COURSE TITLE	**:**	**DIGITAL COMPUTER PRINCIPLES**
COURSE CODE	**:**	**3066**
COURSE CATEGORY	**:**	**B**
PERIODS/WEEK	**:**	**4**
PERIODS/SEMESTER	**:**	**72**
CREDITS	**:**	**4**

TIME SCHEDULE

MODULE	TOPICS	PERIODS
1	Number system and Boolean algebra	17
	Test I	1
2	Logic simplifications and logic families	17
	Test II	1
3	Combinatorial circuits	17
	Test III	1
4	Sequential circuits, shift registers, counters	17
	Test IV	1
	Total	**72**

MODULE I

1.1.0 Understand number systems

1.1.1 Discuss the need for a number system based on which the modern digital technology is built up

1.1.2 Give the features of a binary number system with examples and compare with decimal number system.

1.1.3 Explain the conversion from decimal to binary and vice versa with suitable example.

1.1.4 Give the features of octal number system

1.1.5 Give the features of Hexadecimal number system with suitable examples for conversion of hexadecimal into decimal and binary and vice versa.

1.1.6 State the need for binary codes and list different types of binary codes.

1.1.7 Discuss the BCD codes, excess-3 code, Gray code and binary weighted codes with suitable examples.

1.1.8 Discuss ASCII code and EBCDIC

1.1.9 Give the idea of parity and error detecting and correcting codes. (7 bit Hamming code)

1.1.10 With suitable examples give the idea of binary arithmetic such as addition, subtraction, multiplication and division.

1.2.0 Understand Boolean algebra

1.2.1 State the importance of logic theory with examples.

1.2.2 Draw symbols for AND, OR, NOT, NAND, NOR, EXOR and discus its operation.

1.2.3 Know about the sum of product (SOP) expression, product of sum expression (POS.) min terms and max terms.

MODULE II

2.1.0 Understand logic simplifications

2.1.1 State the need for simplifying Boolean expression.
2.1.2 Understand Boolean postulates and theorems
2.1.3 Discuss the straight simplification with the help of logic rules and truth tables.
2.1.4 Give the basic principle of Karnaugh map.
2.1.5 Discuss two variables, three variables and four variables K-maps with the help of suitable examples and its reductions.
2.1.6 Give an idea of Don't care terms.

2.1.7 Discuss reduction of Boolean expressions using K-map.
2.1.8 Give the idea of simplification in both SOP and POS form with the help of example
2.1.9 List the advantages and disadvantages of Karnaugh map.

2.2.0 Understand logic families

2.2.1 Give an idea of existing logic families.
2.2.2 Distinguish between positive and negative logic.

2.2.3 Give the detailed circuit description of transistor transistor logic and TTL inverter.
2.2.4 Identify the terms VIL, VIH, VOL, VOH, Noise margin, noise immunity propagation delay.
2.2.5 Give an idea of open collector gate and high threshold logic.
2.2.6 Explain the working principle of emitter coupled logic.
2.2.7 Describe in detail, the CMOS logic family.
2.2.8 Give the features of CMOS logic gates.
2.2.9 Compare different logic families with respect to 'current sourcing' and 'current sinking', fan-in, fan-out, power dissipation, speed power product.

MODULE III

3.1.0 Understand combinational logic circuits

3.1.1 Give the idea of combinational logic circuits.
3.1.2 Design half adder, full adder, half subtractor, and full subtractor.
3.1.3 Study parallel adders and serial adders.
3.1.4 Discuss the operation of Multiplexers and de-multiplexers.
3.1.5 List and explain the various applications of multiplexers and de-multiplexers.
3.1.6 Understand operation of encoders and decoders.
3.1.7 Explain various decoders such as BCD to decimal, binary to excess 3 code, binary to gray code and BCD to 7 segment with suitable examples.
3.1.8 Give an idea of digital comparators.

