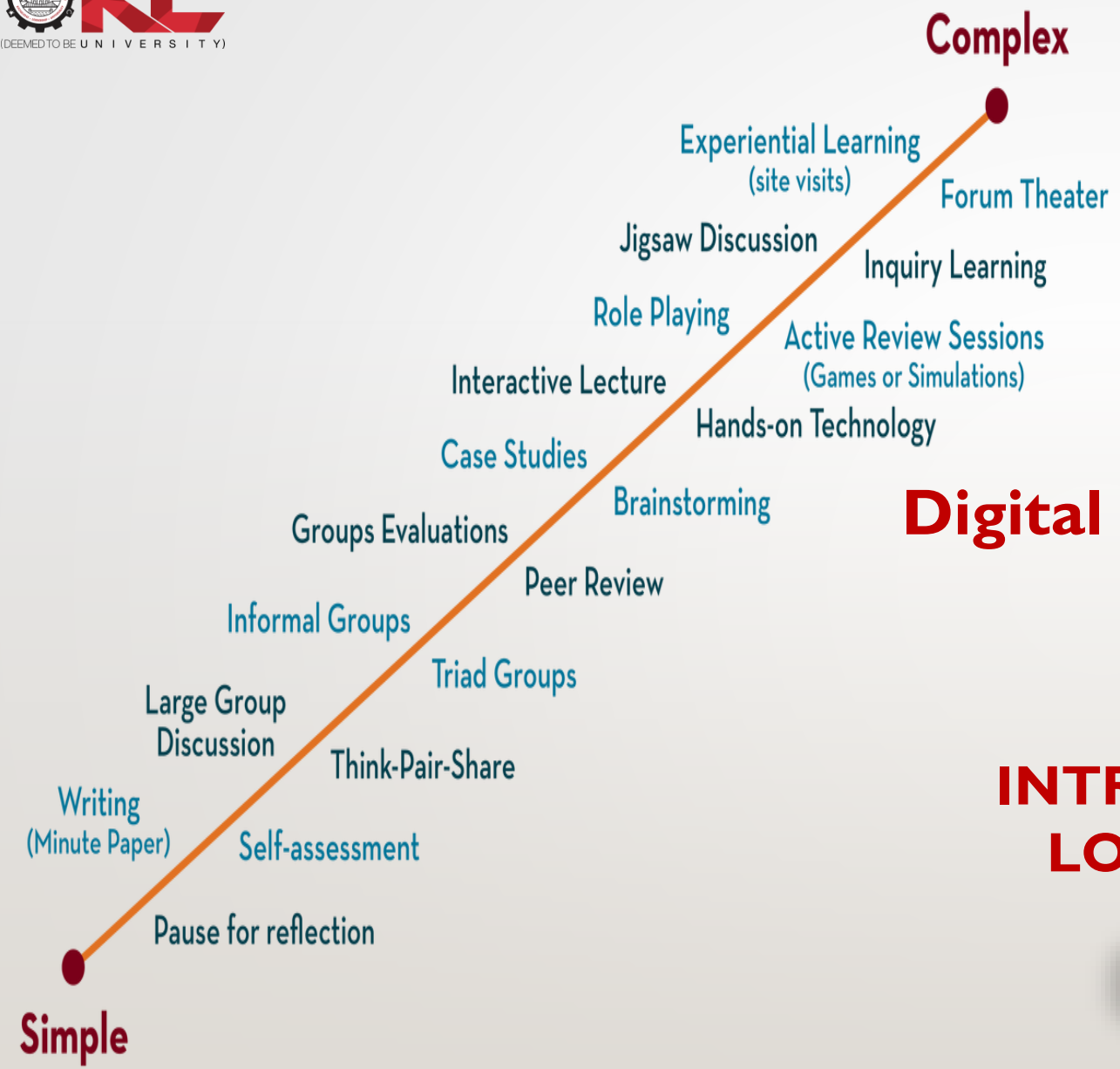


Department of BES-II

Digital Design and Computer Architecture

23EC1202

Topic:

INTRODUCTION TO DIGITAL SYSTEMS
LOGIC GATES & NUMBER SYSTEMS

Session No: 01

(DEEMED TO BE UNIVERSITY)

AIM OF THE SESSION

To familiarize students with the basic concept of Logic gates & Number Systems

INSTRUCTIONAL OBJECTIVES

This Session is designed to:

1. Master the concepts of binary, decimal, octal, and hexadecimal number systems, and gain proficiency in converting between different bases.
2. Understand the fundamental principles of logic gates, including their types, truth tables, and applications, to design and analyze digital circuits.

