QUESTIONS FOR FINAL EXAMS

Main questions

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, the 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 characteristics, internal capacitances, models, temperature dependence). Types of diodes and their applications.

8. Semiconductor diode types and their applications. Simple diode circuits (rectifiers, voltage stabilizers, limiters). Analysis of circuits using diode models.

9. Bipolar transistors (physical operation, high and low signal modeling, characteristic parameters, transfer and output characteristics, internal capacitances and their effects).

10. Applications of single-stage BJT amplifiers (working point setting and gain principle, basic amplifier connections: CE, CB, CC).

11. MOSFET (physical operation, modeling, characteristic parameters, transfer and output characteristics, internal capacitances and their effects).

12. Switching applications of transistors (BJT and MOSFET, operating point adjustment, characteristics, features).

13. Ideal operational amplifiers. Inverting and non-inverting, different circuits and characteristics. Non-ideal operational amplifier parameters.

14. Operation of functional operational amplifier circuits (summing, subtracting, integrating, differentiating, precision rectifiers).

DIGITAL ELECTRONICS:

15. Design procedure of combinational logic: min terms, max terms, simplification of expressions using algebraic methods and K maps. Hazards in combinational logic.

16. Fundamental 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, examples of usage, realization of combinational logic using HDLs.

INTRODUCTION TO MEASUREMENTS:

19. Determining the measurement result and estimating its uncertainty using repeated measurements. Estimation of the uncertainty of a single measurement given the properties of the measuring instrument. Possibilities of resistance measurement.

MEASUREMENTS AND INSTRUMENTATION:

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

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