.		
Teaching methods	Lectures , laboratory training		
Literature	1. Borovkov A. A. Theory of probability. M.: Nauka, 1986. 2. Ventcel A.D. The theory of random processes. M: Nauka, 1978. 3. Meshalkin L.D. Collection of the theory of probability tasks. M: MSU, 1963.		
Examination	Credit test, laboratory works presentation, credit		
Recommended for	The fourth year students of the following specializations G 31 03 01 mathematics, G 31 03 03 mechanics, G 31 03 01 04 mathematical electronics.		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:**0	**GMPh.6**	**Equations of mathematical physics I**	**ECTS**: 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the chair of mathematical physics Kouleshov A. A.		
Goal	The purpose of the course "Equations of mathematical physics" is to teach students to master the general concepts of the theory of differential equations with partial derivatives and the methods of solution of general boundary problems of mathematical physics. The educational purpose is to teach students to use general methods of mathematical physics and to apply them while studying such disciplines as computing technique, CAD in microelectronics and others.		
Precedence	It is obligatory for students to know such parts of general physics as mechanics, thermal conductivity, gravitation and electrostatics, and also such parts of higher mathematics as algebra, geometry, mathematical analysis of real and complex variables and ordinary differential equations. The following parts of functional analysis are optional: general functions theory and theory of linear integral equations.		
Contents	Theme 1. Introduction. General notions. Statement of boundary problems. Correct and incorrect boundary problems. Adamar Example. Cauchy-Kovalevskaya theorem. Classification and reducing to canonical form of equations in partial derivatives of the second order. Classification of equations in partial derivatives of higher orders. Characteristics of the equations. Characteristic cone. Theme 2. Hyperbolic equations. Derivation of the equation of lateral vibrations of a string. Derivation of the equation of lateral vibrations of a membrane. Statement of boundary problems. Cauchy problem on a line for homogeneous and inhomogeneous equation. D'Alember formula. Generalized problem of Cauchy. Riemann formula. The solution of Cauchy problem in space using averaging-out method. The solution of Cauchy problem on a plane using the lowering method. Poisson's formula. General formal scheme of the method of separating variables for the solution of mixed problems for hyperbolic equations. Energy inequalities, Bessel equation. Cylinder functions. Spherical and some other special functions.		
Teaching methods	Lectures , training		
Literature	1. Tichonov A.N., Samarskij A.A. Equations of mathematical physics. M., 1977. 2. Mihlin S.G. Course of mathematical physics. M., 1968. 3. Collection of problems of equations of mathematical physics (edited by Vladimirov V.S.). M., 1982.		
Examination	Credit test		
Recommended for	The third year students of the following specializations G 31 03 01 mathematics, G 31 03 03 mechanics, G 31 03 01 04 mathematical electronics.		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:**0	**GMPh.7**	**Equations of mathematical physics II**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the chair of mathematical physics Kouleshov A. A.		
Goal	The purpose of the course "Equations of mathematical physics" is to teach students to master the general concepts of the theory of differential equations with partial derivatives and the methods of solution of general boundary problems of mathematical physics. The educational purpose is to teach students to use general methods of mathematical physics and to apply them while studying such disciplines as computing technique, CAD in microelectronics and others.		
Precedence	It is obligatory for students to know such parts of general physics as mechanics, thermal conductivity, gravitation and electrostatics, and also such parts of higher mathematics as algebra, geometry, mathematical analysis of real and complex variables and ordinary differential equations. The following parts of functional analysis are optional: general functions theory and theory of linear integral equations.		
Contents	Theme 3. Parabolic equations. Derivation of the equation of thermal conductivity. Statement of boundary value problems. The theorem on maximal and minimal values of the solutions of equation of thermal conductivity. Correctness of the first mixed problem and the Cauchy problem for equation of thermal conductivity. Solution of the Cauchy problem for the equation of thermal conductivity using the method of integral Fourier transformation. Poisson's formulas. General formal scheme of the method of separating variable solutions of the mixed problems for parabolic equations. Source function. Substantiating the method of separating variables in case of classical and generalized solutions. Heat transfer in bounded and semi-bounded bodies with discontinuous boundary conditions. Paired integral equations. The theory of non-destructive control of thermo-physical characteristics of solid-state bodies. Theme 4. Elliptic equations. Green's integral formulas. Definition and properties of harmonic functions. On the uniqueness of the solutions of Dirichle and Neumann problems. Volume potential. Solid angle. Gauss integral. Lyapynov surface. Surface potential of double layer. Surface potential of single layer. Reducing the problems of Dirichle and Neumann for Laplas equation to the integral equations with weak singularity. Solvability of inner Dirichle problems and outer Neumann problems by the method of Green's function. The method of fictitious charges of the construction of Green's function of Dirichle problems. Poisson's integrals. General formal scheme of the method of separation of variable solutions of the mixed problems for the Poisson equations. Substantiating the method of separating the variables in case of classical and generalized solutions. Liuvill theorem. The behaviour of the derivatives of harmonic functions on the infinity. Variation methods of the solution of the problems of the problems of Dirichle and Neumann.		
Teaching methods	Lectures, training		
Literature	Basic literature: 4. Tichonov A.N., Samarskij A.A. Equations of mathematical physics. M., 1977. 5. Mihlin S.G. Course of mathematical physics. M., 1968. 6. Collection of problems of equations of mathematical physics (edited by Vladimirov V.S.). M., 1982.		
Examination	Credit		
Recommended for	The fourth year students of the following specializations G 31 03 01 mathematics,G 31 03 03 mechanics,G 31 03 01 04 mathematical electronics.		
Notes			