LEARNING OUTCOMES

At the end of this session, you should be able to:

1. Students will demonstrate proficiency in converting numbers between different bases (binary, decimal, octal, and hexadecimal), showcasing an understanding of the interrelationships between various number systems.
2. Students will be able to apply their knowledge of logic gates to design, construct, and analyze digital circuits, demonstrating proficiency in implementing logical operations.

(DEEMED TO BE UNIVERSITY)

Course Title: DIGITAL DESIGN AND COMPUTER ARCHITECTURE

Course Code: 23EC1202, L-T-P-S Structure: 3-0-2-0, Credits: 4

Course Coordinator: APPIKATLA PHANI KUMAR

SYLLABUS

CO 1: Combinational Digital Logic Circuits

Boolean Algebra, Digital Logic SOP/POS representation and optimization techniques. Adders, Subtractors, Multiplexers, De-Multiplexers, Decoder, Encoder, Concept of Reversible Gates. Programmable Logic Devices: PROM, PAL, and PLA design. Implementation of CPLD (Macro cells) and FPGA (CLB/LUT) based digital logic modules and their applications.

CO-2: Design of Sequential and Memory Circuits

Latches and Flip-Flops, Modeling of memory, Registers and Shift registers, Timing and sequence control modules using Asynchronous/Synchronous counters, Ring and Johnson counter as timing and control units. Random Access Memory (RAM) and Memory decoding.

CO-3: Basic Computer Architecture and Instructions

Features of Micro Computer, Operands, Addressing modes, Instruction formats, Machine cycle, Instruction sets, subroutine call and return mechanisms. Instruction set architectures - CISC and RISC architectures. Hardwired realization vs micro-programmed realization, multi-cycle implementation, Instruction level parallelism, instruction pipelining and pipeline hazards.

CO-4: Memory Architecture and I/O Organization Storage systems, introduction to memory hierarchy

Importance of temporal and spatial locality; main memory organization, cache memory: address mapping, block size, replacement, and store policies. Virtual Memory System: page table and TLB. External storage; IO fundamentals: handshaking, buffering, programmed IO, interrupt driven IO.

(DEEMED TO BE UNIVERSITY)

Course Title: DIGITAL DESIGN AND COMPUTER ARCHITECTURE

Course Code: 23EC1202, L-T-P-S Structure: 3-0-2-0, Credits: 4

Course Coordinator: APPIKATLA PHANI KUMAR

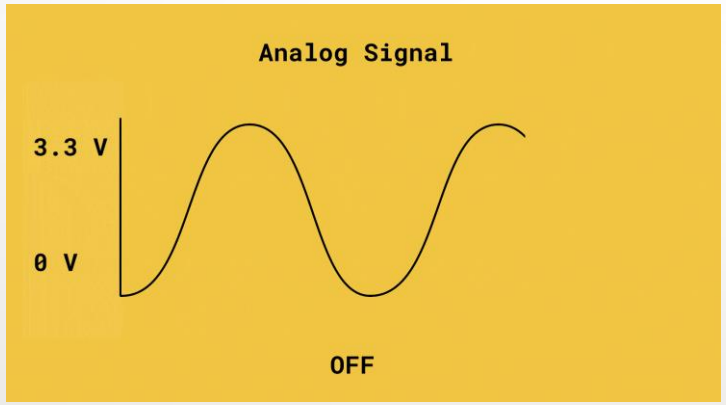
CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Build the combinational and programmable digital logic circuits using logic gates and optimization methods	PSO1,PO1,PO2	3
CO2	Construct the sequential and memory circuits using flip-flops	PSO1,PO1,PO2	3
CO3	Able to organize computer architecture and instructions sequence	PSO1,PO1,PO2	3
CO4	Model the Memory Architecture and I/O Organization modules	PO2,PSO1,PO1	3
CO5	Develop and analyze of computer architecture modules using basic combinational, sequential and memory logics	PSO1,PO1,PO3,PO5	4

