FINAL EXAM TOPICS

(Electrical Engineering BSc Program)

- for the students from 2019. subject curriculum;
- and for those EE BSc students who do not have a Neptun signature and grade on TTFBS1200 (TTFBS1200_L) Electrical Engineering Fundamentals Exam subject.

Main subject

ELECTRICITY 1.:

1. **Fundamental elements of electric circuits:** passive and active two-poles, fundamental connections of passive two-poles, Thevenin's and Norton's models of generators, equivalence of generators, characteristics of generators, efficiency of generators, electric power, Ohm's law, Kirchhoff's laws

2. **Fundamental theorems of complex circuits:** simple and complex voltage and current dividers, principle of linear superposition, Thevenin's theorem, Norton's theorem, Millmann's theorem, bridge connection, wye-delta and delta-wye transformations.

ELECTRICITY 2.:

3. **Alternating-current RLC circuits:** fundamental parameters of sinusoidal signals, linear and quadratic means of alternating signals, interpretation of complex signals and impedances, phasor diagrams, phase conditions of serial and parallel RLC circuits, resonance.

4. **Three-phase circuits:** operational principle of three-phase generators, fundamental connections of three-phase circuits, definitions of line and phase quantities and their relationships, powers of three-phase circuits.

5. **Magnetic circuits:** magnetic Ohm's law, structure and operational principle of transformers, operational states of transformers, losses of transformers, main parameters of transformer design.

ELECTRICITY 3.:

6. **Analysis of signals and systems in the time and frequency domains:** special signals (unit-step function, unit-impulse function, Dirac-impulse), excitation-response relations given by convolution, Fourier-series, Fourier-transform, Laplace-transform, transfer characteristic, transfer function.

ELECTRONICS:

7. Semiconductor diodes (physical operation, U-I characteristic, internal capacities, models, temperature dependence). Diode types and their applications.

8. Simple diode circuits (rectifiers, voltage stabilizers, limiters). Analysis of connections using diode models.

9. Bipolar transistors (physical operation, large and small signal models, main parameters, input, transfer and output characteristics, internal capacitances, and their effects on frequency characteristics).

10. Single-stage BJT amplifier (biasing and amplification principle, basic amplifier circuits: CE, CB, CC).

11. MOSFET (physical operation, models, main parameters, input, transfer and output characteristics, internal capacitances, and their effects on frequency characteristics).

12. Transistor operation as a switch (BJT and MOSFET, operating point setting, characteristics).

13. Ideal operational amplifiers. Inverting and non-inverting basic circuits and characteristics. Non-ideal op amp parameters.

14. Functional operational amplifier circuits (summing, subtracting, integrating, differentiating, precision rectifiers).

DIGITAL ELECTRONICS:

15. Design procedure of combinational logic: minterms, maxterms, simplification of expressions by the use of algebraic methods and K maps. Hazards in combinational logic.

16. Basic storage devices: cross-coupled inverter pair, RS and S`R` latch, D latch and D flip-flop.

17. Fundamentals of state machine design: Mealy and Moore state machines, main building blocks of state machines, State diagram, state transition diagram, state encoding.

18. Basics of hardware description languages: historical overview, application examples, implementation of combinational logic using HDLs.

INTRODUCTION TO MEASUREMENTS AND INSTRUMENTATION:

19. Determination of the measurement result and estimation of its uncertainty by multiple measurements. Estimation of the uncertainty of a single measurement based on the known properties of the measuring instrument. Possible ways of measuring resistance.

MEASUREMENTS AND INSTRUMENTATION:

20. Analog-to-digital, digital-to-analog converters: basic principles, methods, parameters, applications.

21. Methods and modes of data transmission in computer-aided data acquisition systems, serial and parallel communication protocols.