

2008 - 2009

SÜLEYMAN DEMİREL UNIVERSITY

FACULTY OF ENGINEERING

Undergraduate Catalogue

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Welcome Message from the Dean

Aliyev Humbet

Associate Professor

Ph.D., Mathematics, Institute of Mathematics & Mechanics of Academy of Sciences of Azerbaijan,
1993. Applied Mathematics and Mechanics.

The Engineering Faculty at SDU is a major center for leading-edge research and top-quality education in computer science and engineering in Kazakhstan. In addition to offering the only contemporary computer and information sciences education in Kazakhstan, it plays a major role as a source of talented graduates for the computer industry, locally and beyond. The number of faculty members in the department has been steadily increasing. They are not only providing high quality undergraduate to the students, but also are immersed in cutting edge research which covers almost all disciplinary areas of computer science and engineering. They include: software engineering, computer graphics, artificial intelligence, programming languages, database, human-computer interface, internet technologies, data mining, computer networks, high performance computing, computer architecture, parallel and distributed systems theory and algorithms, system software, and several other areas. We are offering bachelor degrees in mathematics. The new specialism has strong links to the computer science and engineering specialisms. That's why our math students benefit from being taught the computer science course in addition to their math courses.

Undergraduate Programs in Engineering Faculty

Education at the Süleyman Demirel University prepares students for leadership in research, teaching and application of knowledge in a highly competitive professional environment. We are on our way to achieve excellence in providing high level professional and graduate education. Mutual respect, fairness, honesty, dedication to excellence, integrity and friendly environment are the main characteristics of everyday life at Süleyman Demirel University(SDU).

Süleyman Demirel University Engineering Faculty is highly competitive and interesting place for research, work and study. More than 75% of SDU Engineering Department students hold Educational State Grant and more than 5% hold various SDU Scholarships. Each year undergraduate and graduate students of Süleyman Demirel University participate in various Olympiads, Scientific and Project-oriented contests over the globe and receive honorable prizes. Each year we also run local SDU Olympiads sponsored by SDU, iSens Systems, Open Technologies Corporation and BEE Software.

Süleyman Demirel University is an officially recognized Local Cisco Network Academy. Here, students study network technologies and approaches using modern network computing facilities of the world known companies like Cisco, IBM, HP and other. After finishing Networking course at the Academy, students receive Cisco professional certificates and become high level specialists in that area. Since SDU it started in a year 2003, more than 60 students became Cisco Certified Specialists and now work in different companies over the world.

Since 2005, Software Laboratory (KazComLab) is running at SDU as a part of SDU IT Group sponsored by SDU, Kazkommertsbank, BEE Software, Open Technologies Corporation and iSens Systems. Laboratory members are teachers, professors, graduate and undergraduate students. Software Laboratory develop and support all IT projects at Süleyman Demirel University including my SDU (university ERP), departments web sites, and outsource other commercial projects mainly from BEE Software, iSens Systems and Open Technologies Corporation and support research in Computer Science. After laboratory foundation more than 35 students worked there applying their knowledge and high potential into developing real-life software solutions.

At SDU Engineering Department students study many Core Computer Science courses along with various interesting Electives. Core subjects include Algorithms Analysis, Software Engineering, Database Systems, Logic Programming, Cryptography, Artificial Intelligence, Computer Networks, Computer Graphics, Elements of Computer Aided Design, Web Programming, Discreet Math and many other interesting subjects taught by teachers, high level professionals and professors from around the world. We have Ph.D., M.Sc. and high level professionals teaching at SDU--graduates of Moscow State University (Russia), Novosibirsk State University (Russia), Faith University (Turkey),

Bilkent University (Turkey), Carnegie-Mellon University (United States of America), Twente (Holland), Süleyman Demirel University (Kazakhstan) and many other.

Graduates of our Engineering Department successfully continue their research and education in math and computer science in Kazakhstan, United States, United Kingdom, Switzerland, Germany, Holland, Malaysia, Turkey and etc.

One of the main advantages of our graduates is high level of spoken and technical English. That is mainly because of the fact that language of instruction at our university is English and most of the materials, text books and lectures are provided in English. High level of English proficiency gives our students an opportunity to find interesting job not only in Kazakhstan but also abroad. The de-facto world communication language is English and the ability to easily communicate in that language helps our students to become part of the world's community of professionals.

Our graduates work at the prestigious state institutions, in various private companies and corporations both foreign and domestic. These are companies specializing in software development, telecommunication, IT departments of big corporations and banks. Here is the list of some of them: Kazkommertsbank, National Bank, Narodniy Bank, KZI bank, Temir Bank, Demir Bank, Bank CenterCredit, BTA, Agip, Tengiz-Chevroil, KazMunaiGaz, K-Cell, K-Mobile, National Innovation Fund (KazNIF), AlmaTV, BEE Software, Open Technologies Corporation, iSens Systems, Capital Partners and many other.

Our graduates participate in development of the following projects: homebank.kz (Kazkommertsbank), homeshop.kz (Kazkommertsbank), Kazkommertsbank internet banking system, krisha.kz, kolesa.kz, everyday.kz, KazEnergy ERP system, tamak.kz (CallCentre&CRM), railways.kz (Kazakhstan Temir Zholy), lokomotiv.kz (Kazakhstan Temir Zholy), e-gov (Electronic Government), and many many other.

While studying at our department students will:

- develop the **ability to apply** the necessary **mathematical tools, basic science, and fundamental knowledge** of electrical engineering and computer science;
- develop a **professional understanding** of electrical engineering and computer science so that they are **prepared for** immediate employment;
- be provided with an educational foundation that prepares them for diverse career paths;
- develop an **understanding** of the importance of the **social, business, technical, and human context** in which a process or product being designed will work;
- develop **leadership** skills and appreciation of the larger context of Electrical Engineering and Computer Science design and development
- develop **familiarity** with multiple important technical areas
- support and increase their **curiosity level**—that is the desire and ability to keep learning throughout life
- develop ability to **communicate** and **express ideas** persuasively in written and oral form
- develop ability to work with others in professional and social settings, i.e. Become highly **sociable** person
- develop an appreciation of **diversity** in the world—a **global view** and in intellectual areas
- develop **professional ethics**: ability to recognize and appreciate the importance of ethical standards in professional work

Here is the list of Specialization at Engineering Faculty

➤ **Bachelor Degree Programs:**

050704 – Computer Systems and Software

050703 – Information Systems

050602 – Informatics

050109 – Mathematics

050601 – Mathematics

TEACHING STAFF

Chairman

Aliyev Humbet

Associate Professor

Ph.D., Mathematics, Institute of Mathematics & Mechanics of Academy of Sciences of Azerbaijan, 1993. Applied Mathematics and Mechanics.

Peretyat'kin Mikhail

Professor

Ph.D., Mathematics, Novosibirsk State University, Russia, 1974; Doctor of Sciences Degree in Mathematics, Institute of Mathematics of Siberian Branch of Russian Acad Sci., Novosibirsk, 1983. Mathematical Logics: Finitely axiomatizable theories, Artificial Intelligence, Expert Systems, Intelligent Tutoring Systems.

Dzhumadil'daev Askar

Professor

Ph.D., Mathematics, Steklov Mathematical Institute, 1981. 2-nd Ph.D. in Mathematics, Steklov Mathematical Institute, 1988. Lie Algebras, Nonassociative Algebras, Cohomology Groups, Identities and Representations.

Krasnoperov Vladimir

Professor

Ph.D., Geology, Mineralogy and Nuclear Geophysics, Novosibirsk State University, Russia, 1970. Doctor of Sciences in Geology and Mineralogy, Ekaterinburg, Russia, 1986. Geomathematical and geostatistical methods of revealing ore deposits in the periborehole space; geoecology and geochemistry; structural and oil geophysics; economy of environment.

Hajiyeu Fuad

Associate Professor

Ph.D., Mathematics, Steklov Mathematical Institute, 1985. Algebraic Topology, Algebras of Continuous Functions, Mathematical Economic Theory.

Baizhanov Bektur

Associate Professor

Ph.D., Mathematics, Institute of Mathematics of Siberian Branch of Russian Acad Sci., Novosibirsk, 1980. Model Theory and its Applications in Computer Science. Languages of Specifications, Constraint Databases.

Bazarbayeva Larissa

Associate Professor

Ph.D., Mathematics, Institute of Mathematics & Mechanics of Academy of Sciences of Kazakhstan, 1988. Partial Differential Equations and its Applications in Mechanics. Pedagogics.

Slyunyayeva Natalya

Associate Professor

Ph.D., Physics, Institute of Nuclear Physics of Academy of Sciences of Kazakhstan, 1985. Cosmic rays; Thermal phenomena.

Matkarimov Bakhit

Assistant Professor

Ph.D., Computer Science, Institute of Mathematics of Acad Sci., of Kazakhstan, 1999. Applications of computing in mathematics, physics and biology. Databases. Neuroinformatics.

Ivanov Alexander

Assistant Professor

Ph.D., Mathematics, Institute of Mathematics & Mechanics of Academy of Sciences of Kazakhstan, 1988. Mathematical models in physics, biology, Computer Aided Design, Expert Systems, Information Retrieval, Computer-Aided Education.

Kiziyeva Larissa

Instructor

Ph.D., Electrical Engineering, Almaty Power Engineering Institute, 1981. Digital design, CAD tools, computer engineering education.