MODULE IV

4.1.0 Understand sequential logic circuits

4.1.1 Give the idea of sequential logic circuits
4.1.2 Distinguish between synchronous and asynchronous sequential logic circuits
4.1.3 Discuss latches & flip-flops
4.1.4 Construct SR flip flop using NAND gates
4.1.5 Explain JK flip-flop with the help of truth table and timing diagram.
4.1.6 Discuss synchronous and asynchronous inputs of a flip flop.
4.1.7 Analyze the race around condition in JK flip flop
4.1.8 Give the idea with diagram and truth table of master slave JK flip flop
4.1.9 Explain D flip flop, T flip flop with the help of diagram and truth table

4.2.0 Understand Shift registers and Counters

4.2.1 Discuss the working of shift registers serial in serial out parallel in parallel out parallel in serial out and serial in parallel out
4.2.2 Differentiate between right shift and left shift registers
4.2.3 Give the working of ring counter and its applications
4.2.4 Explain Johnson counter and its applications
4.2.5 Give an introduction to Binary counters

4.2.6 Differentiate between synchronous and asynchronous counters
4.2.7 Give the idea of asynchronous ripple counter with the help of flip flop
4.2.9 Design and implement mod-N asynchronous counter using flip flop
4.2.10 Study the design procedure of mod-N synchronous counter and its realization using flip flop.
4.2.11 Study the implementation of 3 bit up-down counter using flip flop.

CONTENT OUTLINE

MODULE I

Number System and Boolean algebra

Number systems - decimal, binary, Hex number system – conversion from one system to another system – use of binary codes - different types of binary codes - binary coded decimal, excess 3 codes
ASCII Code – EBCDIC - 7 bit Hamming code - binary addition, subtraction, multiplication and division - 1'st complement and 2's complement method of subtraction - Introduction to logic gates - switching functions AND, OR, NOT, NOR, NAND, EX-OR operations – Universal property of NAND and NOR gates.
The sum of products (SOP) expression - product of sum (POS) expression -

MODULE II

Logic simplification and logic families

Boolean theorems and postulates - simplifications of Boolean expressions – simplification of min term and max term using Karnaugh map.
SSI, MSI, LSI, VLSI and ULSI - existing logic families - positive and negative logic – Transistor Transistor Logic, TTL inverter, Emitter Coupled Logic, high threshold logic -

CMOS logic family - features of CMOS logic gates - VIL, VH, VOL, VOH, noise margin, noise immunity, propagation delay, current sourcing and current sinking - fan in, fan out, power dissipation, speed power product, Comparison of advantages and disadvantages of various logic families

MODULE III

Combinational Logic Circuits

Introduction – Design half adder, full adder, half subtractor, full subtractor – Parallel and serial Adders - multiplexer/data selector - basic 2 to 1MUX, 4 to 1 MUX, 8 to 1 MUX - applications of the MUX – demultiplexer - 1 to 2 demultiplexer, 1 to 4 demultiplexer, 1 to 8 demultiplexer – Encoders and decoders - BCD to decimal - BCD to 7 segment decoder – encoder, priority encoder

MODULE IV

Sequential Logic Circuits

Introduction - SR flip flop, SR latch - SR flip-flop using NAND gates - JK flip- flop with preset and clear inputs - D flip-flop - T flip-flop - Master Slave flip-flop – Flip flop ICs Shift registers, serial in serial out, parallel in parallel out, serial in parallel out, parallel in serial out shift registers, left shift and right shift registers applications of shift registers, ring counter, Johnson counter - Binary counters-design and implementation of asynchronous modulus N counter – examples - Design and implementation of mod N synchronous counter, up down counter.

TEXT BOOKS

1. **Digital Principles and Applications – by Malvino & Leach**
2. Digital Electronics – Anil.K.Maini
3. Digital fundamentals - Floyd & Jain

REFERENCE BOOKS

1. Fundamentals of digital circuits - A. Anand Kumar
2. Digital computer fundamentals - Thomas. C. Bartee
3. Digital electronics by P.Raja
4. Digital design, Basic concepts and principles – Mohammad A. Karim, Xinghao Chen
5. Digital Logic Design – Brian Holdsworth , Clive Woods