LIST OF QUESTIONS AND TOPICS FOR THE DIPLOMA EXAMINATION
Automatics Control and Robotics (Master Study)

General

1. Give examples of applications of the calculus of variations.

2. Explain the differences between a material model, a physical model, and a mathematical model.

3. Present the procedure for linearizing state equations using the Taylor method.

4. Explain the relationships between a transfer-function model and a state-space model.

5. Discuss canonical forms of a linear system.

6. State the Kalman rank condition for controllability and the Kalman rank condition for observability.

7. Discuss the criteria for testing the stability of linear control objects.

8. Explain the concepts of static accuracy and dynamic quality of a control system.

9. Discuss the pole-placement method used in control-system design.

10. Explain the concept of a state observer for a dynamic system.

11. Give the definition of a real-time system and list its basic features.

12. Discuss the impact of real-time controllers on the operation of everyday devices.

13. Discuss the requirements imposed on real-time controllers.

14. Discuss the structure of the STM32 microcontroller.

15. Present the priority system and interrupt queuing in STM32.

16. Discuss the use of DMA in the STM32 microcontroller.

17. Present the purpose of using queues in the FreeRTOS system.

18. Explain the differences between a task and a coroutine.

19. Explain the concept of a decision tree. Present the advantages and disadvantages of decision trees.

20. What is the essence of how genetic algorithms operate?

21. Explain how an individual is represented in genetic algorithms.

22. Characterize the basic operators used in genetic algorithms.

23. Present the classification of signals.

24. Discuss the conditions for the existence of the Fourier transform.

25. Discuss the principle of correct sampling of analog signals.

26. What is an intelligent measurement transducer?

27. Present the classification of A/D signal-conversion methods and characterize one selected method.

28. Present the classification of D/A signal-conversion methods and characterize one selected method.

29. Give the definition of a continuous image and a digital image.

30. Describe the image-processing pipeline.

31. List and characterize the basic methods of image-quality enhancement.

32. Discuss the properties of selected morphological transformations.

33. Present the main issues related to image compression.

34. Explain the concepts of forward kinematics and inverse kinematics of a robot.

35. List and describe the selection criteria and methods for generating a robot transition trajectory.

36. Present and discuss selected parametric methods for system identification of control objects.

37. Present and discuss correlation analysis as a method of non-parametric identification of control plants.

38. Discuss the methods of communication between nodes used in ROS.

39. Discuss the structure of the workspace and a package in ROS.

40. List the stages of comprehensive automation.

41. Discuss the basic rules to be followed when handling electronic components of microprocessor systems.

42. Explain what innovation is and how it can be achieved.

43. What has the greatest influence on the correct completion of an engineering task or project? Justify your answer.

44. Discuss the issue of digital image filtering.

45. Discuss the syntax, principles of creation, and testing of designs in the VHDL language.

Specialization: Industrial Automation

1. Give the definition and operating principle of the ETHERNET and PROFINET IO network protocols.

2. Present methods for diagnosing industrial networks at the physical-layer and protocol levels for ETHERNET and PROFINET IO.

3. Give the types of PROFINET IO network devices and their tasks.

4. Discuss the elements of the FPGA structure that are particularly useful in the design of real-time controllers.

5. Discuss the process of system modeling according to diagnostic principles.

6. List the phases of the decision-making process.

7. Discuss the life cycle of an object or machine.

8. Discuss the concepts of genesis, prognosis, and technical-condition assessment.

9. Characterize the following types of failures: catastrophic, parametric, and transient.

10. Explain the essence of robotization in industrial and service processes.

11. Present methods for linearizing nonlinear control systems.

12. Discuss Lyapunov methods.

13. Discuss RT and IRT communication modes and the conditions required to start them.

14. Discuss how OPC communication is implemented in a PLC controller.

15. List and characterize the IT protocols used in Ethernet networks.

16. What is the ARP protocol and in which commonly used communication interface is it employed?

17. Give methods for identifying a PLC controller using the Profinet communication interface.

Specialization: Information Systems

1.List and describe the main elements of an expert system.

2. List and describe the properties of expert systems.

3. Present and describe the general model of a neuron.

4. Present models of artificial neural networks and describe them.

5. Present the types of learning used in artificial neural networks.

6. List the advantages and disadvantages of object-oriented programming in relation to procedural programming.

7. Characterize the relational model of databases.

8. Discuss the principles of creating a conceptual model of a relational database in Barker notation.

9. Explain what a normal form of a relation is. Describe the process of database normalization.

10. Explain the concept of a transaction in databases.

11. Present the process of designing a database application.

12. List the signals processed by A/D and D/A converters in a control system.

13. List the control methods that can be used to stabilize a dynamics model.

14. List and briefly discuss known methods of trajectory interpolation.

15. What are SLAM algorithms? Characterize this method of robot self-localization.

16.Present the classification of fault-tolerant control systems in autonomous mobile robots.

17.What are complementary filters, what are their characteristics, and give examples of such filters.