Nurlybayev Talgat

Instructor

M.S., Theoretical Physics, Kazakh State University Almaty, 1978. Cisco Networking, Object-Oriented Programming, Computer-Aided Education

Romanov Vitalii

Instructor

Honored Professor of Kazakh State Architecture Academy, 1999. M.S., Geophysics, Kazakh Mining and Metallurgical Institute, 1959. 2-nd M.S., Faculty of Automation and Telematics, St.Petersburg State Polytechnic University, 1972. Calculating Geometry, Computer Graphics, Solid-State simulation of Substantial Materials, CAD Systems.

Tulenbayev Kaysar

Instructor

Ph.D., Mathematics, Moscow State University, 2000. Nonassociative algebras.

Arslanov Marat

Professor

Ph.D. in Math, Doctor of Sciences, IPIC Academy of Sciences of Kazakhstan, 2000. Image Recognition, Optimization Theory, Information Theory

Verbovskii Viktor

Associate Professor

Ph.D. in Mathematics, Mathematical Institute of Kazakh National Academy of Sciences, 2002. Mathematical Logic, Model Theory, Discrete Math

Saginbekov Sain

Instructor

B.S. in Computer Engineering, Suleyman Demirel University 2002. M.S. in Computer Science, Bilkent University, 2004. Ph.D. Student in Computer Science, IPIC of Kazakh National Academy of Sciences. Networks, Wireless Networking, Cryptography

Oryspaev Dossay

Instructor

B.S. in Computer Engineering, Suleyman Demirel University 2002. M.S. in Telematics, Twente University, 2006. Ph.D. Student in Computer Science, IPIC of Kazakh National Academy of Sciences. Telematics, Logic Programming, Software Engineering

Israilov Anzor

Instructor

B.S. in Computer Engineering, Suleyman Demirel University, 2004. Geometric Modeling, GIS, Programming Languages, Software Engineering

Sabirgaliyev Tair

Instructor

B.S. in Computer Engineering, Suleyman Demirel University, 2004. Ph.D. in Computer Science.

Student in KazNTU. Programming Languages, Software Engineering, UNIX Operating System, 3D Programming

Alexeyev Mihail

Instructor

B.S. in Computer Engineering, Suleyman Demirel University, 2004. Programming Languages, DBMS

Assanov Daniyar

Instructor

B.S. in Computer Engineering, Suleyman Demirel University, 2004. Programming Languages, Software Engineering, DBMS, Project Management

Fatih Demir

Instructor

M.S. in Computer Engineering, Suleyman Demirel University 2002. Digital Design, Microcontrollers

Dairbekov Nurlan

Professor

Ph.D. in Math, Doctor of Sciences, Novosibirsk State University, 1995. Differential Geometry, Mathematical Analysis, Finsler Geometry

Kharin Stanislav

Professor

Ph.D. in Math, Doctor of Sciences, Thermodynamics Institute of the Siberian Branch of the USSR Academy of Sciences, Novosibirsk, Russia, 1990. Mathematical Models of Thermodynamical Processes, Heat transfer with phase transformation

Cetinkaya Kenan

Instructor

Marmara University, 1995. Techniques Teacher.

Guverchin Selim

Instructor

Bosfor University, 1995. Physics Teacher.

Nartova Dilara

Ph.D., in Math, Docent

Kazakh National University, 1993. Mechanical Engineer

RMIPK Goskom.stata i min truda RK, 1995. Accountant Economist.

Ten Vladimir

Associate Professor

Ph.D. in Math, Novosibirsk State University, 1970. Algebra, Mathematical Analysis.

Shayakhmetova Kulimkan

Associate Professor

Ph.D. in Pedagogics,

Kazakh National Pedagogical University. Theory and Methods of Teaching Math

Mamedova Saadat

Associate Professor

B.S. in Physics, Moscow State University, 1993. Ph.D. in Physics,

Baku State University, 2004.

Mirzabulatov Meyram

Assistant

B.S. in Computer Engineering, Suleyman Demirel University, 2008

Uhikbayev Kanat

Assistant

B.S. in Computer Engineering, Suleyman Demirel University, 2008

Suliyev Rassim

Assistant

B.S. in Computer Engineering, Suleyman Demirel University, 2008

Bogdanchikov Andrey

Assistant

B.S. in Computer Engineering, Suleyman Demirel University, 2008

Latuta Konstantin

Assistant

B.S. in Computer Engineering, Suleyman Demirel University, 2008

Zhamanov Azamat

Methodist

B.S. in Computer Engineering, Suleyman Demirel University, 2008

Satabaldiyev Askar

Methodist

B.S. in Computer Engineering, Suleyman Demirel University, 2008

Shalkarbayulu Askar

Methodist

B.S. in Computer Engineering, Suleyman Demirel University, 2008

LABORATORIES OF ENGINEERING FACULTY

There are:

- 5 computer,
- 1 Chip,
- 1 Physics,
- 1 Micro Process,
- 1 Language labs and
- 2 Internet Cafes at our university.

Internet Cafe

Since the primary aim of the Suleyman Demirel University is to provide the best knowledge for its students, it also provides the limitless access to the Internet. Every student has a chance to search for the required information even without leaving the University campus. Two Internet Cafe and wireless has been open from the first days of the university life, especially to meet the needs of the students and it provides the students with quality service.



Computer Laboratories

Suleyman Demirel University, under the guidance of the Faculty of Computer Engineering, has opened five Computer Laboratories with developed computers.

First lab –

Operating Systems and Network Laboratory

Laboratory is used mainly for solving various networking and operating systems problems. All core courses and electives in Operating Systems and Networking are given in that laboratory.

The main area of specialization is programming in Java, networking and operating systems.

This lab specializes in, java environment, and operating system, here students create projects by involving most high-level developed tools of java. Also here students learn how to use and modify almost all operation systems, such as Windows, Linux, Macintosh.

Second lab –

This lab is our database programming lab, here students learn and develop projects in database programming. Here students learn how to use most of SQL languages and how to develop own projects.

Third lab –

Here students improve their knowledge in programming. Learn and realize all known algorithms of programming. Here also our students prepare for student Olympiads in programming.

Fourth lab –

This lab is computer graphics lab. Here our students with support of instructors develop new algorithms of computer graphics. Also here students gain basic knowledge in computer graphics.

Fifth lab –

Lab uses high-level computers, such as thin client machines. And this lab is most comfortable for CISCO lessons. Here students learn and make own programs in computer networking.

The number of available computers will be more within the following years.

An other laboratories are also available to meet the students' need for technical subjects.



Digital Design and Advanced Digital Electronics Laboratory (Chip Lab)

The objectives of the laboratory are to learn to: design, implement and test combinational and sequential circuits using gates, MSI circuits; account for the electrical characteristics of devices; use state-of-the-art design software for drawing (schematic capture) and simulating logic circuits; and implement and test some designs via hardware and software projects, using test equipment. This laboratory presents 28 laboratory experiments in Digital Design and Advanced Digital Electronics. The digital circuits can be constructed by using standard integrated circuits (ICs) mounted on

breadboards that are easily assembled in the laboratory. The experiments are ordered according to the laboratory book. Each experiment is presented informally and the student is expected to produce the circuit diagram and formulate a procedure for checking the operation of the circuit in the laboratory. To be mentioned the students have got such experiments as experiments with logic gates, adders, comparators, decoders, multiplexers, demultiplexers, flip-flops, counters, registers, timer circuits.

Physical laboratory

Students work at the physical laboratory in the process of course of physics. The physical laboratory consists of a number of the laboratory setups designated for a study of physical phenomena with the main accent made on electricity, magnetism and optics. The students have a chance to examine main physical laws, to study methods of taking experimental data and their handling. In the process of laboratory works students get acquaintance with a modern equipment such as multimeters and oscilloscope.

Semiconductor devices are of the main interest of engineering students, so our laboratory has a series of laboratory works devoted to semiconductor devices. These works help student to understand physical principles behind the operation of semiconductor devices and their application in modern technique.

Descriptions of laboratory works published as a booklet contain theoretical and experimental parts and allow to get acquaintance with the theory of physical phenomena, process of taking readings and their handling.

Department of Computer Systems and Software (050704)

Informatics department

Chairman : Ph.D, Assistant Professor Ivanov A.I.

Main aspects of this program are: Computer Networks, Computer Security, Electrical Engineering, Software Engineering, Microprocessor Programming, Computer Systems Engineering, Operating Systems, Database Management Systems, Logic Programming and Expert Systems. Understanding of these core computer science subjects require strong knowledge in Programming, Algorithms, Math and Physics, which are covered during first two years of studying.

Graduates of that program usually work as electrical engineers, information technology experts, software developers and information security engineers.

