CLUSTER UNIVERSITY SRINAGAR

SYLLABUS (FYUP UNDER NEP 2020)

Offered By Department Of ELECTRONICS

Semester 2nd (Major Course)

Course Title: Digital Electronics

Course Code: UGELT22J201 **Max. Marks 100**
Credits: 4 (Theory: 3, Practical: 1) **Theory External: 60; Min Marks: 24**
Contact Hrs: 75 (Theory: 45, Practical: 30) **Theory Internal (Continuous Assessment): 15 Marks, Min Marks: 06**
Practical Experimental Basis= 15, Min. Marks: 06
Practical Experimental (Continuous assessment) = 10, Min. Marks: 04

Objectives:

- To learn and understand different types of number systems.
- To understand the operations of logic gates so as to use in many circuits like a push button lock, light activated burglar alarm, safety thermostat, an automatic watering system etc. Digital communication cannot happen without logic operations.
- To learn the basic laws of Boolean algebra and representation of Boolean expressions.
- To analyze and simplify the digital logic circuits using Boolean Algebra.
- To reduce the gate count of a design using Boolean Functions.
- To represent a truth table as a Boolean function in SOP and POS forms.
- To generate a Boolean function from truth table.
- To K-Map to simplify a Boolean function.
- To understand the operation and design of various combinational logic circuits.
- To process two or more inputs to generate at-least one output signal based on the logic function of each logic gate using Combinational Logic.
- To understand the operation and design of various sequential logic circuits.
- To construct finite-state machines, a basic building block in all digital circuitry.

Learning Outcomes:

By the end of this course, the students will be able:

- To identify the extent to which there is a need to limit an entity via Number System.
- To do interconversion and arithmetic so that numbers can easily represent and interpret the information in the form of numbers.
- To understand the concept of place value (ones, tens, hundreds).
- To perform the basic functions like addition and subtraction with simpler digits i.e., up to three-digit numbers.
- To understand that Decimal Number System is easily readable, used by humans, and easy to manipulate.
- To learn that there is a one-to-one relationship between logic gates and Boolean expressions.
- To learn how logic gates are used to evaluate Boolean expressions to produce a result.
- To explain digital system concept and design fundamental digital systems.
- To Use truth tables and laws of identity, distributive, commutative, and domination.
- To build reconfigurable digital circuits.

UNIT – I **(15 Hrs)**

Number System and Codes: Decimal, Binary, Octal and Hexadecimal number systems, Base conversions. Representation of signed and unsigned numbers, Binary, Octal and Hexadecimal arithmetic; Addition, Subtraction by 2's Complement method, multiplication, BCD code.

Logic Gates: Truth Tables of OR, AND, NOT, NOR, NAND, XOR, XNOR Gates, Universal Gates.

UNIT – II **(15 Hrs)**

Boolean Algebra: Basic postulates and fundamental theorems of Boolean algebra.

Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).

Combinational Logic: Adders (Half and Full Adder). Subtractors (Half and Full Subtractor), Multiplexers, Demultiplexers, Decoders, Encoders, Implementation of Logic Functions with Multiplexers.

UNIT – III **(15 Hrs)**

Sequential Logic: Flip-Flops - SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops, Race-around conditions in JK Flip-Flop, Master-slave JK Flip-Flop.

Shift registers - Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

Counters (4 bits) - Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.

Programmable Logic Devices: Basic Concepts, ROM, PLA, PAL, CPLD, FPGA.

PRACTICAL (Digital Electronics Lab) **(30 Hrs)**

At least 06 experiments from the following:

Digital circuits (Hardware)

1. To Verify and Design AND, OR, NOT and XOR Gates using NAND Gates.
2. To Convert a Boolean Expression into Logic Gate Circuit and design it using Logic Gate IC's.
3. Design Half and Full Adder.
4. Design Half and Full Subtractor.
5. To design a seven-segment decoder.
6. Design 4 × 1 Multiplexer using Gates.
7. To Build Flip-Flop Circuits (RS, Clocked RS, D-type) using Gates.
8. Design Counters using Flip-Flop.
9. Design Shift Register and Study Serial and Parallel Shifting of Data.

Simulations using MULTISIM/Any other simulation software

10. Simulate basic logic gates.
11. Design and simulate binary half/full adder using basic logic gates.
12. Design and simulate a clocked SR Flip-Flop using NAND/NOR Gates.
13. Design and simulate a 4-bit asynchronous counter using Flip-Flops

Recommended Books:

Mano and Ciletti, Digital Design: With an Introduction to Verilog HDL, Pearson.
Flyod, Digital Fundamentals, Pearson.
Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw Hill.
Digital Systems: Principles & Applications, Tocci, Widmer, Moss, Pearson.