

**YEREVAN STATE UNIVERSITY**  
**IT EDUCATIONAL AND RESEARCH CENTER**

**«INFORMATION SYSTEMS» SPECIALTY**

**INFORMATION SYSTEMS DEVELOPMENT**

**GRADUATE PROGRAM**

**GUIDE**

## General and special courses

Code	Name of the course		Semester	
2301/M02	Foundations of Programming Languages		1	
<b>Lecturer</b>	Candidate of Physical and Mathematical Sciences, Associate Professor A.Kostanyan			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
3	4/28	90	58	2
Grading Procedure		EVALUATION STRUCTURE	Course content	
○ Homeworks		4 points (20%)	Course is a continuation of a corresponding undergraduate level course on imperative programming systems. The structure of logic programming Prolog interpreter, programming of types. Problem solving in Prolog system: processing of lists, polynomials and matrices, sorting and graph algorithms, scanning and parsing algorithms.	
○ Interrogates		2 points (10%)		
○ Midterm examinations		6 points (30%)		
○ Final examination		8 points (40%)		
<b>Total grade</b>		<b>20 points (100 %)</b>	<b>6 միավոր (30%)</b>	

Code	Name of the course			Semester
2301/M03	Foundations of Database Systems			1
Lecturer	Candidate of Physical and Mathematical Sciences, Associate Professor M.Manukyan			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
3	4/28	90	58	2
Grading Procedure		EVALUATION STRUCTURE	Course content	
○ Homeworks		4 points (20%)	Theory and application issues for relational, object, object-relational, deductive and semi-structured data models are considered.	
○ Interrogates		2 points (10%)		
○ Midterm examinations		6 points (30%)		
○ Final examination		8 points (40%)		
Total grade		20 points (100 %)	<b>6 միավոր (30%)</b> (Object Query Language) are examined. Formal basis of relational query languages, active, semi-structured and deductive databases is considered in detail. Theoretical considerations are accompanied by development of corresponding projects in well-known database systems which help to acquire the knowledge. A comparative analysis of different approaches in database systems is provided. Prerequisites: Basics of Database Systems	

## Bridging Courses

Code	Name of the course				Semester
2301/M00	Extended Programming in C++				1
<b>Lecturer</b>	Candidate of Physical and Mathematical Sciences, Associate Professor A.Kostanyan				
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours	
3	4/28	90	58	2	
Grading Procedure		EVALUATION STRUCTURE	Course content		
			General structure of STL. Sequential, adapted and associated containers. Functional objects and iterator adapters. Algorithms.		
			The concept of extended programming. A concept, a model, development of a concept. Concept of iterators and containers. Models defined in STL. Building of other models.		

Code	Name of the course				Semester
2301/M00	Basics of Database Systems				1
<b>Lecturer</b>	Candidate of Physical and Mathematical Sciences, Associate Professor M.Manukyan Candidate of Physical and Mathematical Sciences, Associate Professor R.Topchyan				
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours	
3	4/28	90	58	2	
Grading Procedure		EVALUATION STRUCTURE	Course content		
			Theory and application of database concept implementation are considered within the course. Entity – relationship and object definition models are used as formalism for database modeling. Problems of relational database scheme design are emphasized. The algebraical and logical approaches of the query language construction are examined in detail. The problems of database integrity constraints are considered in the context of the relational model.		
			Prerequisites: Data Structures, Discrete Mathematics, Programming languages, System Programming.		

# 1. Graduate Program “Development of Information Systems”

*Program Supervisor - Doctor of Physical and Mathematical Sciences, Professor Samvel Shoukourian*

## 1.1. Core Courses

Code	Name of the course	Semester		
2301/M04	Theory of computing systems design	1		
<b>Lecturer</b>	Candidate of Physical and Mathematical Sciences, Associate Professor A.Kostanyan			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
6	64	180	116	4
Grading Procedure		EVALUATION STRUCTURE	Course content	
○ Homeworks		4 points (20%)	Discrete Dynamic Systems (DDS). Implementations of DDS. Automata and automata networks. Network implementations.  6 միավոր (30%) algorithms. Program structuring. Hoare's and Floyd's approaches for program verification. Program invariants. Program optimization: acceleration of iteration of monotonic operators. Agents and environments. Interaction of an agent and a system. Examples of interaction: execution of imperative programs, parallel computing with limited resources, computations in time and in space.	
○ Interrogates		2 points (10%)		
○ Midterm examinations		6 points (30%)		
○ Final examination		8 points (40%)		
<b>Total grade</b>		<b>20 points (100 %)</b>		