SÜLEYMAN DEMİREL UNIVERSITY DEPARTMENT OF COMPUTER SYSTEMS AND SOFTWARE UNDERGRADUATE CURRICULUM 050704

First Semester		
Code	Courses	Credit
Math 151	Algebra & Geometry	3
CS 101	Algorithms & Programming (JAVA 1)	3
ENGL 163	General English in Practice 1	3
HSS 101	Kazakh Language 1	3
HSS 111	Kazakh History	3
Inf 101	Informatics	3
SFL 103	Turkish Language 1/ Advanced Turkish Language 1	2
HSS 191	Physical Education 1	0
XXX	ELECTIVES*	2
	TOTAL	22
Second Semester		
Code	Courses	Credit
CS 102	Programming Technologies (JAVA 2)	3
Math 152	Mathematical Analysis 1	3
Phys 152	Physics 1	3
ENGL 164	General English in Practice 2	3
HSS 102	Kazakh Language 2	3
HSS 221	Philosophy	3
HSS 192	Physical Education 2	0
XXX	ELECTIVES*	6
	TOTAL	24

Third Semester		
Code	Courses	Credit
Phys 251	Physics 2	3
EE 201	Basic Circuit Theory	3
Math 251	Probability & Math Statistics	2
HSS 132	Ecology	1
XXX	ELECTIVES*	12
TOTAL		21
Fourth Semester		
EE 202	Microelectronics (Digital Design)	2
CS 202	Information Theory	2
Math 252	Discrete Mathematics	3
CS 204	Operating Systems	3
CS 208	Computer Organization and Architecture	3
XXX	ELECTIVES*	8
TOTAL		21
Fifth Semester		
CS 301	Models and methods in management	2
CS 303	Foundations of Information Security	3
XXX	ELECTIVES*	14
TOTAL		19
Sixth Semester		
CS 302	Software Engineering	3
CS 304	Computer System Interface	3
CS 306	Computer Networks	3
XXX	ELECTIVES*	8
TOTAL		17
Seventh Semester		
CS 403	Internet Technologies	3
OBJ 400	Fundamentals of Security	3
XXX	ELECTIVES*	9
TOTAL		15
Eighth Semester		
MAN 472	Economics and Production Management	3
XXX	ELECTIVES*	2
TOTAL		5
ELECTIVE COURSES		
CS 409	JAVA EE, JAVA ME	3

CS 411	Microsoft Windows Sever 2003. Active Directory	3
CS 313	Geoinformation systems	3
CS 315	Object-Oriented Programming	3
EE 301	Advanced Microelectronics	3
Math 153	Intro to Mathematical Logic & Counting	2
CS 104	Foundations of WEB programming	2
CS 106	Intro to Elementary Algorithms	2
SFL 104	Turkish Language 2/ Advanced Turkish Language 2	2
Math 253	Mathematical Analysis 2.	3
Math 255	Differential Equations	2
CS 201	Programming Technologies I (C/C++)	3
CS 203	Operating System UNIX	2
SFL 103	Turkish Language / Advanced Turkish Language	2
CS 206	Database Management Systems 1	3
CS 210	Applied JAVA	3
ECO 272	Introduction to economy theory	2
CS 305	Logic Programming	3
CS 307	Database Management Systems 2.	3
CS 309	Assembly	3
CS 311	Computer Modeling	2
HSS 252	Sociology	2
CS 308	Numerical Methods	3
CS 312	Data Processing Software	3
EE 302	Microprocessor Systems	3
CS 405	Windows Workflow	3
CS 407	Analysis of Algorithms	3
CSS 212	Programing technologies II (Advanced technologies)	3
HSS 172	Introduction to law	2

Total credits required in Degree Program: 144

*** Students must select ELECTIVES from the elective courses list approved by the department at the beginning of each semester.**

*** Students must select ELECTIVES from the elective courses list shown above.**

Department of Information Systems (050703)

Chairman : Ph.D, Assistant Professor Ivanov A.I.

Main aspects of Information Systems study are: Computer Networks, Operating Systems, Computer Security, Database Systems Development, Operations Research, Expert Systems, Artificial Intelligence. Understanding of these core computer science subjects require strong knowledge in Programming, Algorithms, Math and Physics, which are covered during first two years of studying. Graduates of that program usually work as system administrators, information systems developers, network systems developers, database developers and system administrators.

**SULEYMAN DEMIREL UNIVERSITY
DEPARTMENT OF INFORMATION SYSTEMS
UNDERGRADUATE CURRICULUM
050703**

First Semester		
Code	Courses	Credit
Math 151	Algebra & Geometry	3
CS 101	Algorithms & Programming (JAVA 1)	4
ENGL 163	General English in Practice 1	3
HSS 101	Kazakh Language 1	3
HSS 111	Kazakh History	3
Inf 101	Informatics	3
SFL 103	Turkish Language 1/ Advanced Turkish Language 1	2
HSS 191	Physical Education 1	0
XXX	ELECTIVES*	2
	TOTAL	23
Second Semester		
CS 102	Programming Technologies (JAVA 2)	3
Math 152	Mathematical Analysis 1	3
Phys 152	Physics 1	3
ENGL 164	General English in Practice 2	3
HSS 102	Kazakh Language 2	3
HSS 221	Philosophy	3
SFL 104	Turkish Language 2/ Advanced Turkish Language 2	2
HSS 192	Physical Education 2	0
XXX	ELECTIVES	4
	TOTAL	24

	Third Semester	
Code	Courses	Credit
Phys 251	Physics 2	3
EE 201	Basic Circuit Theory	3
Math 251	Probability & Math Statistics	2
HSS 132	Ecology	1
XXX	ELECTIVES*	5
	TOTAL	14
	Fourth Semester	
EE 202	Microelectronics	2
CS 212	Principles of Information Systems	3
CS 206	Database Management Systems 1	3
XXX	ELECTIVES*	14
	TOTAL	22
	Fifth Semester	
CS 303	Foundations of Information Security	3
CS 311	Computer Modeling	3
XXX	ELECTIVES*	14
	TOTAL	20
	Sixth Semester	
INT 310	WEB technologies	3
XXX	ELECTIVES*	10
	TOTAL	13
	Seventh Semester	
CS 403	Internet Technologies	3
OBJ 400	Fundamentals of Security	3
CS 306	Computer Networks	3
INF 409	Information System Project	3
XXX	ELECTIVES*	6
	TOTAL	18
	Eighth Semester	
MAN 472	Economics and Production Management	3
XXX	ELECTIVES*	3

	TOTAL	3
	ELECTIVE COURSES	
Code	Courses	Credit
Math 153	Intro to Mathematical Logic & Counting	2
CS 104	Foundations of WEB programming	2
CS 106	Intro to Elementary Algorithms	2
Math 253	Mathematical Analysis 2.	3
Math 255	Differential Equations	2
CS 201	Programming technologies I (C/C++)	3
CS 203	Operating System UNIX	2
SFL 203	Turkish Language 3/ Advanced Turkish Language 3	2
Math 252	Discrete Mathematics	3
CS 204	Operating Systems	3
CS 208	Computer Organization and Architecture	3
CS 210	Applied JAVA	3
ECO 272	Introduction to economy theory	2
CS 301	Models and methods in management	2
CS 305	Logic Programming	3
CS 307	Database Management Systems 2.	3
CS 309	Assembly	3
HSS 141	General Psychology	3
CS 304	Computer System Interface	3
HSS 252	Sociology	2
CS 308	Numerical Methods	3
HSS 162	History of civilization	2
CS 405	Windows Workflow	3
CS 407	Analysis of Algorithms	3
CS 302	Software Engineering	3
HSS 172	Introduction to law	2
CSS 212	Programming technologies II (Advanced technologies)	3

Total credits required in Degree Program: 137

*** Students must select ELECTIVES from the elective courses list approved by the department at the beginning of each semester.**

*** Students must select ELECTIVES from the elective courses list shown above.**

Department of Informatics (050602)

Chairman : Ph.D, Assistant Professor Ivanov A.I.

Main aspects of this program are: Artificial Intelligence, Computer Systems Engineering, Electronics, Fundamental Structures of Computer Science, Database Design, Programming Languages, Software Engineering, Computer Architecture, Object-Oriented Programming, Analysis of Algorithms, Formal Languages and Automata Theory, Logic Programming and Expert Systems. Understanding of these core computer science subjects require strong knowledge in Programming, Algorithms, Math and Physics, which are covered during first two years of studying.

Graduates of that program usually do research oriented work in Computer Science and work as system analysts, software developers, information system engineers and software project managers.

DEPARTMENT OF INFORMATICS UNDERGRADUATE CURRICULUM 050602 First Semester

Code	Courses	Credit
Math 121	Mathematical analysis. Introduction course	3
Math 123	Algebra	3
Math 125	Geometry	3
CS 121	Algorithms and data structure	3
HSS 101	Kazakh Language 1	3
ENGL 163	English Language 1	2
Inf 101	Informatics	3
SFL 103	Turkish Language 1/ Advanced Turkish Language 1	2
HSS 191	Physical Education 1	0
XXX	ELECTIVES*	0
	TOTAL	22
	Second Semester	
Math 122	Mathematical analysis. Analysis of function of one variable	3
CS 156	Programming Technologies (JAVA)	3
HSS 111	Kazakh History	3
ENGL 164	English Language 2	2
HSS 102	Kazakh Language 2	3
HSS 132	Ecology	1
SFL 104	Turkish Language 2/ Advanced Turkish Language 2	2
HSS 192	Physical Education 2	0
XXX	ELECTIVES	2
	TOTAL	19
	Third Semester	
Math 221	Mathematical analysis. Function of two or more variables	3
Math 223	Differential Equations	3
CS 221	Formal Languages and automata theory	3

CS 204	Operation systems	3
Math 201	Math Logic and Discrete Maths	3
HSS 221	Philosophy	3
ENGL 265	General English in Practice 3	2
XXX	ELECTIVES*	5
	TOTAL	25
	Fourth Semester	
Code	Courses	Credit
CS 224	System Programming	3
CS 226	Basics of Schemotechnics	2
XXX	ELECTIVES*	5
	TOTAL	10
	Fifth Semester	
Math 321	Numerical Methods	3
CS 327	Database Management Systems	2
XXX	ELECTIVES*	13
	TOTAL	18
	Sixth Semester	
CS 322	Optimization and operational research	3
Math 322	Probability & Math Statistics	3
Math 324	Methods of teaching informatics	2
CS 324	Computer Networks	3
XXX	ELECTIVES*	8
	TOTAL	19
	Seventh Semester	
CS 421	Object-Oriented Programming	3
CS 423	Artificial Intelligence	2
XXX	ELECTIVES*	9
	TOTAL	14
	Eighth Semester	
CS 422	Parallel Computing	2
XXX	ELECTIVES*	7
	TOTAL	9
	ELECTIVE COURSES	
Code	Courses	Credit
CS 409	JAVA EE, JAVA ME	3
CS 411	Microsoft Windows Sever 2003. Active Directory	3
CS 104	Foundations of WEB programming	2
SFL 203	Turkish Language 3/ Advanced Turkish Language 3	2
CS 201	Programming Technologies (C/C++)	3

