

LIST OF QUESTIONS FOR THE DIPLOMA EXAM

FIRT CYCLE STUDIES

MECHATRONICS

1. Types of mechatronic devices without communication
2. Types of mechatronic devices with communication
3. Examples of mechatronic solutions in everyday life
4. Present the concept of serial transmission
5. Present the concept of parallel transmission
6. Present the principles of tolerance of linear dimensions
7. Discuss the designation and description of components on assembly drawings
8. Present the basic material groups with examples of its applications
9. List and briefly characterise Newton's laws of mechanics
10. Present the equilibrium conditions of the system of forces
11. Discuss sliding and rolling friction
12. Present the principle of conservation of mechanical energy
13. What is the rms value of alternating current?
14. What are active power, reactive power and apparent power of sinusoidal alternating current?
15. Discuss the structure and principle of operation of an electrical device. Give examples of such devices.
16. Discuss the principle of operation of an electronic device. Give examples of such devices.
17. Explain the concept of track and measurement system
18. Present the structure, principle of operation of a selected measuring transmitter
19. Give rules for adjudicating ability / non-compliance with specifications
20. Describe the principle of operation of an A/D and D/A converter.
21. Discuss the principle of an ultrasonic sensor, give examples of its applications.
22. Discuss the principle of an inductive sensor, give examples of applications.
23. Characterise photoelectric sensors.
24. Discuss design principles of structural elements: strength, stiffness, stability.
25. Classify the basic elements of automation and discuss their dynamic properties.
26. List the known types of regulators and their tasks in control systems.
27. Discuss the types of connections of automation components.
28. Define IIoT, present the benefits of IIoT in industrial automation.

29. What is the flexibility and vulnerability of a process to automation? Give examples.
30. Present the structure of a PLC.
31. List and briefly characterise graphical PLC programming languages.
32. List and briefly characterise text-based PLC programming languages.
33. Discuss the PLC scan time.
34. Discuss the division of tasks between the PLC and the visualisation software.
35. What is a mechatronic drive? What components does it consist of?
36. List the types of drives and their actuators used in mechatronic systems.
37. What is an electric drive? List the basic components of an electric drive.
38. What is servo and where is it used?
39. Difference between conventional and mechatronic approaches to construction.
40. Discuss techniques used in mechatronic design.
41. Present features of mechatronic design.
42. Discuss the key components of a mechatronic system.
43. Discuss safety issues in mechatronic devices.
44. Outline the differences between the design of mechatronic devices and classic mechanical devices.
45. Outline the types of linkages found in mechanical structures.
46. Discuss the idea of parametricity in CAD systems.
47. Rapid prototyping - general principles, areas of application of rapid prototyping methods.
48. Discuss advantages and disadvantages of rapid prototyping.
49. Discuss the role of a robot controller.
50. Give advantages and disadvantages of robotic system with an autonomous robot.
51. Compare asynchronous with synchronous robotic system.
52. Characterise safety systems used in robotic processes.
53. List and briefly describe types of material feeders used in robotic systems.
54. Discuss the principle of selecting a base operation when designing a part in CAD systems.
55. Lagrange equations of the second kind. Give the formula, describe the variables and give the purpose of its application.
56. Classification of bonds of nonholonomic systems.
57. Give differences and examples of holonomic and nonholonomic systems.
58. Characterise types of motion and give examples of combinations of elements (nodes) with different degrees of freedom.
59. Present the principle for determining the mobility of planar and spatial mechanisms.
60. Characterise elements of a microprocessor system.

61. What are interrupts?
62. What is debugging and what types of debugging do you know?
63. Describe the mechanism of cooperation between the microprocessor and input-output circuits.
64. Explain what you think has the greatest impact on the correct completion of an engineering task or project.
65. Characteristics of basic groups of materials with examples of applications.
66. Definition and characteristics of composite materials.
67. Functional materials (e.g. electric, magnetic, piezoelectric, shape memory)
68. What is a central processing unit? Introduce the concept of a programme stored in memory.
69. What are programming languages? Present the division of programming languages.
70. What is a database? Give examples.

FIELD OF STUDY: Intelligent structures

1. Discuss the input and output signals of sensors and actors. Give some examples of sensors and actors.
2. Discuss the roles of a microprocessor in a mechatronic device.
3. Discuss the methodology for designing a mechatronic device using the V-model.
4. Provide the definition and discuss advantages of CAD.
5. Outline the key elements and advantages of CAM.
6. Discuss the criteria for selecting a CAD/CAM system.
7. Discuss the role of the objective function in optimisation problems using the example of mechatronic components
8. Discuss similarities and differences in structural optimisation using mechanical and mechatronic approaches.
9. What is the difference between single and multi-criteria optimisation using mechatronic systems as an example.
10. What is a mobile robot and what are the recommendations when building it?
11. Compare wheeled and tracked chassis systems.
12. Classify and describe types of walking robots considering the type of stability and the number of legs.
13. What is the problem of mobile robot navigation?
14. List global motion planning methods for mobile robots and describe one of them in details.
15. Characterise communication over the I2C bus.
16. Characterise the CAN bus.
17. List and characterise the SPI bus modes.
18. List systems that can be controlled in a smart home.

19. List and describe steps in the implementation of a smart home.
20. Discuss communication standards in smart homes.
21. Describe the process of designing a control system.
22. Discuss the architectures of control systems of mechatronic systems that you are familiar with.
23. Discuss the process of selecting the type of controller for a given control object and the set quality requirements.
24. Discuss the types and methods of implementing the anti-windup function.