Code	Name of the course	Semester		
2301/M05	Principles of Database Systems	1		
Lecturer	Candidate of Physical and Mathematical Sciences, Associate Professor M.Manukyan			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
6	64	180	116	4
Grading Procedure		EVALUATION STRUCTURE	Course content	
o Homeworks		4 points (20%)	The course offers an introduction to the implementation of database systems and contains the following sections: <ul style="list-style-type: none"> <li>• data storing essentials</li> </ul>	
o Interrogates		2 points (10%)		
o Midterm examinations		6 points (30%)		
o Final examination		8 points (40%)		
Total grade		20 points (100 %)	6 միավոր (30%) <ul style="list-style-type: none"> <li>• query development,</li> <li>• systems self-repair</li> <li>• parallel management</li> <li>• transaction development</li> <li>• security and information integration</li> <li>• distributed databases</li> </ul> Prerequisites: Database Systems Basics, Data Structures and Fundamental Algorithms	

Code	Name of the course	Semester		
2301/M06	Operating Systems	2		
Lecturer	Doctor of Physical and Mathematical Sciences, Professor S.Shoukourian			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
6	64	180	116	4
Grading Procedure		EVALUATION STRUCTURE	Course content	
o Homeworks		4 points (20%)	OS facilities (linkers and loaders) interfacing asynchronous processes: I/O; buffering, interrupts; general parallel processes using fork and join; critical sections, P and V for	
o Interrogates		2 points (10%)		
o Midterm examinations		6 points (30%)		
o Final examination		8 points (40%)		
Total grade		20 points (100 %)	6 միավոր (30%) <p>in software and with hardware assist. Other coordination primitives. Segmentation and paging; virtual memory; storage allocation and sharing. Requires several modest size programming exercises.</p>	

Code	Name of the course		Semester	
2301/M07	Data Communication and Computer Networking 1		2	
Lecturer	Candidate of Physical and Mathematical Sciences, Assistant Professor A.Vasilyan			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
3	32	90	58	2
Grading Procedure		EVALUATION STRUCTURE	Content	
o Homeworks		4 points (20%)	This course introduces the student to a broad range of topics fundamental to computer communications. <b>Topics that will be covered are:</b>	
o Interrogates		2 points (10%)		
o Midterm examinations		6 points (30%)		
o Final examination		8 points (40%)	6 միավոր (30%)	
Total grade		20 points (100 %)	<p>and networks</p> <ul style="list-style-type: none"> <li>• Protocols and Protocol Architectures (OSI, TCP/IP)</li> <li>• Data Encoding and Transmission</li> <li>• Data Link Layer (Framing, Error Control, Flow Control, Protocol Examples)</li> <li>• MAC Sublayer (CSMA/CD, Token Ring, FDDI)</li> <li>• Network Layer (Packet Switching, Circuit Switching, Distance Vector Routing, Link State Routing, X25, ATM)</li> <li>• Internet Network Layer (IP Protocol, Subnets, CIDR, ICMP, ARP, RARP)</li> <li>• Routing Protocols (Inter-AS/Intra-AS Routing, RIP, OSPF, BGP)</li> <li>• Transport Layer (connection-oriented/connectionless communications, multiplexing/demultiplexing, TCP, UDP, TCP Flow Control, TCP Connection Management)</li> <li>• Sockets in C</li> <li>• Congestion Control in Data Networks (TCP Congestion Control, TCP AIMD, TCP Slow Start, TCP Fairness, ATM ABR)</li> <li>• Application Layer (HTTP, FTP, SMTP, MIME, DNS)</li> <li>• IP Multicast</li> </ul> <p>The <b>cnet</b> network simulator will be used for the programs written by students. The simulator allows to implement some of the algorithms studied during the course. All of the simulator programming will be done in C. Students will also write some simple socket applications.</p>	