Phys 228	Physics	3
CS 228	Introduction to PL JAVA	2
ECO 272	Introduction to economy theory	2
CS 321	Models and methods in management	2
CS 303	Foundations of Information Security	3
CS 305	Logic Programming	3
CS 309	Assembly	3
CS 311	Computer Modeling	3
CS 302	Software Engineering	3
CS 304	Computer System Interface	3
HSS 252	Sociology	2
CS 403	Internet Technologies	3
OBJ 400	Fundamentals of Security	3
KZ 225	Documentation in Kazakh language	2
MAN 472	Economics and Production Management	3
HSS 172	Introduction to law	2

Total credits required in Degree Program: 136

*** Students must select ELECTIVES from the elective courses list approved by the department at the beginning of each semester.**

*** Students must select ELECTIVES from the elective courses list shown above.**

Department of Mathematics (050109)

Chairman : Ph.D Tulenbaev K.

Students of this specialization get their professional training in fundamental fields of mathematical science: mathematical analysis, analytical geometry, algebra, mathematical logics, topology, theory of functions, and others.

At the same time they get to know the history of mathematical studies, get necessary knowledge in programming and informatics as a whole, and deeply learn the theory and methodology of teaching mathematics. Graduates of this specialization can be involved in the scientific-pedagogical activity in secondary schools, at universities, and in scientific centers.

Department of Mathematics (050601)

The fields of professional activities of the graduates of this specialization are mathematics, applied mathematics, system programming, mathematical and computer modeling, mathematics in economics and actuarial mathematics.

**SÜLEYMAN DEMİREL UNIVERSITY
DEPARTMENT OF MATHEMATICS
UNDERGRADUATE CURRICULUM
050601
First Semester**

Code	Courses	Credit
HSS 101	Kazakh Language 1	3
ENGL 163	General English in Practice 1	2
HSS 111	Turkish Language 1/ Advanced Turkish Language 1	2
Inf 101	Informatics	3
Math 111	Mathematical Analysis 1	4
Math 103	Analytic Geometry	3
Math 107	Algebra 1	2
HSS 191	Physical Education 1	0
XXX	ELECTIVES*	2
TOTAL		21
Second Semester		
Code	Courses	Credit
HSS 111	История Казахстана	3
HSS 102	Kazakh Language 2	3
ENGL 164	General English in Practice 2	2
SFL 104	Turkish Language 2/ Advanced Turkish Language 2	2
Math 112	Mathematical Analysis 2	4
Math 108	Algebra 2	2
CS 154	Programming technologies (JAVA)	3
HSS 132	Ecology	1
HSS 192	Physical Education 2	0
XXX	ELECTIVES	0
TOTAL		20

Third Semester		
Code	Courses	Credit
ENG 265	General English in Practice 3	2
HSS 221	Philosophy	3
Math 203	Mathematical Analysis 3	4
Math 201	Math Logic and Discrete Maths	3
XXX	ELECTIVES*	7
TOTAL		19
Fourth Semester		
Code	Courses	Credit
Math 204	Mathematical Analysis 4	3
Math 206	Differential Equations	3
Math 214	Calculation methods	3
Math208	Real analysis	3
XXX	ELECTIVES*	8
TOTAL		20
Fifth Semester		
Code	Courses	Credit
Math 317	Functional Analysis	3
Math 301	Numerical methods	3
Math 307	Complex analysis	2
XXX	ELECTIVES*	7
TOTAL		15
Sixth Semester		
Code	Courses	Credit
Math 312	Theory of probability and mathematical statistics	4
Math 304	Equaion of mathem. Physics	3
Math 308	Differential geometry and topology	2
XXX	ELECTIVES*	7
TOTAL		16
Seventh Semester		
Code	Courses	Credit
Math 421	Theoretical mechanics	3
Math 423	Variation theory and methods of optimisation	3
XXX	ELECTIVES*	10
TOTAL		16
Eighth Semester		
Code	Courses	Credit
XXX	ELECTIVES*	5
TOTAL		5
ELECTIVE COURSES		
Code	Courses	Credit
Math 105	Introductory Mathematics	2
SFL 203	Turkish Language 3/ Advanced Turkish Language 3	2
Math 209	Algebra and Number Theory 3	2
CS 251	Programming Technologies (C/C++)	3
ECO 272	Intro to Economy Theory	2
Math 210	Methodical Principles of Problems' Solution	3
Math 212	Model Theory	3

Math 309	Principles of Geometry	2
HSS 281	Political science	2
	<i>Elective course</i>	3
Math 313	Partial Differential Equations	3
Math 315	Functional Equations	3
Math 305	Mathematical problems' Solution Methods 1	3
Math 306	Mathematical problems' Solution Methods 2	2
Phys 302	Physics 1	2
Math 310	Theory of Functions and Functional Analysis	3
Math 425	Methods of teaching mathematics	2
Math 427	Algebraic topology	3
Math 429	Algorithm Analysis	3
HSS 162	History of civilization	2
HSS 172	Introduction to low	2
KZ 225	Documentation in Kazakh language	1
Math 422	History of mathematics	2

Total credits required in Degree Program: 132

* Students must select **ELECTIVES** from the elective courses list approved by the department at the beginning of each semester.

* Students must select **ELECTIVES** from the elective courses list shown above.

**SÜLEYMAN DEMİREL UNIVERSITY
DEPARTMENT OF MATHEMATICS
UNDERGRADUATE CURRICULUM
050109
First Semester**

Code	Courses	Credit
HSS 101	Kazakh Language 1	3
SFL 103	Turkish Language 1/ Advanced Turkish Language 1	2
Inf 101	Informatics	3
Math 111	Mathematical Analysis 1	3
Math 103	Analytic Geometry	3
Math 109	Algebra and Number Theory 1	2
Math 105	Introductory Mathematics	2
HSS 191	Physical Education 1	0
	TOTAL	18
	Second Semester	
Code	Courses	Credit
HSS 111	Kazakh History	3
HSS 102	Kazakh Language 2	3
ENG 164	General English in Practice 2	3
SFL 104	Turkish Language 2/ Advanced Turkish Language 2	2
HSS 132	Ecology	1
Math 112	Mathematical Analysis 2	3
Math 110	Algebra and Number Theory 2	2
HSS 142	Develop mental psychology	1
CS 152	Computer technologies	2
HSS 192	Physical Education 2	0
	TOTAL	20

Third Semester		
Code	Courses	Credit
HSS 141	General Psychology	2
HSS 221	Philosophy	3
ENGL 265	General English in Practice 3	3
Math 201	Math Logic and Discrete Maths	2
Math 203	Mathematical Analysis 3	3
Math 209	Algebra and Number Theory 3	2
TOTAL		18
Fourth Semester		
Code	Courses	Credit
HSS 243	Pedagogics	3
Math 204	Mathematical Analysis 4	3
Math 206	Differential Equations	3
Math 210	Methodical Principles of Problems' Solution	3
TOTAL		12
Fifth Semester		
Code	Courses	Credit
Math 301	Numerical methods	2
Math 303	Theory and Methods of Teaching Maths. 1.	3
Math 305	Mathematical problems' Solution Methods 1	3
Math 307	Complex analysis	2
XXX	ELECTIVES*	3
TOTAL		13
Sixth Semester		
Code	Courses	Credit
Math 302	Theory and Methods of Teaching Maths. 2.	2
Math 306	Mathematical problems' Solution Methods 2	2
Phys 302	Physics 1	2
Math 308	Differential Geometry and topology	2
Math 310	Theory of Functions and Functional Analysis	3
Math 312	Theory of probability and mathematical statistics	2
XXX	ELECTIVES*	9
TOTAL		22
Seventh Semester		
Math 401	History and methodology of mathematics	2
XXX	ELECTIVES*	12
TOTAL		14
Eighth Semester		
XXX	ELECTIVES*	8
Total		8
ELECTIVE COURSES		
ENGL 163	General English in Practice 1	3
SFL 203	Turkish Language 3/ Advanced Turkish Language 3	2
CS 251	Programming Technologies (C/C++)	3
ECO 272	Intro to Economy Theory	2
Math 208	Real Analysis	3
Math 212	Model Theory	3
Math 309	Principles of Geometry	2

HSS 281	Political science	2
Math 311	Introduction to Topology	3
Math 313	Partial Differential Equations	3
Math 315	Functional Equations	3
Math 314	Intro to Algebraic Topology 1	3
Math 316	Algebraic Structures	3
Math 310	Theory of Functions and Functional Analysis	3
Math 409	Intro to Algebraic Topology 2	3
Math 411	Differential Geometry. Advanced Course.	3
Math 405	Mathematical Competitions. Problems' Solution Methods 1.	3
KZ 225	Documentation in Kazhakh Language	2
Phys 401	Physics 2	3
Math 407	Model theory. Advanced course	3
HSS 172	Introduction to Law	2
HSS 252	Sociology	2
Math 404	Mathematical Competitions. Problems' Solution Methods 2.	2

Total credits required in Degree Program: 128

* Students must select **ELECTIVES** from the elective courses list approved by the department at the beginning of each semester.

