Category I

BSc. (Hons.) Instrumentation

DISCIPLINE SPECIFIC CORE COURSE -4 (DSC-4) – : Fundamentals of Digital Circuits

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		
Fundamentals of Digital Circuits	4	3	0	1	Class XII pass with Science	Nil

Learning Objectives

- To impart the knowledge of Number systems and codes.
- To familiarize with concepts of Boolean algebra, logic gates.
- To minimise and design various combinational logic circuits.
- To develop the basic understanding of flip flops and use them to design sequential circuits.
- To differentiate between various digital logic families.

Learning outcomes

At the end of this course, students will be able to

Learn various number systems, binary codes and concepts of Boolean algebra.
Apply the knowledge of Boolean algebra to solve real time problems and determine how to interconnect logic gates to convert the circuit input signals to desired output signals.
Analyse the combinational and sequential circuits using flip flops and show how they can be used for designing various types of digital circuits used for processing and transmission of data.
Compare various digital logic families with respect to their speed, power consumption and cost

SYLLABUS OF DSC-4

Unit-1 **(09 Hours)**

Number System and Codes: Decimal, Binary, Hexadecimal and Octal number systems,

base conversions, Binary, octal and hexadecimal arithmetic (addition, subtraction by complement method, multiplication), representation of signed and unsigned numbers, Binary Coded Decimal code, gray code, excess-3 code.

Unit-2 **(12 Hours)**

Boolean algebra and Logic Gates: Introduction to Boolean Algebra and Boolean operators, Basic postulates and fundamental theorems of Boolean algebra, construction, and symbolic representation of OR, AND, NOT, XOR, XNOR Gate, Truth Tables, Universal (NOR and NAND) gates.

Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Speed power product, TTL and CMOS families and their comparison.

Unit-3 **(12 Hours)**

Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Encoder and Decoder, Multiplexers and Demultiplexers, Implementing logic functions with multiplexer, binary Adder, binary subtractor, parallel adder/subtractor.

Unit-4 **(12 Hours)**

Sequential logic design: Latches and Flip-flops, S-R Flip flop, J-K Flip flop, T and D type Flip flop, Clocked and edge triggered Flip flops, master slave Flip flop, Registers, Counters (synchronous and asynchronous and modulo-N), State Table, State Diagrams, counter design using excitation table and equations, Ring counter and Johnson counter.

Programmable Logic Devices: Basic concepts- ROM, PLA, PAL, CPLD, FPGA

Practical component (if any) – Fundamentals of Digital Circuits Lab – 30 Hours

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 assemble it using logic gate ICs.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a Seven Segment display driver.
6. Design a 4 X 1 Multiplexer using gates.
7. Design a 2 X 4 Decoder using gates.
8. To build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
9. Design a counter using D/T/JK Flip-Flop.
10. Design a shift register and study Serial and parallel shifting of data.

Essential/recommended readings

1. M. Morris Mano, Digital Logic & Computer Design, Pearson Education Asia (2016)

2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Limited, 11th Edition, Global Edition (2015)
3. Kumar A. Anand, Fundamentals of Digital Circuits, 3rd Edition (2014), PHI Learning Private Ltd.
4. R. J. Tocci, Neal.SWindmer, Gregory L Moss, Digital Systems, Principles and Applications, 10th Edition, Pearson (2009)

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 eight.

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

DISCIPLINE SPECIFIC CORE COURSE – 5 (DSC-5): Sensors and Actuators

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		
Sensors and Actuators	4	2	0	2	Class XII pass with Science	Nil

Learning Objectives

The Learning Objectives of this course are as follows:

- To study different types of transducers – resistive, capacitive, inductive, light and temperature
- Be conversant in construction and working of various pressure and flow measuring instruments
- Get an exposure to actuators, micro actuators, and their different types

Learning outcomes

At the end of this course, students will be able to

Identify and comprehend various sensors used in the real-life applications and paraphrase their importance

Classify and explain with examples of transducers, including those for measurement of temperature, strain, light, capacitance and inductance

Be conversant in construction and working of various pressure and flow measurement devices used for industrial purposes