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Detailed syllabus
DIGITAL LOGIC CIRCUITS

UNIT I - NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES

Introduction to digital electronics - History of digital system, Basics of digital electronics, Digital revolution. **Introduction to number system** - What is number system?, Types of number systems. **Different types of number system** - Binary number system, Decimal number system, Octal number system, Hexadecimal number system. **Number base conversion** - Binary to decimal conversion, Conversion of octal number systems, Conversion of hexadecimal number systems. **Signed binary numbers** - Representation of binary numbers. **Arithmetic operations** - Binary arithmetic, Negative numbers in 1's complement form, and Negative numbers in 2's complement form, Binary multiplication, Binary division, Hexadecimal arithmetic. **Binary codes** - Binary codes, BCD (Binary Coded Decimal) code, Excess-3 code, Gray code, Gray to binary and binary to gray code conversion, Five-bit BCD codes. **Error detecting and correction codes** - Error detection, Error correction. **Introduction to Digital ICs** - Introduction to digital logic family, Logic families, CMOS logic levels, Specifications of digital ICs. **RTL logic family** - RTL circuits. **DTL logic family** - Diode Transistor logic (DTL). **Introduction to TTL logic family** - Transistor Transistor Logic (TTL), 3-input TTL NAND Gate, Input and Output Currents Fan-out, Standard TTL Characteristics, High-Speed (H) and Low-Power (L) TTL, Schottky TTL, Comparison of TTL Series Characteristics, Open Collector Output, Wired-AND Connection, Tri-state Gates, TTL NOR Gate, Comparison of TTL Series Characteristics. **Emitter Coupled Logic (ECL)** - Introduction to ECL, Basic ECL Circuit, ECL OR/NOR Gate, ECL 10K Family, ECL 100 K Family, Interfacing CMOS and TTL with ECL Gates. **MOS logic families** - Introduction to MOS transistor, MOS Logic Families. **Comparision between different logic families** - Comparision between different logic families.

UNIT II - COMBINATIONAL CIRCUITS

Introduction to Combinational circuit - Combinational circuit, Introduction of Design Procedure. **Boolean expression** - Boolean expression, Sum of Product Form, Product of Sum Form, Standard SOP and POS Forms, Converting expressions in Standard SOP or POS Forms, M-Notations: Minterms and Maxterms, Complements of Canonical formulae. **Minimization of Boolean expression** - Minimization of Boolean expression. **Karnaugh (K) map** - Introduction of Karnaugh (K) map, Variable of K - map, Plotting a Karnaugh map, Grouping cells for simplification. **Simplification of SOP And POS Expressions** - Simplification of SOP Expressions, Incompletely specified Functions (Don't Care Terms), Describing incomplete boolean function, Don't Care conditions in logic design, Minimization of incompletely specified Function, Simplification of POS Expressions, Five variable K-map. **Realization of Boolean expression with logic gates** - Implementing the expression with logic gates, Implementation of SOP boolean expression, Implementation of POS boolean expression, NAND – NAND implementation, NOR – NOR implementation, Multilevel gate implementations, Multilevel NAND and NOR implementation. **Multiplexers** - What is a multiplexer (MUX), 74XX151 8 to 1 multiplexer, 74XX157 Quad 2-Input Multiplexer, 74XX153 Dual 4 to 1 multiplexer, Expanding Multiplexers, Application of Multiplexer. **Demultiplexers** - Introduction of demultiplexer, Introduction of 1 to 16 demultiplexer, IC 74X154 1 to 16 demultiplexer. **Code converters** - Introduction of code converter, Binary to BCD converter, BCD to Binary converter, BCD to Excess-3, Excess-3 to BCD code converter, Binary to Gray code converter, Gray Code to Binary code converter, Introduction of BCD to Gray code converter, Introduction of Gray

to BCD code converter. **Adders** - Half adder, Half adder using NAND gates, Half - adder using NOR gates, Introduction of full adder. **Subractors** - Half subtractor, Introduction of Full subtractor.