* Students must select **ELECTIVES** from the elective courses list shown above.

COURSE DESCRIPTIONS

- Department of Information Science (050602)
- Department of Information Systems (050703)
- Department of Computer Systems and software (050704)
- Department of Mathematics (050109)
- Department of Mathematics (050601)

COURSE DESCRIPTION OF THE COURSES OF ENGINEERING FACULTY

[CS 201]. Programming technologies I (C/C++) (3 credit)

C++ fundamentals: Language C++. Standard types. Signed and unsigned specifications. Types conversions. Bitwise and shift operations over integer types. Float types. Operations and their priority, evaluation the arithmetic expressions. Structure operators of C++. Arrays. Strings. Functions. Standard input--output devices. Manipulators. Input from the keyboard. Files, input from a file, output to a file.

[Math 151] Algebra & Geometry (3 credit)

Vectors, linear equations, matrices, determinants, vector spaces and subspaces, basis and dimensions, linear mappings, linear operators, and analytic geometry.

[INF 101]. Informatics (Computer Concepts & MS Office Applications) (3 credit)

Course "Informatics " covers the following topics: MS Excel-2000, MS Access-2000, MS PowerPoint-200, computer viruses, computer networks, internet and e-mail.

[CS 104]. Foundations of WEB Programming (2 credit)

The course is designed to educate students about the foundations of HTML, Java Script, VB Script, MS FrontPage and Macromedia Dreamweaver.

[CS 212]. Principles of Information Systems (3 credit)

This course is intended for a first course in Information Theory at the graduate level. This course assumes familiarity with probability theory. Main concepts are presented using intuitive descriptions, based on common case examples of Information Theory. Important theoretical results are covered, but

formal proofs are provided at the university degree level. The bibliographic notes contain references to material for further reading.

[CS 203] Operating System UNIX (2 credit)

This course covers basics of UNIX operating systems, its design and shell programming.

[CSS 212] Programming technologies II (Advanced technologies) (3 credit)

Programming technologies II is the application of programming languages JAVA and C++ to industrial and Web technologies, implementation of GSP in Web environment and creation of some projects.

[CS 311] Computer Modeling (2 credit)

The course covers graphics hardware, user interface software, rendering, and a host of other subjects. Assuming a solid background in computer science or a related field, Computer Graphics gives example programs in Fortran and provides exercises at the end of each chapter to test the student's knowledge of the material. Also illustrations of important topics and algorithms, such as ray tracing and bump maps, are taught. Encyclopedic in its coverage, the course provides comprehensive, current coverage of concepts and practical applications in computer graphics. The important algorithms in 2D and 3D graphics are detailed, and there is a thorough presentation of the mathematical principles of geometric transformations and viewing. In the course the multiple perspectives on computer graphics are being explored: the user's, the application programmer's, the package implementer's, and the hardware designer's.

[CS 101]. Algorithms and Programming I (JAVA 1) (3 credit)

The object-oriented programming is introduced, assuming that (the reader has had little or no exposure to this idea. The two types of development models (i.e. applications and applets) are introduced to evaluate the efficiency of various algorithms. Main algorithms are implemented as Java applications. Java packages, inheritance and extension of classes along with the exceptions handling are considered in detail. The topic of the i/o and file streams closes the course.

[CS 102]. Programming Technologies (JAVA 2) (3 credit)

In the continuation of the course an introduction to the Java AWT is given. The topics covered include the MVC model and the Swing components, layout managers and the AWT exceptions handling. Java's facilities for drawing graphics and producing animations are presented in details. Multithreaded programming introduces the topics of how threads may be used to allow different sections of a program to operate independently of each other. The problem of synchronizing separate threads is also discussed.

[Math 153] Mathematical logics and counting (2 credit)

This course is aimed to introduce students to Mathematical Logic and Discrete mathematics, which is a part of mathematics, where functions to discrete sets are investigated as well as foundation of mathematics. Main topics of this subject are: propositions, logic of predicates, algorithm theory, combinatorics, graphs and trees, and Boolean functions.

[EE202]. Microelectronics (Digital Design) (2 credit)

The course presents the basic concepts used in design and analysis of digital systems and introduces the principles of digital computer organization and design. The course includes the following topics: Boolean algebra, Boolean functions, logic gates. Analysis and design of combinational circuits. Minimization of combinational circuits. Combinational MSI components. Flip-flops, counters and shift registers. Analysis and design of sequential circuits. State table, state minimization and state assignment. Sequential MSI components. Number systems. Data representation. Register transfer and micro-operations. Basic computer organization and design.

[CS 403]. Internet Technologies (3 credit)

The course gives broad, practical coverage on the various technologies that make up the Internet. Topics include Networking, TCP/IP, connections, sockets, and client / server structures, the World Wide Web, HTML, HTTP, and server side programming with CGI and servlets, standards, network effects and inertia, spam, security and privacy.

[CS 309] Assembly (3 credit)

This course is about the design and organization of microprocessors systems, memory and their programming. Program preparation and the bagging, analysis of bagging process, data description, addressing nodes, jumps, calls of programs and many other aspects of ACCEMLY..

[CS 210] Applied JAVA (3 credit)

Main topics of this course are: JAVA basics, classes, exception handling, collections, Java input /outputs, frames and applets, Java Database and simple JAVA projects.

[CS 405] Windows Workflow (3 credit)

This course starts with Windows Workflow tour and continues with objects and relationships, sequential Workflow, rising events and invoking methods, transactions and compensation, fault handling, Workflow Hosting, event –driven workflow. Communication in Workflow, rules and conditions are among some basic topics.

[INF 409] Information System Project (3 credit)

This course is about working with the information system. It contains such topics as selection criteria and representation, accessing reports in background processing, project hierarchy display, currencies in the information system, old information system functions and some advices on information system performance.

[EE 301] Advanced Microelectronics (3 credit)

This course mentions the design and operation of digital circuits, such as: registers, counters, arithmetic and logic circuits, MOS, CMOS families, Schmitt triggers, three-state devices, timer circuits, amplifiers, and optoelectronics.

[CS 313] Geoinformation systems (3 credit)

With the increasing rapidity of successive changes in the world the demand for up-to-date planning information and data has grown exponentially. The integration of environmental and specialist information for various disciplines and areas of expertise in geo information systems (GIS) form the basis for future planning tasks. This course contains Design, development and maintenance of Geo Information Systems , Survey, processing and analysis of geo data , Environmental and landscape planning , Base data for planning for municipalities, Integration of geo data and GIS–Technology in business processes , Digital Cartography, Utilities network management .

[CS 409] JAVA EE, JAVA ME (3 credit)

This course is aimed to introduce students to JAVA 2 platform, Enterprise edition including several API specifications, such as: EJB, JPA, GSP, GSF, RMI, JMS, Web services, XML and etc.

[INF 310] WEB technologies (3 credit)

At this course students will find all the Web-building need, from basic HTML and XHTML to advanced XML, SQL, Database, Multimedia and WAP.

[HSS 132] Ecology (1 credit)

Resources of the planet, influencing the industrial plant on environment, protection of atmosphere, protection of aqueous basin, non waste and low waste productions, protection from the noise, protection from an infrasound both vibrations, protection from electromagnetic fields and ionizing radiations.

[CS 208]. Computer Organization and Architecture (3 credit)

The course is designed to educate students about the structure and function of computers. Its purpose is to present, as clearly and completely as possible, the nature and characteristics of modern-day computer systems. It contains such topics as computer evaluation, base component of computer, interrupts mechanism, system buses, Cache memories, external memory and virtual memory.

[EE 201]. Basic Circuit Theory (3 credit)

EE 201 is designed to educate students about the analysis of basic electrical circuits. Its purpose is to present, as clearly and completely as possible, the transient and the steady state responses of basic circuit elements such as resistors, capacitors, and inductors.

[CS 315]. Object-Oriented Programming (3 credit)

Language evaluation criteria. Describing syntax and semantics. Tools for constructing lexical and syntactical analyzers. Names, bindings, type checking, and scopes. Data types. Expressions and the assignment statement. Statement-level control structures. Subprograms. Abstract data types. Concurrency. Exception handling. Functional programming languages. Logic programming languages.

[CS 204]. Operating Systems (3 credit)

This course contains: Introduction to operating systems concepts, Command languages, Job management and job scheduling, Process management, Memory management, virtual memory, and paging, Interrupt structures and interrupt processing, Message-driven systems and data management,

Device management, I/O systems, and I/O processing. Examples of operating systems such as MS-DOS, UNIX.

[CS 206]. Database Management Systems I (3 credit)

Data models: Relational and object-relational data models, relational algebra and relational calculus, normalization theory, transaction management, query processing and optimization, concurrency control, recovery system, distributed, object oriented and XML-databases.

[CS 307]. Database Management Systems II (3 credit)

Object-relational and object-oriented database systems, declarative databases, active databases, real-time databases, distributed databases, XML and document databases, temporal and spatial databases, multimedia databases, scientific and statistical databases.

[CS 302]. Software Engineering (3 credit)

Software development lifecycle, software modeling languages, advanced UML and design patterns, software engineering tools, software project planning and tracking, software process management, business and domain object models, architectural design, database design techniques, class and interaction design, testing, refactoring, user interface development, data engineering and business components.

