State Final Examinations	Academic Year 2018/2019
Bachelor's Degree Studies Program:	Engineering Informatics
Study Branch:	Information and Control Technologies

Information and Communication Technologies

1. Quantification of information, entropy, transmission of information - characteristics of a communication channel, disturbances of the transmission, noise.
2. Codes, encoding, fixed-length and variable-length codes, construction techniques for variable-length effective codes (Shannon-Fano and Huffman method).
3. Security codes, Hamming distance, correction and detection capabilities of the code, examples of error-correction codes.
4. Difference between encryption and encoding, symmetric, asymmetric and hybrid cryptography, advantages and disadvantages of these systems, basic principles of modern cryptography - stream and block ciphers, examples of one-way cryptographic functions.
5. Von Neumann architecture and Harvard architecture of computers. Scheme of the motherboard, BIOS (UEFI). Description of the computer startup process (including the operating system booting - Linux or MS Windows).
6. Processor - basic scheme and description of the function principle. Process management in the operating system (process life cycle; concepts: process, thread, multitasking; deadlock and concurrency issues).
7. Memories - Hierarchical categorization of memories. Operating system memory management (virtual memory and its implementation by segmentation and paging). File systems (FAT, NTFS, EXT…).
8. Principles of basic computer peripherals (LCD, laser and inkjet printer,…). Modern bus (parallel and serial bus - differences, bus banwidth and frequency; PCI, PCIe, USB, Fireware,…).
9. Definition and properties of algorithms, categorization and description of algorithms - recursive, greedy search, divide and conquer, probabilistic, dynamic programming algorithm, heuristic. Techniques for speed-up of algorithms.
10. Computational complexity - definition of space and time complexity. Definition of mean and pessimistic complexity terms. Computability theory, P, NP and NP heavy and complete problems, graphical visualization of relations between individual classes.
11. Theoretical informatics - definition of the terms language, grammar, hierarchy of grammars. Finite automata and Turing / Post machines, basic description, categorization, equivalence of automata / machines.
12. Dynamic data structures, dynamic array, linear (linked) list, binary tree, hash table (description, basic properties, memory overhead, time complexity of inserting, searching and deleting items, examples of usage).
13. Fast sorting algorithms (Quick sort, Heap sort, Radix sort: basic properties, principles, memory and time complexity).
14. Synchronization entities for multithreaded programming in Java (monitor, semaphore, lock, barrier and examples of their usage).
15. Implementing Servers in Java language (ServerSocket class usage, usage of threads, and java.nio.* library)

16. HTTP protocol - principle of communication and request types, support of cache, cookies, possible ways of keeping context information ("sessions") in web applications, types of common attacks on web applications - SQL injection, cross-site scripting.
17. HTML markup language (HTML5 version upgrade), CSS (box-model) cascading style sheet language, Java-based client scripting (jQuery framework), appropriate programming languages for server scripting (PHP, ASP, ASP.NET, Java), MVC design pattern, ORM programming technique.
18. Principles and basic concepts of relational database systems - database structure, table structure, data types, attributes, indexes, relationships between tables, integrity rules, normal forms.
19. SQL Query Language - Basic commands for creation of a database and table, change of the table structure, inserting, editing, deleting, and selecting of data.
20. SQL Query Language - projection and selection, union, intersection, scalar and aggregation functions, nested queries, views, and triggers.
21. Storage methods of raster and vector types 2D images. Properties, methods of compression, color depth, application areas.
22. Transmission media in computer networks, transmission of data over the network in baseband and passband. Physical and logical topology of computer networks.
23. Principles of access methods in computer networks, datagram service and virtual link, PDU acknowledgment. Computer network standardization.
24. TCP / IP - the most widely used protocols, addressing in TCP / IP networks, ports, sockets and demultiplexing.
25. Connection of computer networks, LAN Ethernet, Internet and Domain Name System.