Lectures: 34 **Practical:** 34 **Laboratory:** 0	**TM.7**	**Engineering Mechanics**	**ECTS:** 3
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of engineering mechanics Savchuk V.P.		
Goal	Science liberalizing, improvement of competence level for solving mechanics problems in different fields of professional activity.		
Basic courses	Mathematical analysis		
Contents	Fundamental conceptions of kinematics. Velocity of point. Acceleration of point. Uniform and variable motion. Kinematics of point in curvilinear coordinates. Definition and properties of forward movement of solid. Rotation of a solid round the fixed axis. Angular velocity and angular acceleration. Flat- parallel movement of a solid. Geometrical and analytical research. Movement of a solid near the fixed point. Dalamber-Euler theorem. Axoids. Velocities and accelerations of solid's points. Kinematic Euler equations. Motion of a free solid. Shal's theorem. Complicated motion of a point. Complicated motion of a solid. Composition of momentary rotations. General case. Screw. Laws and problems of dynamics of a point. General theorems of dynamics of a point. Rectilinear motion of a point. Rectilinear oscillation of a point. Free, convergent, forced oscillations. Motion of a point in the field of central forces. Bine's formulas. Newton's problem. Artificial satellite. Motion of a constrained point particle. Simple pendulum. Relative motion of a point particle. Relative rest in motion nearby the ground surface. Fuko's pendulum. Basic conceptions and basic dynamical values. Basic theorems of dynamics of system. Dynamics of solids of variable-mass. Meshchersky's equation. Tsyalkovsky's problems.		
Teaching methods	Lectures and practical training.		
Literature	1. Appel P. Engineering mechanics: In 2 volumes.-M.: Phismatgiz, 1960. 2. Buhgolts N.N.. Base course of engineering mechanics: In 2 volumes.-M.: Nauka, 1972. 3. Vilke V.G. Engineering mechanics. M.: Edition of MSU, 1991		
Examination	Final test.		
Recommended for	students of the 4th course, specialization Computer mathematics.		
Remarks			

Lectures: 34 **Practical:** 34 **Laboratory:** 0	**TM.8**	**Engineering Mechanics**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of engineering mechanics Savchuk V.P.		
Goal	Science liberalizing, improvement of competence level for solving mechanics problems in different fields of professional activity.		
Basic courses	Mathematical analysis.		
Contents	Mass geometry. Inertia tensor, inertia ellipsoid. Rotation of a solid round the fixed axis. Axle pressure. Compound pendulum. Flat movement of a solid. Movement of a solid near the fixed point Dynamic Euler equations. Movement of a heavy solid. Fourth integral problem. Euler, Lagrange, Kovalevskaya cases. Gyroscope elementary theory. Principle of virtual work Dalamber principle. Common dynamic equation. Lagrange equation of the first kind. Lagrange equation of the second kind. Hamilton's canonical equation. Small oscillations of mechanical system. Equilibrium stability. Lejen-Dyrikhle theorem. Variation principals. Hamilton's principle, Gauss principle.		
Teaching methods	Lectures and practical lessons.		
Literature	4. Appel P. Engineering mechanics: In 2 volumes.-M.: Phismatgiz, 1960. 5. Buhgolts N.N.. Base course of engineering mechanics: In 2 volumes.-M.: Nauka, 1972. 6. Vilke V.G. Engineering mechanics. M.: Edition of MSU, 1991		
Examination	Examination.		
Recommended for	students of the 4th year, specialization Computer mathematics.		
Remarks			

Lectures: 34 **Practical:** 17 **Laboratory:** 0	**OF.8**	**Research of Operations**	**ECTS:** 3
Lecturer	Doctor of physics-mathematics sciences, professor of the department of the theory of mathematical methods of management Lebedev A.V.		
Goal	Improvement of level of professional skills in research of optimization problems of complicated organizational activity and solution of conflict situations in social and production structures.		
Basic courses	Discrete mathematics.		
Contents	Introduction into the theory of extremal problems on graphs. Theory of extremal problems on graphs. Optimization problems for streams. Network planning. Introduction into game theory. Games with naught sum. Non-cooperative games. Nesh's balance. Dynamic programming. Scheduling theory. Theory of waiting lines.		
Teaching methods	Lectures and practical lessons.		
Literature	1. Bahtin V.I., Kovalenok A.P., Lebedev A.V., Lysenko U.V. Research of operations.2003. 2. Maynika E. Algorithms optimisation on networks and graphs. 1977. 3. Basaker R., Saaty T. Finite graphs and networks. 1974.		
Examination	Examination.		
Recommended for	students of the 3th and 5th years, specialization Computer mathematics, Specialization Mathematical methods in economics, industry and pedagogical specialization.		
Remarks			

Lectures: 34 **Practical:** 17 **Laboratory:**0	**ML.8**	**Mathematical logic**	**ECTS:** 3
Lecturer	Candidate of physics and mathematics sciences, associate professor of department of mathematical physics equations Suprun V.P.		
Goal	Improvement of level of professional skills, analytical skills in questions of research of mathematical bases, structure of proofs, logical bases of programming, logical design of microprocessor and computing technology. Information the students about the subject and method of logistics and its importance for mathematics, mathematical cybernetics, programming and computers.		
Precedence	The fundamentals of algebra and the laws of analysis in course of secondary school.		
Contents	Introduction: Logistics, its subject and importance. Historical sketch. Subject of logistics and the connection with mathematical cybernetics and programming. Algebra of propositions: Propositions. Logic operations. Definition of formula.. Feasibility. Equivalency of formulas. Basic equivalencies. Application of algebra af statements to solving the problems of analysis and synthesis of contactor-relay circuits, contact networks and networks composed of functional elements. Sentential calculus: Symbols. Definition of formula. Axiomatics, rules of inference (rewrite rule, rule of conclusion). Conclusion from hypotheses. Deduction theorem. Monotony. Equivalence. Consistency. Fullness. Independence of axioms system. Predicate logic: Predicates, quantifiers. Definition of formulas. Reduced and normal forms. Problem of solution. Functional calculus: Symbols. Definition of formulas. Collision of variables. Axiomatics. Rules of conclusion. Binding rule by quantifier. Consistency. Duality law. Application of mathematical logic: Turing machine. Definition. Analysis and synthesis. Solving the problems.		
Teaching methods	Lectures and practical training.		
Literature	1. Novikov P.S. Elements of logistics. M.: Nauka, 1973. 2. Lavrov I.A., Maksimova L.L. Tasks on set theory logistics, algorithm theory. M.: Nauka, 1984. 3. Klini S. Logistics. M.: Mir, 1973.		
Examination	Test, final tests		
Recommended for	Students of the 4th course, specialization Computer mathematics		
Notes			