[CS 303]. Foundations of Information Security (3 credit)

Objective of the course is to teach students security concepts from the integrated point of view. With this approach social aspects involving the human factor are treated as being closely interrelated with the technical aspects. Among the social aspects considered psychology, management policies and procedures based on best practices. Among the technical aspects network, Internet, and operating systems security topics are being thoroughly reviewed. Cryptography and encryption algorithms and systems as well as underlying issues are being examined in detail.

[CS 308]. Numerical Methods (3 credit)

Main objectives of the course are as follows: studying of the practical issues related to the main topics of constructing empirical formulas; regression analysis and correlation; -numerical solutions of the linear and nonlinear systems, differential equations; numerical integration; interpolation and approximation; boundary and finite element problems; linear and nonlinear optimization; learning the implementation of the numerical solutions in FORTRAN and C++; learning the development of the application packages for complex numerical problems solution .

[CS 305]. Logic Programming (3 credit)

Types of expert system. Pure Logical and fuzzy logical (probability based) components of expert systems. Symbolic calculations as a base of artificial intelligence and expert systems. Artificial and natural languages used as an interface in expert systems. Programming languages used for constructing of expert system (Prolog, LISP, CLISP and traditional languages as well). Multilingual programming media used for constructing of expert systems. Development in details of an expert system of type "Fellow of a professor" applicable in education process.

[CS 407]. Analysis of Algorithms (3 credit)

Divide and conquer techniques, greedy methods, and dynamic programming, approximation, randomization, mathematical, genetic, simulated annealing algorithms. Formal verification methods, correctness of algorithms, recurrence relations, generating functions, asymptotic approximations and NP-completeness.

[CS 221]. Formal Languages and automata theory (3 credit)

Alphabets, languages and grammars. Grammars of types 0, 1, 2 and 3 and their main properties. Undesirability of Type 0 grammars and decidability of types 1 grammars. Recognizing of Type 2 grammars by finite stack-automata. Type 3 grammars, context-free grammars and regular expressions. Recognizing of Type 3 grammars in finite automata. Type 2 and Type 3 grammars and their applications to natural languages and programming languages and other computing systems.

[CS306]. Computer Networks (CCNA Exploration 4.0 – Fundamental Networks) (3 credit)

Protocol mechanisms and implementation principles, protocol specification/verification techniques, network algorithms, advanced network architectures, delay models in data networks (Queuing models, Markov systems, Little's theorem). Performance analysis of computer networks, QoS, and network simulation.

[Phys 152]. Physics 1 (3 credit)

This course is about measurements in mechanics, rate of change, motion in one dimension, vector arithmetic, Newton's law of motion, work and kinetic energy, potential energy and fields, rotation and gravity.

[Phys 251]. Physics 2 (3 credit)

This course makes discussions of the topics periodic motion, sound, electric force, electric current, resistance, electric circuits, magnetism, electromagnetic induction, ac circuits, light, and optics.

[Math 251]. Probability & Math Statistics

The course is designed in basic probability to be taken by mathematics, physics, engineering, statistics, actuarial science, operations research, and computer science majors. This course covers axioms, probability rules and discrete and continuous random variables. Special distributions, central limit theorem, expectation and variance also among basic topics of this subject.

[Math 252]. Discrete Mathematics (2 credit)

Discrete mathematics is the part of mathematics devoted to the study of discrete objects. This course covers the following topics: alphabet and languages, grammars and formal languages, finite memory program, finite state transducers and finite state automata, regular languages, pushdown finite-domain programs, context free grammars and languages, type 0 languages, Chomsky hierarchy and its significance.

[CS 411]. Microsoft Windows Server 2003. Active Directory (3 credit)

This course is intended to meet the needs of individuals preparing for the MCSE Windows Server 2003 certification. In addition to providing coverage of the 70-294 exam objectives, this course provides comprehensive coverage of the skills necessary for people aspiring to obtain positions such as systems engineer, systems analyst, or high-level systems administrator on Microsoft Windows Server 2003.

[Math 255]. Differential Equations (2 credit)

The course differential equations covers the fundamental methods of solving linear and nonlinear differential equations. It includes first-order differential equations, linear differential equations of higher-order, systems of linear differential equations and method of Laplace transform.

[CS 106]. Intro to Elementary Algorithms (2 credit)

Not only the hardware has an impact on the time that takes to finish a particular program, but also an algorithm that is used. If the algorithm you are using is not efficient, you cannot take the advantage of your computer's fast speed. Designing a good algorithm is very important.

In addition to algorithm design, this course describes data structures, methods of organizing large amounts of data, and analysis of elementary algorithms, the estimation of the running time of algorithms. Course presents many algorithms, including graph algorithms, and makes their analysis.

[Math 152]. Mathematical Analysis 1 (3 credit)

This course is aimed to introduce students to Mathematical Analysis, which is a part of mathematics, where functions and their generalizations are investigated by using method of limits. It covers such topics of mathematics as limits, continuity of functions, derivatives, differentiation, concavity, indefinite and definite integrals, basic methods of integration, improper integrals and application of definite integrals.

[Math 253] Mathematical Analysis 2 (3 credit)

This course contains sequences and series, functions of two and more variables, vectors and geometry of space, vector valued functions and motion in the space, partial derivatives, integration in vectors fields.

[CS 202]. Information Theory (2 credit)

This course is intended for a first course in Information Theory at the graduate level. This course assumes familiarity with probability theory. Main concepts are presented using intuitive descriptions, based on common case examples of Information Theory. Important theoretical results are covered, but formal proofs are provided at the university degree level. The bibliographic notes contain references to material for further reading.

This course provides an introduction to the concepts and design principles. General topics include basic notions of information theory. Some of topics are: Coding theorems, binary block codes, Gaussian Channel, Fading Channel, Source Coding theorems Coding for noisy channels, cryptography.

[EE 302]. Microprocessor Systems (3 credit)

EE 302 course is designed to give students an understanding of microcontrollers. The microcontroller is a very common component in modern electronic systems. Its use is so widespread that it is almost impossible to work in electronics without coming across it. This course is meant to be a one-semester course.

[CC 304]. Computer System Interface (3 credit)

Application of research on human-computer interaction to the design of web sites, graphic user interfaces, PDAs, persuasive computing. Design of computer-based solutions for people with physical and cognitive disabilities: text enlargement enhanced audio, custom presentation of information, and unique input devices. Design, evaluation and implementation of innovative user interfaces.

[OBJ 400] Fundamentals of Security (3 credit)

The main aim of this course is to learn the ways how the person can avoid dangers for his life and health if he works using electrical equipment. It consists of bases of industrial safety, labor hygienic, industrial sanitation, accidents, air motion, powder and gaseous pollution, electromagnetic fields, electrical safety, electric shock, first aid, protective tools and devices, fire safety provisions.

[Math 103] Analytic Geometry (3 credit)

Conic sections and quadratic equations: classifying conic sections, rotations, parameterization of plane curves, calculus with parameterized curves. Polar coordinates: graphing in polar coordinates, polar equations for conic sections and integration in polar coordinates. Vectors in the plane: Cartesian coordinates, vectors in space, dot products, cross products, lines and planes in space, cylinders and quadratic surfaces. Cylindrical and Spherical coordinates.

[Math 105] Introductory Mathematics (2 credit)

The aim of this course is the extending of the school program of elementary mathematics. Arithmetic, elements of combinatorics, elementary functions, geometry in the plane and space are some basic topics of this subject.

[Math 206] Differential Equations (3 credit)

1) First- order differential equations; 2) Linear differential equations of higher-order; 3) Application of differential equations; 4) Systems of linear differential equations, 5) Method of Laplace transform. The main aim of the course is to advance skills of students in solution of differential equations for the modeling of various phenomena.

[Math 210] Methodical Principles of Problems' Solution (3 credit)

The aim of this course is to show students some general directions and methods of solving problems and their application to solving problems of elementary mathematics. It contains such topics as forward-backward method, construction and choose methods, contradiction methods

[Math 111] Mathematical Analysis 1 (4 credit)

Functions; trigonometric, exponential, logarithmic and inverse functions. Limit and continuity. Derivatives: rules of differentiation; A thorough discussion of the basic theorems of differential calculus: Intermediate value, extreme value, and the mean value theorems, graph sketching and problems of extrema; Local extrema, monotonic functions, concavity, inflection points and asymptots, indefinite integrals.

[Math 112] Mathematical Analysis 2 (4 credit)

This course covers the following topics: definite integral, numerical series, functional sequences and series, functions in several variables, polar coordinates, cylindrical coordinates.

[Math 203] Mathematical Analysis 3 (4 credit)

Some basic topics of 3-rd part of this course are: implicit functions; improper integrals; n-tuple integrals; integrals depending on parameters; application of integral such as: divergence rotor, gradient; multiple integrals and their applications.

[Math 204] Mathematical Analysis 4 (3credit)

This course is the final part of "Mathematical analysis". The main chapters of this part are: line and surface integrals and their applications, connections between multiple and, line and surface integrals, elements of field's theory.

[Math 307] Complex analysis (2credit)

This course includes complex numbers, complex analytic function, complex differentiation, complex integrals, Taylor and Laurent series, Residue theory and its applications. The main aim of the course is to advance skills of students in fundamental mathematics and their applications for the solution of problems of mathematical analysis.

[Math 427] Algebraic Topology (3credit)

Metric spaces. Complete metric spaces. Open and closed sets. Topological spaces. The neighborhood system and neighborhood base. Subspaces, relative topologies. Accumulation, interior, exterior and boundary points. Convergent sequences. Continuous functions. First countable spaces. Second countable spaces. Separation axioms. T1 and Hausdorff spaces. Compactness. Covers and compact sets. Finite intersection property. Product spaces. Connected spaces.