Code	Name of the course		Semester	
2301/M07	Data Communication and Computer Networking 2		1	
Lecturer	Candidate of Physical and Mathematical Sciences, Assistant Professor A.Vasilyan			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
3	32	90	58	2
Grading Procedure		EVALUATION STRUCTURE	Course content	
○ Homeworks		4 points (20%)	The course is dedicated to trends of network programming development. Microsoft .Net infrastructure, CLR (Common Language Runtime), JIT compilation as well as 6 միավոր (30%) Attributes, SOAP, Web Services and .Net Remoting are discussed.	
○ Interrogates		2 points (10%)		
○ Midterm examinations		6 points (30%)		
○ Final examination		8 points (40%)		
Total grade		20 points (100 %)		

Code	Name of the course		Semester	
2301/M08	Methodology of Object-Oriented Design		1	
Lecturer	Candidate of Physical and Mathematical Sciences, Associate Professor A.Kostanyan			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
6	64	180	116	4
Grading Procedure		EVALUATION STRUCTURE	Course content	
○ Homeworks		4 points (20%)	The Waterfall and Unified Process (UP) of software development. The UP artifacts: use case model, domain model, design model, test model, implementation model. The 6 միավոր (30%) interaction diagrams. Architectural and design patterns. Categories of design patterns. Design solutions for supporting different strategies, external systems, window refresh. Failover to local services. Designing frameworks. Usage of CASE tools to aid in analysis and design.	
○ Interrogates		2 points (10%)		
○ Midterm examinations		6 points (30%)		
○ Final examination		8 points (40%)		
Total grade		20 points (100 %)		



Code	Name of the course		Semester	
2301/M09	XML and Databases		3	
Lecturer	Candidate of Physical and Mathematical Sciences, Associate Professor M.Manukyan			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
3	4/28	90	58	2
Grading Procedure		EVALUATION STRUCTURE	Course content	
o Homeworks		4 points (20%)	Different approaches for creation of XML applications (considering these as DDL for databases) and query languages for XML are considered in the course. The following  <b>6 միավոր (30%)</b> <ul style="list-style-type: none"> <li>XML language and XML data model,</li> <li>XML Scheme - typed XML,</li> <li>OpenMath - a language for representation and exchange of mathematical objects on the Web,</li> <li>XPath and XQuery. XML query languages.</li> </ul> Prerequisites: Database Systems Basics and Database Systems Principles.	
o Interrogates		2 points (10%)		
o Midterm examinations		6 points (30%)		
o Final examination		8 points (40%)		
<b>Total grade</b>		<b>20 points (100 %)</b>		

Code	Name of the course		Semester	
2301/M10	Design of Web-Based System		3	
Lecturer	Candidate of Technical Sciences, Assistant Professor A.Avagyan			
Number of credits	Hours in auditorium	Total hours	Self-training hours	Weekly hours
3	32	90	58	2
Grading Procedure		EVALUATION STRUCTURE	Course content	
o Homeworks		4 points (20%)	This course covers the management and development of web-based information systems. Students will analyze, design and develop web-enabled database applications  <b>6 միավոր (30%)</b>  will be on concepts and architecture of new technologies. Topics include: the CGI processing model and its alternatives , Java applets, Java servlets, JDBC; application service providers; multitier client-server computing; object-oriented models; active server pages and other server-based processing alternatives; distributed business objects; text processing applications; and platform options.	
o Interrogates		2 points (10%)		
o Midterm examinations		6 points (30%)		
o Final examination		8 points (40%)		
<b>Total grade</b>		<b>20 points (100 %)</b>		