Lectures: 34 **Practical:** 17 **Laboratory:**0	**Ph.9**	**Physics**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of theoretical and applied mathematics Repchenkov V.I.		
Goal	To improve thorough training of specialists		
Basic courses	Mathematical analysis, analytic geometry, differential equations, engineering mechanics		
Contents	Electric field: structure of matter. elementary, dotty, distributed charge. Coulomb's law. Electric field intensity. Potential. Ostrogradsky – Gauss theorem in differential form. Poisson equation. Conductors and non-conductors in electric field: Conductor in electric field. Free charges. Doublet in electric field. Polarization. Polarization vector. Electric field in non-conductors. Direct electric current: Current density vector, current strength. Ohm's law in differential form. Voltage. Kirhoff rules. Calculation of direct current circuits. Joul-Lents law. Current strength. Magnetic field: Interaction of conductors with current. Amper law. Magnetic field intensity. Magnetic voltage theorem. Lorents' force. Working in magnetic field. Magnetic flux. Magnetics: Magnetic moment. Magnetization. Paramagnetics. Larmorov's precession. Diamagnetics. Magnetic field in matter. Magnetization vector. Ferromagnetics. Electromagnetic induction: Nature electromagnetic induction. Lents' rule. Voltage of induction. Inductance. Energy of magnetic field. Electric oscillations, resonance. Alternating current: Resistor, condenser, inductor in alternating current circuit. Current resonance and voltage resonance. Complex amplitudes, complex impedance. Calculation of alternating current circuits.		
Teaching methods	Lectures and practical training.		
Literature	1. Kalashnikov S.G. Electricity. M. Nauka. 1970. 2. Irodov I.E. Tasks on general physics. M. Nauka. 1986. 3. Repchenkow V.I. Course, tasks и check questions to part «Electromagnetism» of course «Physics». Educational methodical textbook for students of MMF.: Mn.: Belgosuniversitet. 2001.		
Examination	test, examination		
Recommended for	Students of specialization Computer mathematics.		
Notes			

Lectures: 17 **Practical:** 0 **Laboratory:** 34	**Mod.5**	**Computer Modeling I** **Group Analysis** **of Differential Equations**	**ECTS:** 4
Lecturer	Doctor of physics-mathematics sciences, professor of the department of differential equations Gromak V. I.		
Goal	The purpose of the course is to acquaint students with the methods of the group analysis of differential equations and to teach their use in applications.		
Basic courses	It is obligatory for students to master the following courses: algebra, differential geometry, ordinary differential equations and the equations of mathematical physics.		
Contents	1. Definition of the r-parametric local Lie group. Parameters of the groups of Lie transformations. 2. Tangent vector field of the Lie group. Examples of tangent vector fields. Lie theorem. 3. Infinitesimal operator of the Lie group. Reducibility of the single parametric Lie group to the translation group. 4. Invariants of the Lie group. Criterion of invariance. Examples. Invariant manifolds. Criterion of the invariance of a manifold. 5. Continuation of a group and an infinitesimal operator. Coordinates of the first and the second continuation of an infinitesimal operator. 6. Integrating the first order equations with the known single parametric Lie group. 7. Differential invariants. Obtaining the Lie group of a differential equation. Obtaining the differential equation having a given Lie group. 8. Commutator of a pair of infinitesimal operators. Lie algebra of infinitesimal operators. Generalization of Lie groups in multidimensional case.		
Teaching methods	Lectures, laboratory lessons.		
Literature	1. Olver P. *Application of Lie groups to differential equations*, Mir, 1983. (in Russian) 2. Ovsyannikov *Group analysis of differential equations*, Nauka, 1978. (in Russian) 3. Blumann G.W., Cole J.D. Similarity methods for Differential Equations, Springer-Verlag, N-Y, 1974.		
Examination	Exam		
Recommended for	Students of the third year		
Notes			

Lections: 17 **Practical:** 0 **Laboratory:** 17	**Mod.7**	**Computer modeling II** **Finite Element Method**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of theoretical and applied mechanics Repchenkov V. I.		
Goal	The purpose of the course is to acquaint students with the theoretical basis of the finite element method, and to teach their use in applications.		
Precedence	It is obligatory for students to master the following courses: algebra and number theory, geometry, and ordinary differential equations. It is useful for students to have some knowledge in physics, mechanics and numerical methods.		
Contents	9. One-dimensional springy element. Equations of motion in the matrix form. 10. Equilibrium equations, boundary conditions, physical meaning of the matrix of springing rate. 11. Rod-shaped element, longitudinal deformations, Guck law, a rod under the action of its weight, inaccuracy of numeric solution. 12. Finite element with two nodes, linear approximation, matrix of the shape functions, matrix of gradients, reduction of distributed stress to the nodal one. 13. Integrating equations of motion, defining integration interval, characteristic time of a process, oscillations, and eigenfrequencies. 14. Accounting thermal effects, state functions. 15. Finite element for the problems with spherical and cylindrical symmetries, transverse deformations, shear deformations.		
Teaching methods	Lectures and laboratory training.		
Literature	4. Segerlind L. *Applications of finite element method*, Mir, 1979. (in Russian) 5. Repchenkov V.I. *Physical basics of the finite element method (Part 1)*, Minsk-BSU, 1999. (in Russian) 6. Repchenkov V.I., Nagorniy Y.E., Tatarchenko L.P. *Physical basics of the finite element method (Part 2)*, Minsk-BSU, 2000. (in Russian) 7. Fellippa C.A. *Introduction to Finite Element Methods*. E-book.		
Examination	Exam		
Recommended for	Students of the fourth year		
Remarks			

