WOLLO UNIVERSITY
KOMBOLCHA INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHATRONICS ENGINEERING

Course Number: McEng 3274	**Credit Hours:** 3
Course Title: Digital electronics **INSTRUCROR :** GETAHUN A.	**Contact Hours:** 2 Lecture hrs and 2 Lab. Hrs ECTS 5

Course Objectives:

The course enables the student understand how mechanical system is integrated with computer control and electronics to design Microprocessor / Microcontroller / PLC based Mechatronics Engineering system. It is essential to have the fundamental knowledge of digital circuits and design of digital systems. Hence the subject digital electronics is offered in which they study the design of Arithmetic circuits, shift registers and counters etc.

Course Description:

Study of the working and implementing of the systems covering the following listed below:

1. Knowledge about minimization techniques in digital systems.
2. Demonstrate understanding of Boolean algebra and basic logic gates.
3. Ability to implement simple logical operations using combinational logic circuits.
4. Design and development of serial and parallel binary arithmetic circuits.
5. Know the need and available methods of triggering mechanisms in sequential circuits.
6. Design and implement the synchronous and asynchronous up/down counter with the help of sequential circuits.
7. Acquaintance with basic concepts, need, types and applications of memory devices.
8. Understand the principle and types of programmable logic devices.
9. Knowledge about the use of algorithmic state machine.
10. Ability to design, analyze and implement fundamental mode and pulse mode circuits.

Course Outline:

UNIT I

NUMBER SYSTEM AND BASIC LOGIC

Number systems – Binary, Octal, Hexadecimal, BCD, Complements Conversions and Arithmetic. Boolean theorems, Boolean algebra – AND, OR, NOT, NAND & NOR operation, Sum of Product and Product of Sum forms. Minimization – Kamaugh's map, Tabular Minimization techniques: Boolean postulates and laws, De-Morgan's Theorem, principle of duality, boolean expression, minimization of boolean expressions, minterm, maxterm, Don't care conditions, Quine-McCluskey method of minimization.

UNIT II

COMBINATIONAL CIRCUITS

Design of Logic gates. Design of Adder, Subtractor, Comparators, Code Converters, Encoders, Decoders, Multiplexers and Demultiplexers. Function realization using Gates & Combinational circuits, Flip-Flops, registers and counters, Parity checker, parity generators, mangnitude comparator, Analog to Digital and Digital to Analog Conversion.

UNIT III

SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS

Flip flops – SR, D, JK and T. Analysis of Synchronous Sequential circuits, Design of Synchronous Sequential circuits, Counters, Shift registers, State diagram, State reduction and State assignment.

Stable Unstable states, Output Specifications, Cycles and Races, Race free assignments, Reduction of State and Flow tables, Hazards.

UNIT IV

MEMEORY, PROGRAMMABLE LOGIC DEVICES AND LOGIC FAMILIES

Classification of memories, ROM, PROM, EPROM, EEPROM, RAM, Write operation,

read operation, memory cycle, timing wave forms, static RAM cell, Dynamic RAM cell, Programmable Programmable logic devices, Programmable logic array (PLA), Programmable array logic (PAL), field programmable fate arrays (FPGA), Implementation of combinational logic circuits using ROM, PLA, PAL.

UNIT V
FUNDAMENTALS OF COMMUNICATION ENGINEERING

Types of Signals: Analog and Digital Signals, Modulation and Demodulation:

Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (BlockDiagram Approach only).

Textbook:

1. M.Morris Mano, "Digital Design", third edition, Prentice Hall of India Pvt. Ltd., 2003.

2. Charles H.Roth, "Fundamental logic design", Jace Publishing, fourth edition, 2002.

3. Floyd, "Digital Fundamentals", eigth edition, pearson edition, 2003.

4. John F.Wakerly, "Digital Design Principles and Practice", third edition, pearson education, 2002.

5. John M.Yarbrough, "Digital Logic Applications and Design", Thompson Learning, 2002.

Pre-Requisites: McEng 3362 – Electrical Machines and Drives

Laboratory Exercises:

Implementing simple digital logic systems and signals analysis using MATLAB / LabVIEW.

Evaluation:

- Assignments 10%,
- Laboratory 10%,
- Mid exam 30%
- Final exam 50%