

DIGITAL TECHNICS
State examination 2021

Topics

Logic (Boolean) algebra, logic operations and functions. Combinational logic, analysis and synthesis and implementation of logic circuits.

Description of logic connection: textual, algebraic form, truth table, logic diagram. Boolean algebra: axioms and theorems. Fundamental logic operations.

Two-variable logic functions. Fully and incompletely specified logic functions. Canonic forms of logic functions. Disjunctive (sum-of-products, SOP), conjunctive (product-of-sum, POS) canonic forms, minterms and maxterms.

Manipulation and transformation of logic functions. Graphic representation: Veitch diagrams and Karnaugh maps).

The concept and methods of logic function minimization. Numerical/tabular minimization, Quine-McCluskey algorithm, graphic minimization. Minimization of incompletely specifies logic functions. Symmetric logic functions, XOR logic.

Effect of signal propagation delays on the operation of combinational logic networks. Static hazards (glitches) and their elimination. Functional hazards and their elimination.

Number systems, fundamentals. Binary numbers, pure binary codes (direct, 1s complement, 2s complement codes). Arithmetic operations in 1s and 2s complement codes. Tetrad codes, BCD codes. Arithmetic operations in tetrad and BCD codes.

Digital logic functional building blocks. Encoders and decoders. Simple code changing combinational circuits. Binary/BCD and BCD/binary decoders, Gray code. Error detection, parity bit. Multiplexers, demultiplexers, comparators, arithmetic elements, half-adder, full adder.

Realization of combinational circuits using memory elements. Programmable logic devices, PLDs. Logic design using multiplexers.

Sequential logic circuits, fundamental models and properties. State transition tables, state transition diagrams, excitation tables. Asynchronous and synchronous operation.

Elementary sequential circuits: flip-flops. RS, JK, D, G-D, and T type flip-flops.

Sequential functional blocks: registers, register-based counters, asynchronous and synchronous counters.

Synchronous sequential circuit synthesis based on next state tables.

Logic circuits basic principles (logic families, inverter). FET (MOS and CMOS) circuits and basic gates. CMOS logic, principles, basic CMOS gates, compound gates, pass transistor logic.

Bipolar (saturated logic) circuits, TTL and Schottky TTL circuits.

BiCMOS circuits, ECL circuits. General comparison and evaluation of different logic circuits and technologies.

Semiconductor memories. Classification, technologies, properties and applications.

Arithmetic logic unit and microprocessors. Carry-look ahead and carry select adders, parallel multipliers. Series arithmetic circuits: adders and multipliers. Arithmetic logic unit: structure and properties.

Microprocessor. Elementary concepts, structure, bus system, operation, handling of peripheries, interruption system.