Lections: 17 **Practical:** 0 **Laboratory:** 17	**Mod.8**	**Computer modeling II** **Polynomial Algebra**	**ECTS:** 2
Lecturer	Doctor of physics-mathematics sciences, professor of the department of differential equations Sadovskiy A. P.		
Goal	The purpose of the course is to acquaint students with the theory of polynomial ideals, Groebner bases, and methods of computing of bases and radicals of manifolds.		
Precedence	It is obligatory for students to master the following courses: algebra and number theory, geometry, ordinary differential equations and theory of functions of complex variable.		
Contents	Operations with ideals i.e. addition, multiplication, intersection, and division. Zarissky close. Irreducible varieties. Simple ideals. Polynomial and rational representation of affine varieties. Algorithms for obtaining implicit representation for affine varieties in the cases of polynomial and rational parameterizations. Decomposition of a variety in the union of irreducible ones. Computing the radical of an ideal. Primary ideals. Primary decomposition of ideals. Satiation of an ideal. Algorithm for computing of the satiation. Computing primary decompositions of an ideal. Algorithmic computing in factor rings. Isomorphism of affine varieties. Rational functions on the varieties. Projective varieties and uniform ideals.		
Teaching methodology	Lectures and laboratory training.		
Literature	1. Cox D.A., Little J.B., O'Shea D. *Ideals, varieties and algorithms*, Springer, 1996 (in Russian – 2000.) 2. Adams W., Loustaunau P. An introduction to Grobner Bases. American Mathematical Society.- Providence, 1994. 3. Prosolov V.V. *Polynomials*, MCNMO, 2000 (in Russian) 4. Arjantsev I.V. *Groebner bases and systems of algebraic equations*, MCNMO, 2003. (in Russian)		
Examination	Credit test		
Recommended for	Students of the fourth year		
Remarks			

Lections: 14 **Practical:** 0 **Laboratory:** 14	**Mod.9**	**Computer modeling III** **Mathematical Modeling and Complicated Processes**	**ECTS:** 2
Lecturer	Junior teacher of the department of differential equations Grigor'ev A. A.		
Goal	The purpose of the course is to acquaint students with general principles of mathematical modeling and to teach their use in applications.		
Basic courses	It is obligatory for students to master the following courses: ordinary differential equations, equations of mathematical physics, functional analysis, computer mathematics, and programming. It is useful for students to have some knowledge in physics and mechanics.		
Contents	1. Introduction to mathematical modeling, classification of models by the amount of knowledge in the problem field. 2. The sources of mathematical models i.e. fundamental nature laws, variation principles, linearization, introducing of analogical assumptions, the hierarchies of community. 3. Mathematical models of pendulum phenomena i.e. simple pendulums, the oscillations in the gravity field, Lotka-Volterra systems. 4. The methods of modeling giving PDE's. Transport equation, continuity equation, and Bussinesque equation. 5. Direct and conjugated problems. The dynamics of air pollution, the equation of the turbulent diffusion, conjugated operator, applied conjugated problems. 6. Delay mathematical models. Stability conditions, hysteresis, logistic equation, models of Makkey-Glass and Cheyne-Stokes. 7. Discrete mathematical models. Their solutions, stability and delay. Bifurcation and chaotic solutions. Fibonacci equation, discrete logistic equation, and the model of fishery management. 8. Examples of complicated processes modeling.		
Teaching methods	Lectures, laboratory lessons.		
Literature	1. Samarsky A.A. and Mikhailov A.P. *Mathematical Modeling,* 2002. (In Russian) 2. Petrosyan L.A., Zakharov V.V. *Mathematical models in ecology*, 1997 (In Russian) 3. Amelkin V.V., Sadovsky A.P. *Mathematical models and differential equations*, 1982. (In Russian) 4. Murray J.D. *Mathematical Biology,* (third edition), 2002 5. Basmadjian D. *The Art of Modeling in Science and Engineering*, 1999 6. Chung C.A. *Simulation Modeling Handbook. A Practical Approach*, 2004		
Examination	Credit test		
Recommended for	Students of the fourth and the fifth year		
Remarks			

Lections: 17 **Practical:** 0 **Laboratory:** 17	**Mod.11**	**Computer modeling IV** **Mathematical Modeling** **and Complicated Processes**	**ECTS:** 5
Lecturer	Junior teacher of the department of differential equations Grigor'ev A. A.		
Goal	The purpose of the course is to acquaint students with general principles of mathematical modeling and to teach their use in applications.		
Basic courses	It is obligatory for students to master the following courses: mathematical modeling and complicated processes (main part), ordinary differential equations, equations of mathematical physics, discrete mathematics and logic, computer mathematics, and programming. It is useful for students to have some knowledge in physics and mechanics.		
Contents	9. Cellular automata. 10. Models of infectious diseases. 11. Neural networks. 12. Models of the wave phenomena. 13. Solitons, the method of different scales. 14. Models of language. 15. Modeling of human body movement.		
Teaching methods	Lectures, laboratory lessons.		
Literature	7. Toffoli T., Margolus N. *Cellular automata machines*, 1987 (1991 – in Russian) 8. ed. Gutowitz H. *Cellular Automata: Theory and Experiment*, 1991 9. Murray J.D. *Mathematical Biology,* (third edition), 2002 10. Bailey N.T.J. *Mathematical theory of infectious diseases*, 1975 11. Fyfe C. *Artificial neuron networks*, 1996 12. De Castro L.N., Von Zuben F.J. *Recent developments in biologically-inspired computing*, 2005 13. Karlov N.V., Kirichenko N.A. *Oscillations, waves, structures*, 2001 (in Russian) 14. Kudryashov N.A. *Analytic theory of nonlinear differential equations*, 2004 (in Russian) 15. Chomsky N. *The logical basis of linguistic thory*, 1962		
Examination	Credit test		
Recommended for	Students of the fourth and the fifth year		
Remarks			

Lectures: 17 **Practical:** 0 **Laboratory:** 34	**AF.5**	**Natural-science discipline I** **COM technology**	**ECTS:** 3
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of differential equations Goloubeva L.L.		
Goal	Development of the skill to independently acquire and extend computer and programming knowledge, acquisition of the skill of work on contemporary computing systems, study of new information technologies		
Basic Courses	Programming and Informatics.		
Contents	Introduction to Component Object Model technology of Microsoft. COM Clients and Servers. COM Objects and Interfaces. Interface IUnknown and inheritance of interfaces. Managing the object life time through reference counting. Reference counting methods and rules. Components allocation in DLL. DLL Server requirements. Registering of COM components in Windows register. Windows register hierarchy. Register keys for COM. Globally Unique Identifier GUID. GUID and CLSID. Class factory and Interface IClassFactory. Reusing COM objects. Containment/delegation and aggregation mechanism.		
Teaching methods	Lectures, laboratory lessons.		
Literature	1. D. Chappell. Strategic technology series. Understanding ActiveX and OLE. Microsoft Corporation Press, 1996. 2. D. Rogerson.. Inside COM. Microsoft Corporation Press, 1997.		
Examination	CIW, presentation of laboratory works, final test.		
Recommended for	Students of the third year specializing in Computer mathematics		
Remarks			

