DIGITAL ELECTRONICS

Course Code: BECSE2C026
Course Title: Digital Electronics
Semester: IV
Credits: 04 (03 Theory and 01 Lab)

Rationale

Digital Electronics imparts a fundamental understanding of binary systems, Boolean algebra, and digital circuits. The subject equips students with skills vital for designing and troubleshooting digital systems, laying the groundwork for them in electronics, computer science, and information technology.

Course Outlines

Contents	No. of Lectures
Unit - I **Basic Concepts of Boolean Algebra:** Number systems: Binary, Octal, Decimal, Hexadecimal, conversion from one to another, complement arithmetic, fixed point and floating point number system, Signed and unsigned numbers and their arithmetic operations. BCD, Excess-3, Gray and Alphanumeric codes. Boolean algebra: De-Morgan's Theorems, Standard Forms of Boolean Expressions (SOP, POS), Minimization-Techniques: K-MAPS, Q-M (Tabulation) method.	10
Unit - II **Combinational Logic Circuits:** Problem formulation and design of Basic Combinational Logic Circuits, Combinational Logic Using Universal Gates. Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, ALU, Parity-Checkers and Generators, Comparators, Decoders, Encoders, Code Converters, Multiplexer, De-multiplexers.	10
Unit - III **Sequential Circuits:** Latches, Flip-flops (SR, JK, T, D, Master/Slave FF), Edge-Triggered Flip-Flops, Flip-Flop Operating Characteristics, Basic Flip-Flop Applications, Asynchronous Counter Operation, Synchronous Counter Operation, Up/Down Synchronous Counters.	10
Unit - IV **Shift Registers and Memories:** Shift Register Functions, Serial In - Serial Out Shift Registers, Serial In - Parallel Out Shift Registers, Parallel In - Serial Out Shift Registers, Parallel In - Parallel Out Shift Registers, Bidirectional Shift Registers, Basics of Semiconductor Memories, Random-Access Memories (ROM), Read Only Memories (ROMs), Programmable ROM's (PROMs and EPROM's), PAL, PLA.	10

Unit - V	
Logic Gates and Families: Logic Families: TTL, DTL, RTL, ECL, MOS, CMOS, Bi-CMOS; Performance parameters of IC families: input and output loading, fan-in, fan-out, tristate, current drive, voltage levels, noise margins, power-speed trade off, Unused inputs. **A/D and D/A convertor:** Characteristics of ADC, Types of ADC- SAR, Dual Slope, Flash ADC. Characteristics of DAC, R-2R Ladder, Weighted Resistance Type.	10

Course Outcomes

Upon successful completion of the course, the students will be able to:

- CO-1: To understand the basics of number systems, Boolean algebra and minimization techniques.
- CO-2: To understand the structure and design of combinational and sequential logic circuits.
- CO 3: To understand the concept of various shift registers and memories.
- CO-4: To understand the concept of different logic families.
- CO 5: To understand the concept of A/D and D/A convertors.

Text/Reference Books

- Digital Fundamentals by Thomas L. Floyd, Prentice Hall, Inc.
- Digital Systems - Principles and Applications by Tocci, R. J. and Widner, Prentice Hall.
- Digital Logic Circuit Analysis & Design by Victor P. Nelson, H. Troy Nagle, Bill D. Carroll and J. David Irwin, Prentice Hall.
- Digital logic and computer design by M Morris Mano –PHI.
- Modern digital electronics by R.P. Jain. TMH.
- Digital Design: Principles and Practices by Wakerly J F, Prentice-Hall.
- Digital Experiments Emphasizing Systems and Design by David Buchla, Prentice Hall, Inc.
- Digital Integrated Electronics by Taub and Schilling, McGRAW HILL.

List of Experiments

1. Realization of different gates like NOT GATE, NAND, NOR, EX-OR, OR, AND.
2. Realization of different gates with the help of universal NAND and NOR Gates.
3. To convert Binary code to Gray code and Gray code to Binary code.
4. Implementation of half/full adder and Subtractor.
5. Implementation of multiplexer and de-multiplexer.
6. Implementation of encoder and decoder.
7. To compare two 4-bit binary number.

8. To study and verify working of various Flip-flops: SR, D and Master Slave JK Flip flops, etc.
9. To study and verify working of JK -Flip-flop.
10. To design synchronous/asynchronous counter.
11. To Design the Universal Shift Registers.
12. Verification of operation of BCD to Seven segment code conversion.