Electronics: Digital Devices and Basic Logic (40S)

Instructor: Mr. Pulver
Contact: Pulver.Joe@bsd.ca
Course Code: EXA40S
Credit: 1.0
Prerequisite: Introduction to Electronics Technology (20S) Recommended
Suggested Grade Level: Grade 10, 11 or 12
Delivery Format: Classroom instruction, simulation software, breadboarding, and project-based learning

Course Description

This course introduces students to digital logic concepts, binary systems, and fundamental combinational circuit design. Students explore the use of logic gates, number systems, truth tables, and Boolean algebra to design and analyze digital systems. Hands-on labs using ICs and simulations reinforce key theoretical principles.

General Learning Outcomes (GLOs)

- Understand the binary number system and digital vs. analog signals.
- Analyze logic gates and create truth tables for combinational circuits.
- Simplify logic expressions using Boolean algebra and Karnaugh maps.
- Design and build basic combinational circuits using logic ICs.
- Interpret and construct timing diagrams for simple circuits.
- Develop basic troubleshooting skills using digital probes and simulators.
- Work collaboratively and safely in a lab setting.

Unit Breakdown

Unit 1: Introduction to Digital Systems

- Analog vs. digital signals
- Digital applications in electronics
- Binary states and logic levels

Unit 2: Number Systems & Conversions

- Decimal, binary, octal, hexadecimal
- Conversions between number systems
- Signed vs unsigned binary

Unit 3: Logic Gates and Truth Tables

- Basic gates: AND, OR, NOT
- Universal gates: NAND, NOR
- Exclusive gates: XOR, XNOR
- Building truth tables

Unit 4: Boolean Algebra and Simplification

- Boolean expressions
- Laws of Boolean algebra
- De Morgan's Theorems
- Simplifying using Karnaugh maps

Unit 5: Combinational Circuit Design

- Designing logic circuits from word problems
- Simulating combinational logic
- Implementing designs on breadboard

Unit 6: Timing and Signal Behavior

- Understanding timing diagrams
- Signal propagation and logic probes
- Switch debouncing

Unit 7: Circuit Construction and Troubleshooting

- Using IC datasheets
- Breadboarding logic circuits
- Systematic troubleshooting methods

Unit 8: Capstone Project

- Students design, simulate, build, and present a fully functional digital circuit (e.g., digital lock, voting machine, binary counter)

Assessment

- Theory & Lab Work 60%
- Employability Skills 10%
- Capstone Project 30%

Resources

- Tinkercad Circuits for logic simulation
- Breadboards, logic ICs (74xx series)
- Oscilloscope and logic probe
- Digital Electronics Texts (e.g., Tokheim or Floyd)
- Karnaugh Map templates and online simplification tools