



## Topics for Acceptance Test

# Mechatronics

1. Fundamentals of mathematical analysis: limits of functions, single variable differential and integral calculus, Taylor and Fourier series, analytical solution of linear differential equations.
2. Fundamentals of electric circuit theory, basic elements of electrical circuits, electric power and energy, direct current (dc) and alternating current (ac) circuits, sinusoidal steady-state analysis in ac circuits, power in ac circuits, single phase and three phase systems, resonance, ideal transformer.
3. Physical definition of basic circuits quantities (voltage, current), Kirchoff's laws, Thévenin's and Norton's theorem.
4. Bipolar and unipolar transistors.
5. Operational amplifiers (ideal operational amplifier, static and dynamic parameters of real operational amplifiers), fundamental operational amplifier circuits.
6. Measurement of the basic electrical quantities in single phase and three phase systems (voltage, current, power, electrical energy, electrical resistance, impedance, admittance, frequency, phase).
7. Measurement of temperature: resistance thermometers, thermocouples and thermistors, pyrometry, thermovision. Time constant of a thermometer. Measurement of other process variables: pressure, liquid level, flow.
8. Measurement of the kinematical and kinetic quantities in mechanics of the solids and flexible bodies (linear and angular displacement sensors, velocity and acceleration sensors, force and torque sensors, tensiometers).
9. Fundamentals of digital logic circuits, combinational and sequential (synchronous and asynchronous) circuits, optimization and simplification of logic functions, Karnaugh's map.



10. Architecture of PLC (Programmable Logic Controller) systems, typical functionalities of PLC systems, PLC software architecture and programming according to IEC 61131 standard.
11. Continuous time linear dynamic systems, input-output models of linear systems: differential equations, Laplace transform transfer functions, frequency response. The notion of stability of linear systems, stability criteria: Hurwitz criterion and Nyquist criterion.
12. Computer simulation of dynamic systems and the most important software tools (Matlab, Simulink).
13. Feedback control, PID controllers, tuning of PID controllers, digital implementation of PID controllers. On/off and three position controllers. Gain scheduled PID controllers.
14. Feedforward control for disturbance rejection, cascade control, time delay compensation.
15. High level programming languages (like C, Java, Python) implementation of single numeric data types, structured data types – arrays, records and sets. elementary algorithms of data sorting. input-output operations. files operations.
16. Typical structure of a program in a high-level language: functions, procedures, macros. global and local variables.
17. Local area computer networks, ethernet technology, its principle and development. wireless local area network standard IEEE 802.11.
18. Internet architecture. fundamental principles of relevant protocols (IP, TCP, UDP). IP address, DNS system.