UNIT III - SYNCHRONOUS SEQUENTIAL CIRCUITS

Sequential logic circuits - Introduction to sequential logic circuits. **Flip-flops** - Introduction to flip-flop, Preset and clear inputs, Clocked D flip-flop, JK flip-flop, JK flip-flop using NAND gates, Race-around condition. **Master slave flip-flops** - Master-slave JK flip-flop, Master-slave SR flip-flop, Clocked D flip-flop, Clocked T flip-flop, Flip-flop characteristics, Characteristic equations of flip-flops, Flip-flops as finite state machines, Flip-flop excitation table. **Counters** - Introduction of counters, Asynchronous counters, Asynchronous/ripple down counter, Asynchronous up/down counter, IC 7492/93 (4-bit ripple counter), Introduction of decoding gates, Problem faced by ripple counters (glitch problem), Synchronous counters, Synchronous vs asynchronous counters, Synchronous counter (IC 74191), Changing the counter Modulus, Decade counters, Presettable counters, Counter design as a synthesis problem, Application-digital clock. **Mod-N counter** - Modulo-n counter, Mod-3 counter. **Shift registers** - Introduction of shift registers, Shift registers, Serial-in serial-out shift register, Serial-in parallel-out shift register, Bidirectional shift register, Parallel-in serial-out shift register, Parallel-in parallel out-shift register, 4-bit parallel access shift register (7495), Parallel access shift register (74195), Register with reset facility, Applications of shift registers. **Design procedure** - Design procedure. **Mealy and Moore model** - Mealy and Moore machine representations, State machine notations. **State reduction and state assignment** - State reduction, State assignment. **Design of synchronous counter** - Design of synchronous counter, Design of a synchronous 3-bit up-down counter using JK flip-flops, Design of a synchronous modulo-6 gray code counter, Design of a synchronous modulo-10 gray code counter, Design of a synchronous BCD counter using JK flip-flops.

UNIT IV - ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES

Design of asynchronous sequential circuits - Design of asynchronous sequential circuits. **Reduction of state and flow tables** - Reduction of state, Flow table. **Races** - Races. **Free state assignment** - Free state assignment, Shared row state assignment, One hot state assignment. **Logic Hazards** - Hazards, Design of hazard free switching circuit. **Analysis of asynchronous sequential circuits** - Analysis of fundamental mode sequential circuit. **Programmable logic devices (PLD's)** - Introduction of Programmable Logic Devices (PLDs), Programmable Read Only Memory (PROM), PLA(Programmable Logic Array), Programmable Array Logic Devices.

UNIT V - VHDL

Introduction to VHDL - Introduction to VHDL, Structure of verilog module, Important points to remember while representing any module using Verilog HDL. **RTL design** - RTL design process. **HDL for combinational logic** - HDL for combinational circuits, Structure of the data flow description, Signal declaration and assignment statement, Execution of assignment statement, Data type – vectors, 4-bit Ripple-Carry and Carry-Look ahead Adder, Structure of the HDL behavioral descriptions, Sequential statements, Loop statement, While – loop statement, Repeat statement, Forever statement, Gate Level / Structural description. **HDL for sequential logic** - Description of D-latch, Description of Flip-flops, Description of sequential circuits, Description of Moore circuit, HDL for registers and counters,

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Descriptions of registers in Verilog HDL, Structural model of a universal shift register, Description of counters. **Operators in VHDL** - Operators in Verilog HDL, Verilog data types. **Packages** - Packages. **Subprograms** - Subprograms, Function definition, Procedure definition, Language aspects of subprograms, Nesting subprograms. **Testbenches** - Testbenches, Half adder testbench. **Simulation/Tutorial examples** - Design of multiplexers, Design of counters, Design of full adders, Design of demultiplexer, Design of flip-flops, Design of FSM.