[Math 310] Theory of Functions and Functional Analysis (3credit)

The course is designed for students studying mathematics. It includes 5 parts: 1) metric and normed spaces, product spaces; 2) the topology of metric spaces; 3) measures and integration; 4) Fourier analysis in Hilbert space; 5) an introduction to abstract linear operator theory. The main aim of the course is to advance skills of students in fundamental mathematics and their applications for the solutions of theoretical and practical problems.

[Math 313] Partial Differential equation (3credit)

Equations of the first order. Characteristics. Reduction to canonical form. Equations in more than two independent variables. Wave Equations. D'Alembert's solutions. Hyperbolic systems. Cauchy problem for equations in two independent variables. Fourier series solutions. Fourier and Laplace transformations and their applications to PDE. Fundamental solution. Cauchy's problem in higher dimensional spaces. Dirichlet and Neumann problems, maximum principle. Approximate solutions of PDE

[Math 314] Intro to Algebraic Topology 1 (3credit)

Fundamental group, covering spaces. Singular homology: Homotopy invariance, homology long exact sequence, Mayer-Vietoris sequence, excision. Applications of homology. Homology and attaching cells, CW-complexes. Definition of simplicial homology and its relation to singular homology. Cohomology groups.

[Math 109] Algebra and Number Theory 1 (2 credit)

As a result of the course passage the students gain knowledge about different algebraic and their application in different spheres of knowledge, about modern directions of development. This course covers following topics: sets and relations, algebraic operations, integers, symmetry groups, symmetric polynomials, groups, rings and fields.

[Math 110] Algebra and Number Theory 2 (2 credit)

The aim of the course is the studying of the classical algebraic structures. They are semigroups, groups and rings, and their most interesting and important applications. The different examples such as Novikov's algebras are studied. Elements of deformation theory and representations of groups are also considered.

[Math 209] Algebra and Number Theory 3 (2 credit)

Algebraic structures known of two parts are studied in some more higher levels. Ideas and results of theory conception confirmed with many numerous examples, attaches to all exposition general mathematical sounding. Very important place occupies Abelian groups, Silov's theorem, representations, and characters of final groups, algebra over classical fields. The bases Galua's theory are expounded. Also this course coverage strain theory, Grebner's bases represented in Li algebra.

[Math 201] Math Logic and Discrete Maths (3 credit)

First order language, Logical axioms and derivation rules, Deduction theorem, Structures and satisfaction, Completeness and consistency, Elementary equivalence and imbedding, Compactness theorem, Löwenheim-Skolem theorem, Interpolation and definability, Extensions of first order logic.

[Math 212] Model Theory (2 credit)

A course Model theory should teach students how to work with infinite models, which are the abstract mathematical structures used to represent definable sets and relations between these objects. It contains logic, definable sets, minimal sets, omega-stability topics.

[CS 152] Computer technologies (2 credit)

This course is based on JAVA, containing such topics as Error handling with exceptions, detecting types, concurrency, creating windows and applets, discovering problems, analysis and design. Java server pages, JSP and XML, client side programming with JAVA Script, etc.

[Math 401] History and methodology of mathematics (2 credit)

The aim of this course is the introduction to the history and methodology of mathematics and at the same time to consider more deeply some main directions of development of mathematics and the role of some famous mathematicians. Special attention will be paid to the history of development of mathematics in Kazakhstan.

[Math 107] Algebra 1 (2 credit)

As a result of the course passage the students gain knowledge about different algebraic and their application in different spheres of knowledge, about modern directions of development. This course covers following topics: sets and relations, algebraic operations, integers, symmetry groups, symmetric polynomials, groups, rings and fields.

[Math 108] Algebra 2 (2 credit)

The aim of the course is the studying of the classical algebraic structures. They are semigroups, groups and rings, and their most interesting and important applications. The different examples such as Novikov's algebras are studied. Elements of deformation theory and representations of groups are also considered.

[CS 154] Programming technologies (JAVA) (3 credit)

This course is based on JAVA, containing such topics as Error handling with exceptions, detecting types, concurrency, creating windows and applets, discovering problems, analysis and design. Java server pages, JSP and XML, client side programming with JAVA Script, etc.

[Math 409] Intro to Algebraic Topology 2 (3 credit)

Homology and cohomology with coefficients. Universal coefficient theorems for homology and cohomology. Künneth formula. Cup product and cross product. Cohomology algebra. Homotopy groups.

[Math 422] History of mathematics (2 credit)

The aim of this course is the introduction to the history and methodology of mathematics and at the same time to consider more deeply some main directions of development of mathematics and the role of some famous mathematicians. Special attention will be paid to the history of development of mathematics in Kazakhstan.

[Math 429]. Algorithm Analysis (3 credit)

Main goal is to present the fundamental concepts of analysis of algorithms. These concepts include aspects of algorithms design, performance analysis and algorithms implementation in programming languages. The course assumes familiarity with basic data structures, computer organization and high-level (C++/Java-like) programming languages. The course provides an introduction to the concepts and design principles, used in analysis of algorithms. General topics include asymptotic analysis, solving summations and recurrences, algorithm design techniques (such as divide-and-conquer, dynamic programming, and greedy algorithms), analysis of data structures, sorting, search, selection and introduction to NP-completeness.

[Math 214] Calculation methods (3 credit)

This course covers such topics as Gauss method, Khaletsky Schema, factorization, iteration method, relaxation, Zeydel's principle, some numerical methods, Newton-Kotes formula, Simpson's rule, Euler's transformation, least squares method.

[Math208] Real analysis (3 credit)

Convergence theorems, theorems of Lusin and Egorov. Fubini's theorem, convolutions. Differentiability properties of functions and integrals. Selected applications of Lebesgue theory. General measure and integration theory. General convergence theorems. Decomposition of measures. Radon-Nikodym theorems. Outer measure. Caratheodory extension theorem. Product measures. Fubini's theorem. Riesz representation theorem.

[Math 301] Numerical methods (3 credit)

Initial value problems. Higher order Methods of Taylor series, Runge-Kutta methods. Galerkin method, Least squares method. Stability and convergence analyses, Stiff equations, Taylor's decomposition, Difference schemes generated by the exact difference scheme and Taylor's

decomposition in the three points. Boundary value problems. Non-linear problems and solution of the systems of nonlinear equations.

[Math 322] Probability & Math Statistics (3 credit)

This course includes axioms of probability, basic theorems, probability rules, discrete and continuous random variables, special distributions. An important place is given to the central limit theorem.

[Phys 302] Physics 1 (2 credit)

Physics 1 course covers such topics as measurements in mechanics, rate of change, motion in one dimension, vector arithmetic, Newton's law of motion, work and kinetic energy, potential energy and fields, rotation and gravity.

[Phys 401]. Physics 2 (3 credit)

Last part of this course discusses topics periodic motion, sound, electric force, electric current, resistance, electric circuits, magnetism, electromagnetic induction, ac circuits, light, and optics.

[Math 303] Theory and Methods of Teaching Maths. 1 (3 credit)

Philosophies, issues, techniques, and styles of teaching high school mathematics. Implications of psychological models. Mathematics in the evolving curriculum. Manipulatives and other representations of mathematical.

[Math 306] Mathematical problems' Solution Methods 2 (2 credit)

Methods of teaching middle school mathematics: concept development; focus on classroom materials to promote learning. Area, volume, rational numbers, decimals, function machines.

[Math 425] Methods of teaching mathematics (2 credit)

This course is about teaching mathematics at school. It focuses on concepts used for teaching algebra at the school such as area, volume, rational numbers, decimals, function machines.

[CS 251] Programming Technologies (C/C++) (3 credit)

This course is based on Programming language C and C++. It consists of standard types, signed and unsigned specifications, types conversions, bitwise and shift operations over integer types, float types, operations and their priority, evaluation the arithmetic expressions. Structure operators of C++, arrays, strings, functions, standard input--output devices, manipulators, input from the keyboard, files, input from a file, output to a file also will be considered in this course.

[Math 309] Principles of Geometry (2 credit)

Geometry is an essential part of mathematical knowledge. Its importance and wide applications are well known. This course contains basic topics of modern geometry with an emphasis on Riemann geometry, including non-Euclidean geometries such as hyperbolic (Lobachevskii) geometry, elliptic and projective geometry.

[Math 312] Theory of probability and mathematical statistics (2 credit)

Probability as a measure. Univariate and multivariate random variables in linear spaces. Transformations of random variables. Moments and moment generation functions. Conditional probability and expectations. Markov chains. Brownian motion and stationary process. Statistical inference. Point estimation, method of moments and maximum likelihood. Asymptotic theory, modes of convergence and central limit theorems. The linear regression model.

[Math 304] Equation of mathematical physics (3 credit)

This course considers the theory of differential equations as the language of continuous processes in mathematical physics. This is an interdisciplinary area in which the mathematical phenomena are reflections of their physical counterparts. It covers typical equations of mathematical physics, boundary conditions; Cauchy problem for first-order partial differential equations; Classification of second-order partial differential equations with linear principal part; Cauchy and mixed problems for the wave equation in R^1 ; Cauchy problem for a 2-dimensional wave equation; Cauchy problem for heat-conduction equation; Application of Green's formulas; Fourier's method and Sturm-Liouville equations.