Lectures: 14 **Practical :**0 **Laboratory:** 14	**AF.9**	**Advanced computer mathematics. Relational databases and OLAP technologies**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, junior teacher of the department of differential equations Zenchenko A.S.		
Goal	Introduction into ideas and concepts applied in modern relational database management systems. Acquaintance with online analytical processing systems.		
Basic courses	Courses of informatics, programming methods, higher algebra.		
Contents	Databases and DBMS. Database concept. DBMS architecture. Data models. Relational approach. Basic notions of relational databases. Fundamental properties of relations. Relational data model. Means of manipulation of relational data. Relational algebra. Relational calculus. SQL language. SQL data types. Selection of data (SELECT operator). Data manipulation. Creation of objects of a database. Views. Relational database design. Designing relational databases by means of normalization. Semantic modeling. ER-diagrams. CASE-tools of database design. Data warehouse. Inefficiency of the use of OLTP-systems for data analysis. Warehouse concept. Warehouse management. OLAP-systems. Multidimensional data model. Conceptual multidimensional view. Architecture of OLAP-systems.		
Teaching methods	Lectures, laboratory lessons		
Literature	1. Date C. J.: Introduction to Database Systems, An - 8/E. Addison-Wesley, 2004. 2. Astakhova I.F., Tolstobrov A.P., Melnikov V.M.. SQL in examples and tasks; textbook. – Minsk.: New knowledge, 2002. 3. Bargesyan A.A., Kupriyanov M.S., Stepanenko V.V., Holod I.I. Methods and models of data analysis: OLAP and Data Mining. – St.-Ptb.: BHV-Petersburg, 2004.		
Examination	Laboratory works presentation + credit test		
Recommended for	Fifth year students specializing in Computer mathematics.		
Remarks			

Lectures: 34 **Practical**: 17 **Laboratory**: 17	**AF.11**	**Natural-science discipline III** **Modern questions of information technologies**	**ECTS:** 5
Lecturer	Candidate of physics-mathematics sciences, associate professor of department of differential equations Malevich A.E.		
Goal	Review of modern information technologies. Discussion of new IT tendencies.		
Basic courses	Computer mathematics, programming methods		
Contents	The structure of the package Mathematica. Use of Mathematica FrontEnd as universal workspace in daily routine of a mathematician. Working with objects Notebook and Cell. Structure of an electronic document. TEX – scientific document description language. LATEX – macrolanguage and computer package for preparation of a scientific manuscript. Use of Mathematica for keeping mathematical manuscripts. Preparation of a TEX-document with Mathematica. .NET and J2EE modern conceptions of computer application development. Use Java and .NET in Mathematica environment. Modern database. Technologies of access to data ODBC and ADO.NET. Use of ODBC and ADO.NET in Mathematica environment. Universal format of XML data communications. How to create a personal website from the beginning. Registration of a name and hosting. HTML and web-design. Macromedia Flash. Preparation methods of artwork for scientific article.		
Teaching methods	Lectures, practical lessons, laboratory lessons.		
Literature	1. Golubeva L.L., Malevich A.E., Shcheglova N.L. Computer mathematics. Symbolic mathematical package Mathematica. Course of lectures. Mn., BSU, 2005. 2. Stephen Wolfram. The Mathematica Book. Fourth Edition. Cambridge, Universitiy Press. 1999. 3. Buch G., Object-oriented analysis and designing with examples of C++-applications. M.: Binom 1998 4. Lvovsky S.M. LATEX: particular. 5. Lvovsky S.M. Typesetting and making-up in package TEX. 6. Rambo J., Jacobson A., Buch G. UML: special reference book. SPb.: Piter 2002 7. Avramova O.D. Language VRML. Practical guide. M.: DIALOG-MIFI 2000 8. A.I.Pliss, N.A. Slivina. Mathcad: mathematical practical work. M.: Finansy i statistika 2005. 9. Virt N. Algorithms and data structure. M.: Mir. 1989 10. Kushnirenko, Lebedev. Programming for mathematicians. M.: Nauka 1988 11. Bargesjan A.A. and others. Methods and models of data analysis OLAP and Data Mining 2004		
Examination	Report preparations, final test.		
Recommended for	Students of specialization “Computer mathematics”.		
Remarks			

Lectures: 34 **Practical:** 0 **Laboratory:** 34	**CGA.6a**	**Computer Graphics and Animation I. OpenGL**	**ECTS:** 3
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of differential equations Goloubeva L.L.		
Goal	Teaching the fundamentals of modeling of the objects of real world, working-out the skill to visualize these objects, as well as images and effects of virtual world. Acquiring the skills of work with 3D graphics.		
Basic Courses	Differential geometry and topology, Algebra and theory of numbers, Programming and informatics		
Contents	Introduction to OpenGL. Setting up OpenGL in Windows. Basic and auxiliary OpenGL libraries. OpenGL window style. Setting pixels format. Command syntax. Graphical primitives: points, line segments, polygons, raster primitives. Vertex properties. Basic OpenGL operations. Coordinate systems in 3D space. The world-coordinate system. The coordinate system of a scene. The coordinate system of a window. Homogeneous coordinates and matrices. Mapping between two coordinate systems. Projection types. Basic transformations: translation, rotation, scaling, shear. Composing 3D affine transformations. Light in OpenGL. Light source. Lighting model. Material properties. Color in OpenGL. RGBA and Color-Index modes. Texture and texture mapping. Texture parameters. Texture coordinates. Texture and object surface interaction.		
Teaching methods	Lectures, laboratory lessons.		
Literature	1. Yu. Tikhomirov. Programming of three-dimensional graphics. S.-Pb.: BHV – Saint-Petersburg, 1998. – 256p. 2. F.S.Hill. OpenGL. Programming of computer graphics. For professionals. S.-Pb.: Piter – Saint-Petersburg, 2002. – 1088 p.		
Examination	CIW, presentation of laboratory works, examination		
Recommended for	Students of the third year specializing in Computer mathematics		
Notes			

