DISCIPLINE SPECIFIC CORE COURSE – 5 (DSC-5): Digital Electronics

Credit distribution, Eligibility and Prerequisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Digital Electronics	4	3	0	1	Class 12th Pass with PCM or Physics, Comp. Sc. & Maths.	Nil

Learning Objectives

The Learning Objectives of this course are as follows:

- To represent information in various number systems.
- To convert data from one number system to another and do various arithmetic operations.
- To analyze logic systems and to implement optimized combinational circuits using Karnaugh Map.
- To analyze and implement sequential circuits using state machines.
- To analyze various memories and programmable logic devices.
- To analyze and understand the working of data converters.

Learning outcomes

After completion of the course, students will be able to-

Understand the concept of the number system with emphasis on binary numbers, its algebra and minimization techniques.

Understand basic logic gates, concepts of Boolean algebra and techniques to reduce/simplify Boolean expressions.

Analyze and design combinational as well as sequential circuits.

Understand the concepts related to Memories and PLD's.

Understand the working of analog to digital converters, digital to analog converters.

SYLLABUS OF DSC- 5

UNIT – I Introduction to Digital Electronics (09 Hours)

Number System and Codes: Decimal, Binary, Hexadecimal and Octal number systems, base conversions, Binary, Octal and Hexadecimal arithmetic, Addition, subtraction by Complements (1's and 2's) method, Binary Multiplication by computer method, Signed

numbers, Binary Codes (BCD, 84-2-1, excess-3, Gray) BCD addition, Error detecting/correcting code (Parity, Hamming).
Logic Gates and Boolean Algebra: Truth table and symbolic representation of logic gates and their implementation using Universal gates, Basic postulates and fundamental theorems of Boolean algebra.

UNIT – II Combinational Circuit Design (12 Hours)
Canonical and Standard forms, Standard representation of logic functions (SOP and POS), Simplification of Boolean functions (up to 5 variables) using (i) Kmap (ii) Tabulation method, Binary Adder, Binary subtractor, parallel adder/subtractor, BCD adder, Code convertors.
Encoder, Decoder, Multiplexer, Demultiplexer, Implementing logic functions with Decoder and multiplexer.

UNIT – III Sequential Circuits (12 Hours)
Sequential logic design: Latches and Flip flops, S-R, D, J-K, master slave, T Flip flops and their characteristic equation, Clocked and edge triggered Flip flops, conversion between flip flops, Shift Registers, Universal Shift register, Bidirectional Shift Register, Ring counter and Johnson counter, Counters (synchronous, asynchronous and modulo-N) and their timing sequence.
Synchronous Sequential circuit synthesis: State Tables, State Transition Diagrams, minimization, state assignments, realization with T, D and JK flip flops, Finite state machine- Mealy and Moore model

UNIT – IV Signal Conversion, Memories and Logic Families (12 Hours)
A-D and D-A Conversion: 4 bit binary weighted resistor type D-A conversion, circuit and working. Circuit of R-2R ladder. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).
Memories: ROM, PROM, EPROM, EEPROM, Bipolar RAM, static and dynamic RAM, Memory Expansion (Word size and Word Capacity).
Programmable Logic Devices: Combinational circuit Implementation using PROM, PLA and PAL.
Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Speed power product, TTL and CMOS families and their comparison

Practical component (if any) - Digital Electronics Lab *(Hardware and Circuit Simulation Software)* – 30 Hours

1. To verify and design AND, OR, NOT, XOR and XNOR gates using NAND gates.
2. To convert a Boolean expression into a logic gate circuit and assemble it using logic gate IC's.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a seven segment display driver.

6. Implement a Boolean function using 4 X 1 multiplexer.
7. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type, JK, JK Master slave).
8. Design a SISO, SIPO shift register.
9. Design an asynchronous/ synchronous Up/Down counter using D/T/JK Flip-Flop.
10. Design a non sequential counter using D/T/JK Flip flop.
11. Design a R-2R DAC.
12. Design an ADC circuit using ADC0804.

Note: Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than ten.

Essential/recommended readings

1. M. Morris Mano, "Digital System Design," Pearson Education Asia.
2. Thomas L., "Flyod, Digital Fundamentals," Pearson Education Asia.
3. W. H. Gothmann, "Digital Electronics: An Introduction To Theory And Practice," Prentice Hall of India.
4. Millman & Grabel, "Microelectronics," Tata McGraw Hill.
5. Donald D. Givone, " Digital Principles and Design," Tata McGraw- Hill.
6. R. P. Jain, "Modern digital Electronics," Tata McGraw- Hill.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE– 6 (DSC-6): Analog Electronics-I

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Analog Electronics-I	4	3	0	1	Class 12th Pass with PCM or Physics, Comp. Sc. & Maths.	Nil