[Math 305] Mathematical problems' Solution Methods 1 (3 credit)

The aim of this course is to show students some general directions and methods of solving mathematical problems and their application to solving problems of mathematical competitions. It contains following topics: mathematical induction and Newton's binomial formula, mathematical induction in geometry, elements of combinatorial geometry, logic equations, problem of mathematical competitions.

[Math 312]. Theory of probability and mathematical statistics (2 credit)

The course is designed in basic probability to be taken by mathematics. This course covers axioms, probability rules and discrete and continuous random variables. Special distributions, central limit theorem, expectation and variance also among basic topics of this subject.

[Math 311] Introduction to Topology (3 credit)

This course is concerned with the study of topological spaces and their structure preserving maps (continuous maps). Topological methods and ideas are universal in modern mathematics. A topological space is a type of geometric object that does not necessarily have a distance function associated with it but, via the notion of open sets (introduced by axiomatic properties), it encodes the rigorous approach to the idea of "continuity" and "nearness". Many different examples of topological spaces will be examined, including a class of topological spaces called topological manifolds (spaces that locally look like a Euclidean space), and in particular 2-dimensional topological manifolds, called "surfaces". The course concludes with an introduction to combinatorial topology (which considers topological spaces by means of simplicial complexes and triangulations) and a discussion of the classification theorem for closed surfaces.

[Math 315] Functional Equations (3 credit)

This course covers: Equations for functions of a single variable ; equations which can be solved by Simple substitutions; solution of equations by determining the values of the unknown function on a dense set; equations with several unknown functions; reduction to differential and integral equations, general methods; equations for functions of several variables; composite equations.

[Math 308] Differential Geometry and topology (2 credit)

Tangent vectors. Differential forms. The Frenet formulas. Connection forms and the structural equations. Euclidean Geometry. Mappings of surfaces. Integration of forms. Manifolds. The shape operator of M^2 . Normal curvature. Gaussian curvature.

[Math 407] Model theory. Advanced course (3 credit)

This course presents the main results of descriptive complexity theory - the connections between axiomatizability of classes of finite structures and their complexity with respect to time and space bounds. This course also looks at important logic in this context, which include fixed-point logic, transitive closure logic, and certain infinitary languages.

[Math 411] Differential geometry. Advanced course. (3 credit)

Special curves in a surface. Surfaces of revolution. The fundamental equations. Isometries and local isometries. Integration and orientation. Congruencies of surfaces. Covariant derivative. Geodesics. Gauss- Bonnet theorem. Riemannian manifolds and submanifolds.

[Math 316] Algebraic Structures (3 credit)

This course contains recent developments on the structure of moduli spaces, with an emphasis on the algebraic structures that underlie this structure. Topics covered include Hilbert schemes of points, moduli of instantons, coherent sheaves and their derived categories, moduli of flat connections, Hodge structures, and the topology of affine varieties, topology and geometry of Hilbert schemes of points on surfaces.

[Math 121] Mathematical analysis. Introduction course (2 credit)

This course is the first part of "Mathematical analysis". This course covers such topics as real numbers, limits and continuous functions, derivatives.

[Math 123] Algebra (3 credit)

Groups: Generalities, group acting on a set, Sylow theorems, free group, direct product and sums. Rings: Generalities, commutative rings, principal ideal domains, unique factorization domains, Euclidean domains, Noetherian rings, Hilbert's theorem, field of fractions, localization.

[Math 125] Geometry (3 credit)

This course presents geometry in an exemplary, accessible and attractive form. The course emphasizes both the intellectually stimulating parts of geometry and routine arguments or computations in concrete or classical cases, as well as practical and physical applications. The course covers vector spaces, lines and surfaces of first order.

[CS 121] Algorithms and data structure (3 credit)

This course designed for the purpose of teaching students to different algorithms. If the algorithm you are using is not efficient, you cannot take the advantage of your computer's fast speed. Designing a good algorithm is very important.

In addition to algorithm design, this course describes data structures, methods of organizing large amounts of data, and analysis of elementary algorithms, the estimation of the running time of algorithms. Course presents many algorithms, including graph algorithms, and makes their analysis.

[Math 122] Mathematical Analysis. Analysis of function of one variable.

(3 credit)

Definite integral, indefinite integrals, numerical series, functional sequences and series.

[CS 156] Programming technologies (JAVA) (3 credit)

Error handling with exceptions, detecting types, concurrency, creating windows and applets, discovering problems, analysis and design. Java server pages, JSP and XML, client side programming with JAVA Script.

[Math 221] Mathematical Analysis. Function of two or more variables.

(3 credit)

This part of mathematical analysis course covers function of two or more variables. Some other topics are: implicit functions; improper integrals; n-tuple integrals; integrals depending on parameters; application of integral such as: divergence rotor, gradient; multiple integrals and their applications.

[Math 223] Differential Equations (3 credit)

The course is designed for students studying mathematics. It includes 5 parts: 1) First- order differential equations; 2) Linear differential equations of higher-order; 3) Application of differential equations; 4) Systems of linear differential equations, 5) Method of Laplace transform. The main aim of the course is to advance skills of students in solution of differential equations for the modeling of various phenomena.

[CS 226]. Basics of schemotechnics (2 credit)

This course is designed to educate students about the analysis of basic electrical circuits. Its purpose is to present, as clearly and completely as possible, the transient and the steady state responses of basic circuit elements such as resistors, capacitors, and inductors.

[Math 321] Numerical methods (3 credit)

This course is about: 1) studying of the practical issues related to the main topics of constructing empirical formulas, regression analysis and correlation, numerical solutions of the linear and nonlinear systems, differential equations, numerical integration, interpolation and approximation, boundary and finite element problems, linear and nonlinear optimization

2) learning the implementation of the numerical solutions in FORTRAN and C++

3) learning the development of the application packages for complex numerical problems solution.

[CS 327]. Database Management Systems (2 credit)

Data models: Relational and object-relational data models, relational algebra and relational calculus, normalization theory, transaction management, query processing and optimization, concurrency control, recovery system, distributed, object oriented and XML-databases.

[CS 301]. Models and methods in management (2 credit)

Linear programming; geometric representation, the simplex method, sensitivity analysis, the dual. Integer programming; branch and bound method. Goal programming; simple goal, multiple goals, priority in goals, nonlinear programming; optimality conditions for nonlinear programming, unconstrained optimization, nonlinear inequality constraints, Lagrange multipliers, Kuhn-Tucker conditions, gradient method, quadratic programming, geometric programming.

[CS 324]. Computer Networks (3 credit)

Protocol mechanisms and implementation principles, protocol specification/verification techniques, network algorithms, advanced network architectures, delay models in data networks (Queuing models, Markov systems, Little's theorem). Performance analysis of computer networks, QoS, and network simulation.

[CS 421]. Object-Oriented Programming (3 credit)

Language evaluation criteria. Describing syntax and semantics. Tools for constructing lexical and syntactical analyzers. Names, bindings, type checking, and scopes. Data types. Expressions and the assignment statement. Statement-level control structures. Subprograms. Abstract data types. Concurrency. Exception handling. Functional programming languages. Logic programming languages.

[Phys 228] Physics (3 credit)

This course covers such topics as measurements in mechanics, rate of change, motion in one dimension, vector arithmetic, Newton's law of motion, work and kinetic energy, periodic motion,

sound, electric force, electric current, resistance, electric circuits, magnetism, electromagnetic induction, ac circuits, light, and optics.

[CS 228] Introduction to JAVA (2 credit)

This course is based on JAVA, containing such topics as Error handling with exceptions, detecting types, concurrency, creating windows and applets, discovering problems, analysis and design. Java server pages, JSP and XML, client side programming with JAVA Script, etc.

[Math 324] Methods of teaching informatics (2 credit)

General question of teaching informatics. Methods of teaching basics of programming and algorithms. General principles of solving problems using computers. Methods of teaching programming languages. Basic principles of modal and structural programming. Principles of parallel computing. Foundations of HTML, basics of object oriented programming.

[CS 423] Artificial Intelligence (2 credit)

Problem definition and analysis, design of intelligent agents, heuristic search, adversarial search, knowledge representation, planning and constraint satisfaction, and methods for reasoning under uncertainty, machine learning, expert systems.

[CS 422] Parallel Computing (2 credit)

Interconnection networks for multiprocessors and massively parallel systems, a survey of prototype and commercially available parallel machines, cache coherency issues, parallel programming constructs and paradigms, communication primitives, multiprogramming workloads and methodology for quantitative evaluation, latency avoidance, latency tolerance, multithreading, dynamic instruction scheduling, message passing protocols, design and analysis of parallel algorithms, load sharing and balancing techniques.

[Math 405] Mathematical competitions problems' solution methods 1 (3 credit)

Mathematical induction, and Newton's binomial formulas, mathematical induction in geometry, elements of combinatorial geometry, logic equations, problems of mathematical competitions.

[Math 404] Mathematical competitions problems' solution methods 2(2credit)

Mathematical induction and proofs of the theorems, mathematical induction in combinatorial geometry, application of mathematical analysis to solving of elementary problems, application of higher algebra to solving of elementary problems, application of analytic geometry to solving of elementary problem.

[Math 171] Mathematics for economics (3 credit)

Coordinates, lines, functions, graphs, the limit of the function, derivatives, their applications, integration, logarithmic and exponential functions, inverse trigonometric and hyperbolic functions, techniques of integration, improper integrals.

[Math 172] Calculus (3 credit)

Infinite sequences and series, conic sections, analytic geometry, vectors, functions of two and more variables, partial derivatives, multiple integrals, differential equations.