Lectures: 17 **Practical:** 0 **Laboratory:** 17	**CGA.6b**	**Computer graphics and animation I. Mathematical basis of computer graphics.**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, associate professor of department of differential equations Shcheglova N. L.		
Goal	Teaching the bases of modeling the objects of real world, training its visualization and visualization of the images and the effects of the virtual world. Obtaining the skills of mathematical object description and algorithmization of the display process.		
Basic Courses	Analytical geometry, vector algebra, linear algebra, differential geometry (curves, surfaces and their invariants), algorithmization and programming fundamentals, symbolic mathematical package Mathematica.		
Contents	Graphical elements on plane and in space. Models of graphical elements on plane, tests of their properties and positional relationship. Polygon: a model, algorithms of building, intersections, point orientation, line orientation. Line and surface models in space. Property and positional relationship tests of graphical elements in space. Ray-path methods for building of optical effects: shadow, reflection, refraction. Mathematical models of surfaces and objects. Quadratic and parametric surfaces. Wire-frame model of arbitrary polygon, Plato solids, spheroidal and sidereal objects. Affine transformations. Elementary and compound affine transformations. Calculating methods of compound transformation matrix. Kinematic method of object building. Cyclic curves. Kinematic surface models: motion, transfer, ruled and non-ruled surfaces. Fractal theory in computer graphics Fractal theory basis. Geometrical and dynamical fractals. Modeling of real objects, fantastical images and effects.		
Teaching methods	Lectures and laboratory trainings.		
Literature	1. Nikulin E.A. Computer geometry and algorithms of computer graphics. SPb, BHV – Peterburg, 2003. 2. Porev V.N. Computer graphics. SPb, BHV – Peterburg, 2002. 3. Rogers D., Adams J. Mathematical basis of computer graphics. – M.: Мир, 2001. 4. Rogers D. Algorithmic basis of computer graphics. – M.: Mir, 1989. 5. L.L.Golubeva, A.E.Malevich, N.L. Shcheglova. Computer mathematics. Symbolic mathematical package Mathematica. Course of lectures. Mn., BSU, 2005.		
Examination	Final test (2 hours), defence of 7 laboratory trainings, examination		
Recommended for	Students of specialization Computer mathematics.		
Remarks			

Lectures: 34 **Practical lessons:** 0 **Laboratory lessons:**34	**CGA.8**	**Computer graphics and animation II. Wavelet-analysis**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, associate professor of the chair of differential equations Malevich A.E.		
Goals	Mathematical basics of wavelet-analysis		
Basic Courses	Mathematical analysis, Computer mathematics, Function theory of complex variable, Functional analysis		
Contents	Basic ideas leading to wavelet-structures. Comparison with Fourier analysis. Problem solving using wavelet-analysis. Wavelet concept. Simple examples (Mexican hat, Haar transforms, Gauss and so on). Conditions for wavelet. Wavelet-transform. Identification for signals with connected array. Detecting of nodal (angular, break point, etc.) points. Inverse wavelet-transform. Comparison with Fourier transformation. Complex (Mourle) and multidimensional wavelets .Gabor transform. Windows, window functions. Short time Fourier transform. Uncertainty principle. Integral wavelets transform. Converse of integral wavelet transform. Frames. Two-dimensional transform. Riss basis. R-wavelets. Wavelet series expansion. Classification of wavelets. General notion on wavelet multiscale-transformations of signals. Wavelet-decomposition and wavelet-restoration. Scaling functions and wavelet multiscale-transformations. Discrete signal on a final interval. Daubechies wavelets. Biorthogonal transform. Two dimensional wavelet and wavelet-packets. Applications. How to construct one's own wavelet?		
Teaching methods	lectures and laboratory lessons		
Literature	1. Charles K. Chui. An Introduction to Wavelets. – M., Mir. 2001. 2. Novikov I. Y., Stechkin S.B. Fundamentals of the splash theory/ Progress of mathematical science, v. 53, № 6 (324). – p. 53-128. 1998 3. Stolnitz E., De Rose A. and Salesin D., Wavelets For Computer Graphics: Theory and Applications, Morgan-Kaufmann, San Francisco,1996. 4. Addison P.S. The Illustrated Wavelet Transform Handbook. – Bristol, IOP. 2002		
Examination methods	test, credit test		
Recommended for	for the fourth year students specializing in computer mathematics.		
Remarks			

Lectures: 14 **Practical :** 0 **Laboratory:** 14	**GGA.9**	**Computer graphics and animation III**	**ECTS:** 2
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of geometry, topology and methods of teaching mathematics Vylegzhanin D. V.		
Goals	Studying the basic analytical lines, surfaces, splines, spline surfaces and the methods of their construction. The application of the splines to solving different problems of computer graphics		
Basic courses	Algebra and number theory, analytical and differential geometry, mathematical analysis, computer mathematics.		
Contents	Mathematical models of curves, analytical curves, splines. Means of line construction, analytical parameterization, Hermitian spline, cubic spline, Lagrange spline, Newton spline. Bezier curves. Bernstein functions, De Kastel algorithm, geometrical meaning of the algorithm, representation of canonical sections by Bezier curves. Comparative characteristics of different splines. Rational Bezier curves, generalization of rational curves. B-splines. NURBS curves. Mathematical model of surfaces, analytical surfaces, motion surfaces. Spline surfaces. Bezier surfaces.		
Teaching methods	Lectures, laboratory lessons		
Literature	1. Golovanov N. N. Geometrical modeling. Moscow, Fizmatlit, 2002. 2. Shikin E. V., Plis A. I. Curves and surfaces on display of computer. Moscow, Dialog-MIFI. 1996. 3. Cohen E., Reisenfeld R., Elber G. Geometric Modeling with Splines. A K Peters, Ltd, Massachusetts. 2001		
Examination	Final test		
Recommended for	the fifth year students specializing in Computer mathematics.		
Remarks			

