

LIST OF QUESTIONS AND ISSUES FOR THE DIPLOMA EXAM

field of study: Mechatronics

II degree studies

general academic profile

1. Give and discuss examples of applications of linear programming in practice.
2. Give examples of applications of variational calculus in mechatronics.
3. Discuss the idea of dynamic programming.
4. Explain the difference between baud rate and bit rate in UART transmission.
5. Describe the I2C communication interface.
6. Describe the SPI communication interface.
7. Describe the communication standards TTL, RS232, RS422, RS485.
8. Label the layers of the OSI model and describe their contents.
9. Draw a PLC station wiring diagram for Half-Duplex RS-485.
10. Draw the characteristics of the dependence of data rate on DP segment length.
11. What is geometric modelling in CAX systems?
12. List and characterize 3D geometric models.
13. What is multi-object modelling in CAX systems?
14. What is reverse engineering design?
15. What is meant by the concept of intelligent component, intelligent connections and bonds?
16. Discuss a selected environment for creating design documentation of mechatronic systems and devices.
17. Present the latest development trends in the design of electronic circuits and printed circuits of mechatronic systems and devices.
18. Characterize the selected environment for creating design documentation of mechatronic systems and devices (e.g. Eplan, WSCAD, SEE Electrical).
19. What does the term 'smart building/ home' mean?
20. List and briefly discuss the stages of implementation of a smart building.
21. Present the latest development trends in the design of electronic circuits and printed circuits of mechatronic systems and devices.
22. Present the principles of preparation of design documentation of mechatronic systems and devices.
23. List and describe the components of a measurement system.
24. Explain the concept of computer-integrated manufacturing.
25. Characterize the possible degrees of automation of the production system.
26. Describe the characteristics of a flexible manufacturing system.
27. List and briefly characterize rapid prototyping methods.
28. Discuss the task of simple and inverse kinematics.
29. Discuss the components and construction of manipulators.
30. Describe example tasks of industrial robots in the technological process.
31. Present methods of describing the mutual position of robot members.
32. Discuss the safety systems used in robotic production workstations.
33. Explain the idea of robotisation of industrial and service processes.
34. Explain what innovation is and how to achieve it.

35. What has the greatest impact on the correct performance of an engineering task or project? Justify the answer.

Intelligent Production Systems

- IS.1. List and briefly describe the basic structures in the LabVIEW environment.
- IS.2. Describe synchronization methods in the LabVIEW environment.
- IS.3. Describe the differences between local, global, and Shared Variable.
- IS.4. List the differences between a cluster element and an array.
- IS.5. Describe and list the elements of a measurement system.
- IS.6. Characterize the parameters of sensors, give their division.
- IS.7. Give examples of actuator systems in amateur and professional applications.
- IS.8. Give examples of control systems in amateur and professional applications.
- IS.9. Give an example of the application of mechatronic systems or systems in production lines.
- IS.10. Explain what broadcast communication is. Give an example of its use.
- IS.11. List the OSI layers. Which ones are used in CANopen?
- IS.12. What is the ARP protocol and where is it used.
- IS.13. Give the principle of defining discrete alarms in HMI devices in conjunction with a PLC.
- IS.14. Present the fundamental difference between CSMA/CD and CSMA/CA protocol.
- IS.15. Give the principle of defining discrete alarms when programming a logic PLC using an HMI.
- IS.16. List and characterise robotic system configurations.
- IS.17. Compare an asynchronous and synchronous robotic system.
- IS.18. Describe the safety systems used in robotic production workstations.
- IS.19. What is a collaborative robot and what are its types of operation?
- IS.20. Explain the term Industry 4.0. What technologies are associated with it?

Computer systems in mechatronics

- SK.1. Discuss the assumptions of finite element analysis of deformable systems.
- SK.2. Discuss the basic steps in the finite element analysis process.
- SK.3. Discuss the differences in object-oriented programming implementation of C++ and Python.
- SK.4. Explain the concepts of objective function, decision variables, area of admissible solutions.
- SK.5. Discuss a selected algorithm for minimising functions of multiple variables.
- SK.6. List the basic types of engineering materials indicating their potential importance for mechatronic structures.
- SK.7. Give examples of lightweight materials and rank them in terms of the strength-mass relationship of the material.

- SK.8. List the OSI layers. Which ones are used in CANopen?
- SK.9. Give the principle of defining discrete alarms in an HMI device in conjunction with a PLC.
- SK.10. Give the characteristics of the recessive and dominant bit in the CANopen communication protocol.
- SK.11. Describe the principle of operation of the autoregressive algorithm.
- SK.12. Describe the operating principle of the Bellman-Ford algorithm.
- SK.13. Describe the external and internal parameters of the camera.
- SK.14. List the types of 1D and 2D codes.
- SK.15. List and describe the types of OCR systems used in industry.
- SK.16. List methods of reducing power consumption of a microprocessor chip.
- SK.17. Identify and discuss the hazards of using power-saving modes of microcontroller operation.
- SK.18. Discuss power issues of mobile embedded systems.
- SK.19. Discuss the design process using Constructive Solid Geometry (CSG) techniques.
- SK.20. Discuss the use of simulation in the design process of mechatronic systems.