Code	Name of the course			Semester
2301/M11	Design of Embedded Systems			2
Lecturer	Doctor of Physical and Mathematical Sciences, Professor S.Shoukourian			
Number of credits	Hours in auditorium	Number of credits	Hours in auditorium	Number of credits
6	64	180	116	4
Grading Procedure		EVALUATION STRUCTURE	Course content	
○ Homeworks		4 points (20%)	The following topics are considered <ul style="list-style-type: none"> <li>• Transistors and Gates</li> <li>• Combinational Circuits, Dynamic Behavior of Combinational Circuits</li> </ul>	
○ Interrogates		2 points (10%)		
○ Midterm examinations		6 points (30%)		
○ Final examination		8 points (40%)		
Total grade		20 points (100 %)	<b>6 միավոր (30%)</b> <ul style="list-style-type: none"> <li>• Synchronous, Sequential Circuits, Design Methodologies for State Machines, PLD and FPGA with Registers, Timing and Practical Considerations</li> <li>• Bus Systems</li> <li>• Static and Dynamic Memories, Multi-Port Memories</li> <li>• Formal Description of Synchronous Circuits in Verilog               <ul style="list-style-type: none"> <li>○ Introduction</li> <li>○ Lexical Elements</li> <li>○ Data Types and Objects</li> <li>○ Expressions and Operators</li> <li>○ Sequential statements</li> <li>○ Subprograms and Packages</li> <li>○ Describing Structure and Behavior</li> <li>○ Discrete Event Time Model Organization</li> <li>○ Advanced Verilog</li> </ul> </li> <li>• Interfaces Between Asynchronous Units               <ul style="list-style-type: none"> <li>○ The Handshake Protocol</li> <li>○ Processor-Bus Interfaces</li> <li>○ Adding an I/O Interface to a computer</li> </ul> </li> <li>• Serial Data Transmission</li> <li>• Sample Models: The VNA Architecture Processor</li> <li>• Approaches to Design of Embedded Systems</li> <li>• Samples of Embedded Systems Design</li> </ul>	

Code	Name of the course			Semester
2301/M12	Testing of Electronic Devices and Systems			3
Lecturer	Candidate of Physical and Mathematical Sciences, Associate Professor V.Vardanian			
Number of credits	Hours in auditorium	Number of credits	Hours in auditorium	Number of credits
6	64	180	6	64

Grading Procedure	EVALUATION STRUCTURE	Course content
○ Homeworks	4 points (20%)	The course consists of three parts. The first part includes the definitions of the main concepts of testing of electronic circuits, descriptions of the main fault classes and algorithms for their detection (algorithm, PODEM, FAN, SOCRATES). The second part includes description of the main methods and algorithm of design for testability: insertion of test points, design of scan paths, boundary scan, built-in self test. The third part includes description of modeling of memory devices and physical defects, as well as the main methods and algorithms for their testing, diagnosis and repair.
○ Interrogates	2 points (10%)	
○ Midterm examinations	6 points (30%)	
○ Final examination	8 points (40%)	
<b>Total grade</b>	<b>20 points (100 %)</b>	<b>6 միավոր (30%)</b>

## 1.2 Electives

Code	Name of the course	Semester		
2301/M13	Principles of compilation	2		
<b>Lecturers</b>	Candidate of Physical and Mathematical Sciences, Assistant Professor A.Vasilyan			
Number of credits	Hours in auditorium	Number of credits	Hours in auditorium	Number of credits
3	4/28	90	58	2
Grading Procedure	EVALUATION STRUCTURE	Course content		
○ Homeworks	4 points (20%)	This course provides the foundation for understanding the theory and practice of compilers. It reflects the current state of compilation using recent developments in languages, and computer architecture.		
○ Interrogates	2 points (10%)			
○ Midterm examinations	6 points (30%)			
○ Final examination	8 points (40%)			
<b>Total grade</b>	<b>20 points (100 %)</b>	<b>6 միավոր (30%)</b>		

Code	Name of the course	Semester
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2301/M14	Transaction Processing and Distributed Databases			2
<b>Lecturer</b>	Candidate of Physical and Mathematical Sciences, Associate Professor M.Manukyan			
<b>Number of credits</b>	<b>Hours in auditorium</b>	<b>Number of credits</b>	<b>Hours in auditorium</b>	<b>Number of credits</b>
3	4/28	90	58	2
<b>Grading Procedure</b>	<b>EVALUATION STRUCTURE</b>	<b>Course content</b>		
o Homeworks	4 points (20%)	<p>The course offers an introduction to distributed data and transaction management and contains the following sections: The following sections are included:</p> <p><b>6 միավոր (30%)</b></p> <ul style="list-style-type: none"> <li>• Overview of distributed databases and transactions,</li> <li>• Consistency for distributed data,</li> <li>• Advanced transactions and messaging,</li> <li>• Distributed query processing,</li> <li>• Parallel database systems,</li> <li>• Federated database systems,</li> <li>• Futures and open problems.</li> </ul> <p>Prerequisites: Database Systems Basics and Database Systems Principles.</p>		
o Interrogates	2 points (10%)			
o Midterm examinations	6 points (30%)			
o Final examination	8 points (40%)			
<b>Total grade</b>	<b>20 points (100 %)</b>			

