

Problem topics for the **State Bachelor Exam**
study field "*Information and Automation Technology*"

Instrumentation Technology in Automatic Control

1. Measurement chain, Measurement uncertainties, sampling in time and amplitude
2. Methods of sensor resp. converter output evaluation. Bridge methods. Unified signal
3. Measurement of geometric dimensions, position, speed, acceleration. Principles and design of sensors. Applications.
4. Static and dynamic properties of sensors, systems and instruments. Dynamic error, bandwidth
5. Liquid level and pressure sensors, types of sensors and their properties. Measurement of gases and liquids flow, types and properties of those sensors.
6. Temperature and heat sensors, Sensors types and their properties. Electrical connection of temperature sensors.
7. Sensors for humidity, liquid analysis, types and properties of those sensors.
8. Electromagnetic compatibility, principles for electrical connection of measuring and control systems. Electrical properties of metallic transmission line.
9. Ideal operating amplifier, basic properties, inverting, noninverting, summation and integration amplifier, their applications
10. Computer connection with environment, Digital inputs and outputs, voltage, current and power accommodation. A/D and D/A converters, basic principles of conversion, block diagrams, flow chart of their function.
11. Architecture of monolithic microprocessors, basic building blocks. Embedded systems, process connection, examples of integrated peripherals (as family i8051)
12. Programming of microcomputer systems. Assembler, language "C". Methods of operating peripheral devices
13. Signal filtering, basic types of analog filters, their characteristics, transmission applications.
14. Logical elements. Relay, discrete and integrated logic. Basic elements used in combinational and sequential logic.

15. The 2 and 3 step controllers
16. PID controller, equations, analog and digital implementation. Experimental methods of setting parameters of PID controllers, (critical gain, transient characteristics)
17. PLC - structure, work principle, example of minimal systems (Siemens LOGO), standard IEC 1131.
18. Application design with PLC and visualization (procedure for designing control application with PLC and visualization, SCADA system Reliance)
19. Compressed air preparation, treatment, distribution. Basic sets of components for the pneumatic applications in the industrial automation.
20. Pneumatic and hydraulic schemes symbols. FluidSIM software and its application. Fundamentals of electrohydraulic. symbolic, diagrams, typical elements.
21. Pneumatic actuators. Piston and membrane drives. Pneumatic directional valves (way valves), symbolic, application areas. Pneumatic motors (basic and special types, application areas). Design of application using one and two pneumatic motors.
22. Pneumatics systems. Elements for logic operations, counter, timer and their using for control (blocking, more places handling etc.)
23. DC motor. Principle. Powering, equation. Characteristics. Working modes.
24. Synchronous and stepper motor. Principle. Powering. Characteristics. Working modes.
25. Induction motor. Principle. Powering of IM. Characteristics. Working modes.
26. Motion electromagnet. Principle. Function. Derivation of force.
27. Driving and transmission systems used in instrumentation. Types of worm gears and ball screws.
28. Magnifier: image forming, magnification, field of view, resolving power, types
29. Microscope: image forming, magnification, resolving power
30. Refractive telescopes: types, magnification, resolving power, exit pupil.