Lectures: 17 **Practical :** 0 **Laboratory:** 17	**GGA.11**	**Computer graphics and animation IV**	**ECTS:** 5
Lecturer	Candidate of physics-mathematics sciences, associate professor of the department of geometry, topology and methods of teaching mathematics Vylegzhanin D. V.		
Goals	Studying the basic analytical lines, surfaces, splines, spline surfaces and the methods of their construction. The application of the splines to solving different problems of computer graphics		
Basic courses	Algebra and number theory, analytical and differential geometry, mathematical analysis, computer mathematics.		
Contents	Mathematical models of curves, analytical curves, splines. Means of line construction, analytical parameterization, Hermitian spline, cubic spline, Lagrange spline, Newton spline. Bezier curves. Bernstein functions, De Kastel algorithm, geometrical meaning of the algorithm, representation of canonical sections by Bezier curves. Comparative characteristics of different splines. Rational Bezier curves, generalization of rational curves. B-splines. NURBS curves. Mathematical model of surfaces, analytical surfaces, motion surfaces. Spline surfaces. Bezier surfaces.		
Teaching methods	Lectures, laboratory lessons		
Literature	4. Golovanov N. N. Geometrical modeling. Moscow, Fizmatlit, 2002. 5. Shikin E. V., Plis A. I. Curves and surfaces on display of computer. Moscow, Dialog-MIFI. 1996. 6. Cohen E., Reisenfeld R., Elber G. Geometric Modeling with Splines. A K Peters, Ltd, Massachusetts. 2001		
Examination	Final test.		
Recommended for	the fifth year students specializing in Computer mathematics.		
Remarks			

Lectures: 28 **Practical :**14 **Laboratory:** 14	**VCM.9**	**Advanced computer mathematics I. Computer methods of information protection**	**ECTS:** 4
Lecturer	Candidate of physics-mathematics sciences, doctor of technical sciences, professor of the department of differential equations Lipnitskij V. A.		
Goal	Studying the application of permutation methods in cryptography and in the error correcting code theory.		
Basic courses	Algebra and the Theory of numbers		
Contents	*Cryptography fundamentals*. Classic codes. Crypting and decrypting algorithms in cryptosystem DES. The principals of the AES cryptosystem. *Error correcting code theory.* Definitions, purposes and the main properties of the error-correcting linear codes. Hamming codes. BCH, Reed-Solomon and Reed-Muller codes. The nature of the McEliece . *Normalized syndrome theory.* The operation of code automorphisms on the vector coordinates. Orbits. Code invariants as syndrome norms. Normal method of decoding and its advantages.		
Teaching methods	Lectures, practical lessons		
Literature	1. Konopelko V.K., Lipnitsky V.A. "The theory of normalized syndromes in permutative decoding of error correcting codes", M.: URSS, 2004 2. T J Sloyan, Error-Correcting Codes. 3. Harin U. S., Bernik V. I., Matveev G. V. Mathematical bases of cryptology. Minsk: BSU, 2003, 2126 p.		
Examination	Examination		
Recommended for	the fifth year students of the specialization Computer Mathematics		
Remarks			

Lectures: 34 **Practical :** 17 **Laboratory:** 17	**VCM.11**	**Advanced computer mathematics II. XML technologies**	**ECTS:** 8
Lecturer	Junior teacher of programming and numeric calculation department A. J. Perez Tchernov		
Goals	Improving the level of students' professional knowledge, developing students' skills and understanding of the purpose and use of XML technology for document creation. Educational purpose is to inform students about the basis of XML technology and methods of its use for document creation. Developing purpose is to master the technique of using XML technology for document creation and creating personal web documents.		
Basic courses	It is desirable for students to know HTML, to have a little experience of work with any general purpose language (Java is preferable), and to have the general knowledge of object-oriented design methodology.		
Contents	Navigation issues in XML documents. Using XPath 2.0 technology. Functional model of XML document processing and XSLT 2.0. Schema–based technologies, using of schemas in application, schema design. Differences in usage of DTD, XSchema, RelaxNG, Schematron schemas. Basic application program models of access to XML: DOM, SAX, StAX. XML pipelining. Introduction into service-oriented architecture. Introduction in semantic web conceptions.		
Teaching methods	Lectures and practical lessons		
Literature	1. "Document Engineering", Robert j. Glushko and TIM McGrath, Mit Press, London, 2005 2. "XSLT 2.0". Programmer's Reference, Michael Kay, Third Edition, 2004 3. "XPathTM 2.0". Programmer's Reference, Michael Kay 2004		
Examination	Final test.		
Recommended for	students of MMF BSU		
Remarks			

Lectures: 17 **Practical training:** 0 **Laboratory:** 17	**SAIS.6**	**Methods of system analysis and informational systems designing I** **Rating-analysis**	**ECTS:** 2
Lecturer	Junior teacher of the department of differential equations K. G. Atrokhau		
Goals	To provide students with instrumental method of problem solving (organizational, management & business problems).		
Basic courses			
Contents	• Generation of new ideas. Methods of search activation. • Morphological analysis. 'Goldfish' method. • Justification of new ideas. Implementation of new ideas. • Traditional thinking. Scheme of strong thinking. • Problem statement. Common types of problems. • Methods of phenomena prediction. Prediction by anti-system. • Driving forces of phenomena. Prediction by driving forces. • Stating of the best result. Stating of the worst result. • Action plan. Search of solutions. Control of negative aspects. • Stress in systems. Reasons for stress. Removal of stress.		
Teaching methods	Lectures & labs		
Literature	Aleksandrov S. E., Fadeev P. E. Rating-analysis. — Minsk, Tekhnologiya, 1997. Evlanov L. G. Theory and practice of making decisions. — Moscow, Economics, 1984. Nauman E. Making a decision. But how? — Moscow, Mir, 1987.		
Examinations	Test		
Recommended for			
Notes	The course is based on research work of G. S. Al'tshuller (Theory of inventive problem solving, TRIZ) and S. E. Aleksandrov & P. E. Fadeev (Rating-analysis).		

