MECHATRONICS FINAL EXAM FOR MECHATRONICS ENGINEERING BSC:

- *Electrotechnics and electronics I-II.*
- *Basics of Mechatronics*
- *Mechatronics I-II.*
- *Measurements and automatics I.-II.*
- *Programming and Digital Technics I.-II.*
- *Programmable logic controllers I.*

Programmable logic controllers I.

1. Describe the construction of PLC! Draw the architecture of PLC!
2. Please make list about extension properties of input modules (V, I, T, t, RTD, TC, HSC)
3. Please make list about extension properties of output modules.
4. Describe the operation set of structured text programming language!
5. Describe at least six logic operators that can be used in PLC programming (symbols, algebra, ladder diagrams).

Electrotechnics and electronics I-II.

1. In case of building a high-performance power supply, how could you realize a circuit of a given rectifier?
2. There is given an electrical machine with its loss parameters (transformer, synchronous motor, asynchronous motor). Draw the equivalent circuit of the electrical machine and write the equations of a known circuit analysis method (Kirchoff's laws, mesh analysis, nodal analysis)!
3. Describe a taught electrical circuit that is able to revers the rotation of an electric motor! Explain further application opportunities of the circuit in case of electrical drives.
4. In case of a given logic network, write down the circuit's truth table! Simplify the logic function applying the Karnaugh table and design a logic network for the simplified logic function with AND, OR, NAND, NOR!
5. How can you realize control elements with operational amplifiers? (adding, subtracting, proportional, integrator, differential). Write an application example, where you would apply control engineering basic element.

Programming and Digital Technics I.-II.

1. Describe (with schematic) the microcontroller based, time-multiplexed control of 4 digit, 7-segment display.
2. Describe multiplexers! How to build MUX 4x4, using MUX 2x1?
3. Describe the full adder structure, using half adders! Describe the truth. How to make parallel implementation of adders?
4. Describe the conversion of binary numbers to BCD! Introduce the ShiftAdd3 algorithm with flow chart and block diagram!
5. Show the software implementation of switch debouncing using microcontroller (MCU)! Prepare flow chart for MCU! How to make code, what is able to could switch press?
6. Describe the UART, SPI and I2C communication interfaces. Show the state machine for UART communication! Describe the UART functions can be used used in MCU-s!

Mechatronics I-II.

1. A 2500 kg car jack assuming compare what would be the advantages and disadvantages of electro and electro-hydraulic solution!
2. What kind of practical solutions would implement an electro-pneumatic and electro-hydraulic circuit, four each in different positions to move 800 mm long stroke cylinder!
3. A new industrial process to achieve the expansion of the existing pneumatic system is needed. In the selection of air preparation units, what aspects should be taken into the production of high-quality air!
4. What are the influencing factors that lead to a hydraulic actuator broken / not perfect functioning. Make a chart and describe the appearance of errors.
5. How and what tools need to realize a forest ripping machine? Explain your answer!

Measurements and automatics I-II.

1. What kind of sensors uses for measure the liquid level in industrial processes? Describe the operating principle of the sensor type selected.
2. What aspects would you choose an industrial measurement system? What are the principles which should be considered in the Metrology?

3. Describe the with practical examples of the control and feedback control! Please make an effects sketch of the processes, explain the differences.

4. What are the principles, methods that a control system status can be determined, be describe?

5. Why do we need in an industrial process control as simple as possible to implement the logical connections? Show us Min terms and Max terms form of solution through an example.

Basics of Mechatronics

1. Basic concepts, mathematical description of physical phenomena: real physical system, definition of signal, group the systems by the number of inputs and outputs, definitions of linear and non-linear systems, definition of parameter and variable.

2. Basic concepts, mathematical description of physical phenomena: theory of distributed and concentrated parametric description, description of deterministic and stochastic systems, concept of causality, the concept of static systems and dynamic systems.

3. Describe the basic elements of Bond Graph, provide example from mechanical, electrical domains!