<b>Code</b>	<b>Name of the course</b>	<b>Semester</b>
2301/M15	Unix Operating System	3
<b>Lecturer</b>	R.Khafadaryan	
<b>Number of credits</b>	<b>Hours in auditorium</b>	<b>Number of credits</b>
3	32	90
<b>Number of credits</b>	<b>Hours in auditorium</b>	<b>Number of credits</b>
3	32	90
<b>Grading Procedure</b>	<b>EVALUATION STRUCTURE</b>	<b>Course content</b>
o Homeworks	4 points (20%)	<p>A brief history of the Unix operating system: basic utilities (mail, editors); shells; windowing systems; shell programming using Unix tools; networking tools; C programming</p> <p><b>6 միավոր (30%)</b></p> <p>desktop publishing tools; visualization systems; symbolic algebra tools; and system administration.</p>
o Interrogates	2 points (10%)	
o Midterm examinations	6 points (30%)	
o Final examination	8 points (40%)	
<b>Total grade</b>	<b>20 points (100 %)</b>	

Code	Name of the course		Semester	
2301/M16	C# and .Net platform		3	
Lecturer	Candidate of Physical and Mathematical Sciences, Assistant Professor A.Vasilyan			
Number of credits	Hours in auditorium	Number of credits	Hours in auditorium	Number of credits
3	32	90	58	2
Grading Procedure		EVALUATION STRUCTURE	Course content	
o Homeworks		4 points (20%)	<p>The course starts with a brief overview of the C# language and then quickly moves to key technical and architectural issues for .NET developers. There is not only a coverage of what programmers need to know about such necessary, but subtle, areas as the proper use of threads and how to leverage the new .NET remoting protocol. Readers will also see how to use C# for GUI applications with a complete discussion of Windows Forms, custom controls. There are equally useful discussions on how to use C# and .NET for Web development, Web services, and data access using ADO.NET. The scope is from Windows-based to Web-based applications.</p>	
o Interrogates		2 points (10%)		
o Midterm examinations		6 points (30%)		
o Final examination		8 points (40%)		
Total grade		20 points (100 %)	<p>6 միավոր (30%)</p>	

Code	Name of the course		Semester	
2301/M17	Distributed Computing Systems		3	
Lecturer	T.Gyonjyan			
Number of credits	Hours in auditorium	Number of credits	Hours in auditorium	Number of credits
3	32	90	58	2
Grading Procedure		EVALUATION STRUCTURE	Course content	
o Homeworks		4 points (20%)	<p>Concepts underlying distributed systems: synchronization, communication, fault tolerance, and performance; examined from three points of view: (a) problems, solutions, (b) linguistic constructs, and (c) some typical systems. Distributed file systems are considered.</p>	
o Interrogates		2 points (10%)		
o Midterm examinations		6 points (30%)		
o Final examination		8 points (40%)		
Total grade		20 points (100 %)	<p>6 միավոր (30%)</p>	

Code	Name of the course		Semester	
2301/M18	Software Testing and Quality Assurance		3	
Lecturer	A.Varosyan			
Number of credits	Hours in auditorium	Number of credits	Hours in auditorium	Number of credits
3	32	90	58	2
Grading Procedure		EVALUATION STRUCTURE	Course content	
○ Homeworks		4 points (20%)	Concepts and techniques for testing software and assuring its quality. Topics cover software testing at the unit, module, subsystem, and system levels; automatic and	
○ Interrogates		2 points (10%)		
○ Midterm examinations		6 points (30%)		
○ Final examination		8 points (40%)		
Total grade		20 points (100 %)	6 միավոր (30%) validating test data, the testing process, static vs. dynamic analysis; functional testing; inspections; and reliability assessment.	