

## List of questions for the diploma exam

| Field of study: <b>Automatic Control and Robotics</b> |   | <b>First-cycle studies</b> |
|---|---|----------------------------|
| Profile: <b>Automatic Control</b>                     |   |                            |
| No.   | Question  |                            |
| 1   | How to interpret frequency response from input-output relations viewpoint? <b>[Automatic Control]</b>   |                            |
| 2   | Clarify how obtain frequency response by means of an experiment. <b>[Automatic Control]</b>   |                            |
| 3   | Analyze the need to introduce I term into a PID controller. <b>[Automatic Control]</b>  |                            |
| 4   | Average power of a sum (or a difference) of random signals. <b>[Signals and dynamic systems]</b>  |                            |
| 5   | Basic properties of variance and correlation estimators. <b>[Signals and dynamic systems]</b>   |                            |
| 6   | The Fourier Transform as an extension of the Fourier Series to non-periodic function. <b>[Signals and dynamic systems]</b>  |                            |
| 7   | List and characterize the manipulator kinematics tasks. <b>[Robotics]</b>   |                            |
| 8   | Specify possible ways to determine robot tool orientation. <b>[Robotics]</b>  |                            |
| 9   | Sketch the signal flow diagram in the robot dynamics model. <b>[Robotics]</b>   |                            |
| 10  | Define the real-time system. <b>[Real Time Systems]</b>   |                            |
| 11  | Specify the process components in the computer system. <b>[Real Time Systems]</b>   |                            |
| 12  | Point out 3 ways to pass arguments to functions in C++. <b>[Introduction to Computer Science]</b>   |                            |
| 13  | Explain how floating point variables are represented in memory. <b>[Introduction to Computer Science]</b>   |                            |
| 14  | Referring to containers of STL library: vector, map, and list, explain how each of them stores data in memory. <b>[Introduction to Computer Science]</b>  |                            |
| 15  | What is the role of the IP address in network communication. <b>[Introduction to Computer Science]</b>  |                            |
| 16  | Structure, operation, models and characteristics of various types of semiconductor diodes and transistors. <b>[Electronics]</b>   |                            |
| 17  | Diagrams, characteristics and equations describing the operation of basic systems with an operating amplifier. <b>[Electronics]</b>   |                            |
| 18  | Operation of basic types of DC impulse converters. <b>[Electronics]</b>   |                            |
| 19  | Diagrams, characteristics and control methods for voltage source inverters. <b>[Electronics]</b>  |                            |
| 20  | Mechanical characteristics of a DC commutator motor in case of changes in the armature voltage and excitation flux, speed control capability. <b>[Electrical machines in control engineering]</b> |                            |
| 21  | Classification and principle of operation of stepper motors. <b>[Electrical machines in control engineering]</b>  |                            |
| 22  | Principles of synthesis of combinational and sequential systems using elements of small and medium scale of integration. <b>[Microprocessor systems]</b>  |                            |
| 23  | Measurement of time in microprocessor system. <b>[Microprocessor systems]</b>   |                            |
| 24  | The principle of synchronous and asynchronous serial communication. <b>[Microprocessor systems]</b>   |                            |
| 25  | Measurement of analog signal including calibration of the analogue path. <b>[Microprocessor systems]</b>  |                            |
| 26  | The effect of limiting the output signal of the speed controller in the DC drive cascade control system on the motor starting and braking process. <b>[Control of electromechanical systems]</b>  |                            |
| 27  | Describe the scalar and vector control of the cage induction motor. <b>[Control of electromechanical systems]</b>   |                            |
| 28  | Describe how to operate the DC brushless motor (BLDCM). <b>[Control of electromechanical systems]</b>   |                            |
| 29  | Explain why the position of the motor shaft is measured in the permanent magnet synchronous motor (PMSM) speed control system. <b>[Control of electromechanical systems]</b>                      |                            |
| 30  | Numerical modelling of delays and first-order systems. <b>[Analysis of control systems]</b>   |                            |
| 31  | Control structures with Smith predictor and internal model (IMC). <b>Analysis of control systems</b>  |                            |
| 32  | Influence of delays in main and measurement paths on the control system. <b>Analysis of control systems</b>   |                            |
| 33  | Structure and application of the Kalman filter. <b>Analysis of control systems</b>  |                            |
| 34  | Types of production and concepts of their automatization <b>[Flexible Manufacturing Systems]</b>  |                            |
| 35  | Petri nets - definition of the position/transition network. <b>[Flexible Manufacturing Systems]</b>   |                            |
| 36  | How to create a Gantt diagram. <b>[Flexible Manufacturing Systems]</b>  |                            |
| 37  | Nonparametric identification methods. <b>[System identification]</b>  |                            |
| 38  | Differences between LS and IV method. <b>[System identification]</b>  |                            |
| 39  | Methods of order estimation. <b>[System identification]</b>   |                            |
| 40  | Describe the principle of operation of the relay and the difference between it and the contactor. <b>[Devices of automation and actuators]</b>  |                            |
| 41  | What are the types of sensors used in automation devices? <b>[Devices of automation and actuators]</b>  |                            |
| 42  | Describe the principle of operation of a chosen pneumatic actuator. <b>[Devices of automation and actuators]</b>  |                            |
| 43  | Describe an encoder mode of action. <b>[Devices of automation and actuators]</b>  |                            |
| 44  | The operating points of the drive motor of the crane lifting mechanism. <b>[Foundations of electrical drives]</b>   |                            |
| 45  | Method of equivalent torque for motor power selection. <b>[Foundations of electrical drives]</b>  |                            |

|    |  |
|----|--|
| 46 | Voltage control of the DC motor using an impulse converter. <b>[Foundations of electrical drives]</b>                                    |
| 47 | Discrete implementation of the PID controller, block diagram and operating principle. <b>[Digital controllers and PLC]</b>               |
| 48 | Principle of operation of basic functional blocks of programmable controllers, timers and counters. <b>[Digital controllers and PLC]</b> |
| 49 | Programmable logic controller operating cycle. <b>[Digital controllers and PLC]</b>  |
| 50 | Principles of programming languages: LD, FBD and SFC. <b>[Digital controllers and PLC]</b>   |