Faculty of Electrical Engineering, Automatic Control and Computer Science Topics for the diploma exam	
Field of study: COMPUTER SCIENCE	Level of education: 1st degree

Field of study questions

(Student draws 1 question from the set below)

1. Define the concept of an algorithm and discuss its properties.
2. Explain what are control statements and for what purpose they are used in a program.
3. Describe the most important digital functional blocks – multiplexer, demultiplexer, adder, comparator, arithmetic-logic unit (ALU), register, counter.
4. Present the basic principles of design and implementation of the synchronous sequential logic circuits.
5. Characterize the natural and two's complement notations of binary numeral systems for integer numbers limited to n digits (bits).
6. Characterize abstract data types (typical models, properties, advantages and disadvantages).
7. On a selected example, discuss the divide and conquer method of constructing algorithms.
8. Explain the idea of public key and private key in the context of encryption algorithms.
9. Discuss the following topics: instruction, instruction cycle, microinstructions, microprogramming.
10. Discuss CPU cache technology.
11. Discuss the total probability and the Bayes theorem.
12. Discuss the normal distribution of continuous random variables.
13. Explain what is a pointer variable (a pointer) and what purpose does it serve in a program.
14. Explain what are recursive functions, discuss their pros and cons and some of their applications.
15. Explain and compare the concepts of a sequential process and a thread.
16. Explain the concepts of a semaphore, a mutex, a critical section and an event.
17. Describe transport layer protocols from the ISO / OSI model.
18. Describe the types of transmission media used in computer networks.
19. Outline the chosen method of approximating functions with polynomials.
20. Outline numerical integration with the chosen method.

Specialization: **INFORMATION SYSTEMS**

Specialization questions

(Student draws 2 questions from the set below)

21. Discuss the method of evaluation of measurement uncertainty.
22. Discuss the method of determining the parameters of signals on the basis of their discrete representation.
23. What are abstract classes? Explain using C++ language as an example.
24. What is the function and method overloading mechanism for? Explain using C++ language as an example.
25. RISC vs. CISC processors – main differences and similarities.
26. Describe main organizations of multiprocessor architectures.
27. Describe the three-level ANSI-SPARC database architecture.
28. Describe Entity-Relationship Diagram (ERD).
29. Describe the basic elements of processor architecture, their importance and role in data processing.
30. Present the processor command cycle, its phases as well as micro-operations implemented in these phases.
31. Describe the concept of event-driven programming of graphical user interfaces.
32. Present a way of using mouse and keyboard in an application based on the event-driven programming model.
33. Discuss the advantages of state space continuous system.
34. Present the principles of dynamic programming.
35. Discuss the addressing modes in RISC and CISC processor architectures.
36. Present the microcontrollers and their peripherals on the example of selected architecture.
37. Compare inheritance and composition in Java.
38. Describe the following Java collections: lists, sets, and maps.

39. Characterize the structure, operation and learning algorithm of a single artificial neuron with a step activation function.
40. Characterize the role of hidden layer (hidden layers) in the operation mode of an artificial neural network of the multilayer perceptron type.
41. Discuss the Completely Fair Scheduler (CFS).
42. Discuss the deadline I/O scheduler.
43. Describe three problems of concurrent programming: deadlock, starvation, livelock.
44. Discuss the Dekker algorithm in concurrent programming.
45. Describe how to download a resource from the http server.
46. Describe three examples of ways to attack websites. Present methods of protection against these attacks.
47. Explain the principle of operation of the convolution filter for 2D images.
48. Characterize basic color models used in computer graphics.
49. Present the basics of operation of the depth buffer (Z-buffer) in 3D computer graphics.
50. Explain what are design patterns and describe two chosen structural design patterns.
51. Describe two chosen UML diagrams belonging to the group of behavioral diagrams.
52. Explain what is a structural testing of software.
53. Present advantages and disadvantages of the MVC design pattern.
54. Discuss the characteristics of the DI (Dependency Injection) design pattern.
55. Explain the differences between server-side and client-side systems.
56. Discuss the Business Process Model and Notation BPMN.
57. Characterize the Gantt chart.
58. Present the application of CPM and PERT project scheduling methods, similarities and differences.
59. Discuss the multi-tier (multi-layer) architecture used in web applications.
60. Present the principle of building a front-end web application based on components.