Lectures: 17 **Practical training:** 0 **Laboratory:** 17	**SAIS.7**	**Methods of system analysis and informational systems designing II** **XML technologies**	**ECTS:** 2
Lecturer	Junior teacher of programming and numeric calculation department A. J. Perez Tchernov		
Goals	Improving the level of students' professional knowledge, developing students' skills and understanding of the purpose and use of XML technology for document creation. Educational purpose is to inform students about the basis of XML technology and methods of its use for document creation. Developing purpose is to master the technique of using XML technology for document creation and creating personal web documents.		
Basic courses	It is desirable for students to know HTML, to have a little experience of work with any general purpose language (Java is preferable), and to have the general knowledge of object-oriented design methodology.		
Contents	Navigation issues in XML documents. Using XPath 2.0 technology. Functional model of XML document processing and XSLT 2.0. Schema–based technologies, using of schemas in application, schema design. Differences in usage of DTD, XSchema, RelaxNG, Schematron schemas. Application programming model of access to XML: DOM, SAX, StAX. XML pipelining. Introduction into service-oriented architecture. Introduction in semantic web conceptions.		
Teaching methods	Lectures and training		
Literature	Basic literature: 1. "Document Engineering", Robert j. Glushko and TIM McGrath, Mit Press, London, 2005 2. "XSLT 2.0". Programmer's Reference, Michael Kay, Third Edition, 2004 3. "XPathTM 2.0". Programmer's Reference, Michael Kay 2004 4. "XML Schema Complete Reference", Cliff Binstock, 2001 5. "Relax NG", "XSchema", Eric Van der Vlist 6. "Professional XML Development with Apache Tools: Xerces, Xalan, FOP, Cocoon, Axis, Xindice", Theodore W. Leung, 2004 7. "Web Services Platform Architecture: SOAP, WSDL, WS-Policy, WS-Addressing, WS-BPEL, WS-Reliable Messaging", Sanjiva Weerawarana, 2005 8. "Explorer's guide to the Semantic Web", T.Passin, 2004 9. "Web Semantic and Ontology", D. Taniar, J.W.Rahau, 2006 10. "Semantic Web Technologies, trends and research in ontology-based systems", J. Davies, R. Studer, P. Warren, Wiley publishing, 2006		
Examinations	Examination		
Recommended for			
Notes			

Lectures: 17 **Practical training:** 0 **Laboratory:** 17	**SAIS.8**	**Methods of system analysis and informational systems designing II** **System analysis**	**ECTS:** 2
Lecturer	Junior teacher of the department of differential equations K. G. Atrokhau		
Goals	Developing students' skills and understanding of the purpose and use of system analysis, its methods and modern tools for modeling & management of economic systems and project management.		
Basic courses	Rating-analysis		
Contents	• Introduction to system analysis. Definition of a system, types and kinds of systems. Life cycle of a system. Relationship between systems. • Economic systems: structure and features. • Analysis of systems. Analytical methods: accuracy and efficiency. • Modeling of systems: methods & area of application. Modeling of economic systems. • Control circuits in systems. Definition of a feedback. Compound systems. • Development and transformation of a system. System changes: modeling and management. • Information systems. Principles of data transfer in systems. Electronic data processing. • Modeling methodology and software: IDEF, UML, ARIS. • System analyst: introduction into specialty and principles of work. Typical use of principles of system analysis. • Analysis of an enterprise functioning. Project management. • Enhancement of efficiency of economic systems.		
Teaching methods	Lectures and laboratory lessons		
Literature	Ackoff R. L. The Art of Problem Solving. — Wiley-Interscience, 1978. Van Gigch J. P. Applied General Systems Theory. — Harper & Row, 1978. O'Connor J., McDermott I. The art of systems thinking. — HarperCollins, 1997. Optner S. L. Systems Analysis for Business Management. —Prentice Hall, I960.		
Examinations	Test		
Recommended for			
Notes			

Lectures: 28 **Practical:** 14 **Laboratory:** 14	**SAIS.9**	**Methods of system analysis and informational systems designing III** **Theory of consulting**	**ECTS:** 4
Lecturer	Junior teacher of the department of differential equations K. G. Atrokhau		
Goals	Acquiring practical skills of system analyst and consultant.		
Basic courses	System analysis		
Contents	• Introduction to consulting. History of consulting. • Aspects of consulting, i.e. purpose, objectives and phases. • Consulting service in Belarus. International classification of consulting service. • Personality of consultant. Relations between consultant and client. • Administrative consulting. • Investment consulting. Stock consulting. • Quality management. Engineering. • Marketing consulting. Advertisement and public relations. • Recruitment. Teaching. • Security of an enterprise. Juridical consulting.		
Teaching methods	Lectures and laboratory lessons		
Literature	Beych E. Consulting business. — Saint-Petersburg, Piter, 2005. Bir S. Firma brain. — Moskva, Radio i svyaz', 1993. Uikkhem F. Consulting in project management. — Saint-Petersburg, 2005. Zil'berman M. Consulting methods and technologies. — Saint-Petersburg, Piter, 2005.		
Examinations	Test		
Recommended for			
Notes			

Lectures: 34 **Practical:** 17 **Laboratory:** 17	**SAIS.11**	**Methods of system analysis and informational systems designing IV** **Theory of consulting**	**ECTS:** 7
Lecturer	Junior teacher of the department of differential equations K. G. Atrokhau		
Goals	Acquiring practical skills of system analyst and consultant.		
Basic courses	System analysis		
Contents	• Introduction to consulting. History of consulting. • Aspects of consulting, i.e. purpose, objectives and phases. • Consulting service in Belarus. International classification of consulting service. • Personality of consultant. Relations between consultant and client. • Administrative consulting. • Investment consulting. Stock consulting. • Quality management. Engineering. • Marketing consulting. Advertisement and public relations. • Recruitment. Teaching. • Security of an enterprise. Juridical consulting.		
Teaching methods	Lectures and laboratory lessons		
Literature	Beych E. Consulting business. — Saint-Petersburg, Piter, 2005. Bir S. Firma brain. — Moskva, Radio i svyaz', 1993. Uikkhem F. Consulting in project management. — Saint-Petersburg, 2005. Zil'berman M. Consulting methods and technologies. — Saint-Petersburg, Piter, 2005.		
Examinations	Test		
Recommended for			
Notes			