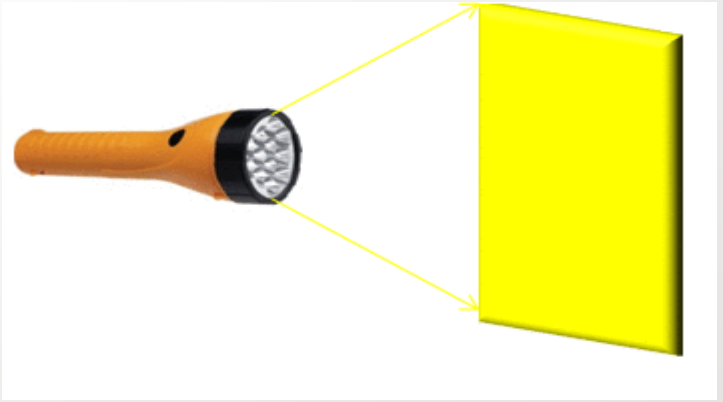
EVALUATION PLAN

Evaluation Type	Evaluation Component	Weightage/Marks		Assessment Dates	Duration (Hours)	CO1	CO2	CO3	CO4	CO5
End Semester Summative Evaluation Total= 40 %	Lab End Semester Exam	Weightage	16	08.05.2025	120					16
		Max Marks	50							50
	End Semester Exam	Weightage	24	07.05.2025,08.05.2025,09.05.2025,10.05.2025	180	6	6	6	6	
		Max Marks	100			25	25	25	25	
In Semester Formative Evaluation Total= 24 %	Continuous Evaluation - Lab Exercise	Weightage	9	22.01.2025	100					9
		Max Marks	50							50
	Home Assignment and Textbook	Weightage	7	22.01.2025,23.02.2025,29.03.2025,01.05.2025	50	1.75	1.75	1.75	1.75	
		Max Marks	100			25	25	25	25	
	ALM	Weightage	8	22.01.2025,23.02.2025,29.03.2025,01.05.2025	50	2	2	2	2	
		Max Marks	100			25	25	25	25	
In Semester Summative Evaluation Total= 36 %	Lab In Semester Exam	Weightage	8	01.04.2025	100					8
		Max Marks	50							50
	Semester in Exam-II	Weightage	14	29.04.2025, 30.04.2025	90			7	7	
		Max Marks	50					25	25	
	Semester in Exam-I	Weightage	14	11.03.2025, 12.03.2025	90	7	7			
		Max Marks	50			25	25			

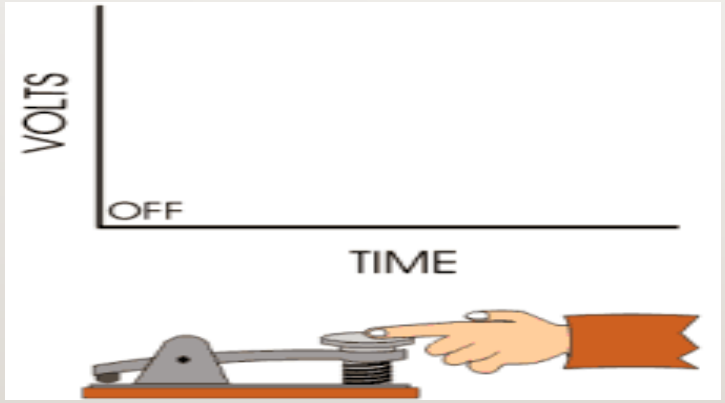
ANALOG Vs DIGTIAL

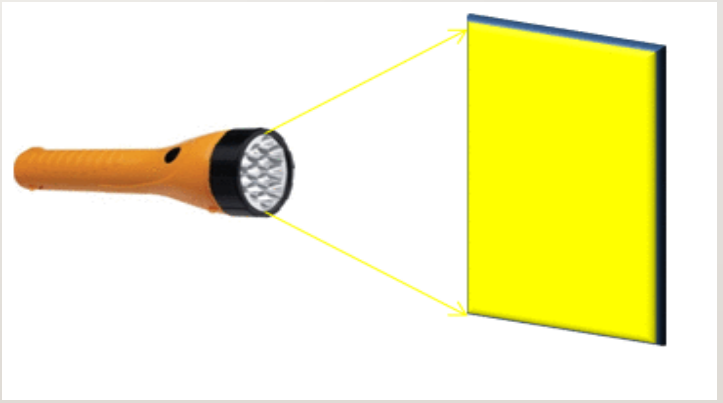
Analog





Digital

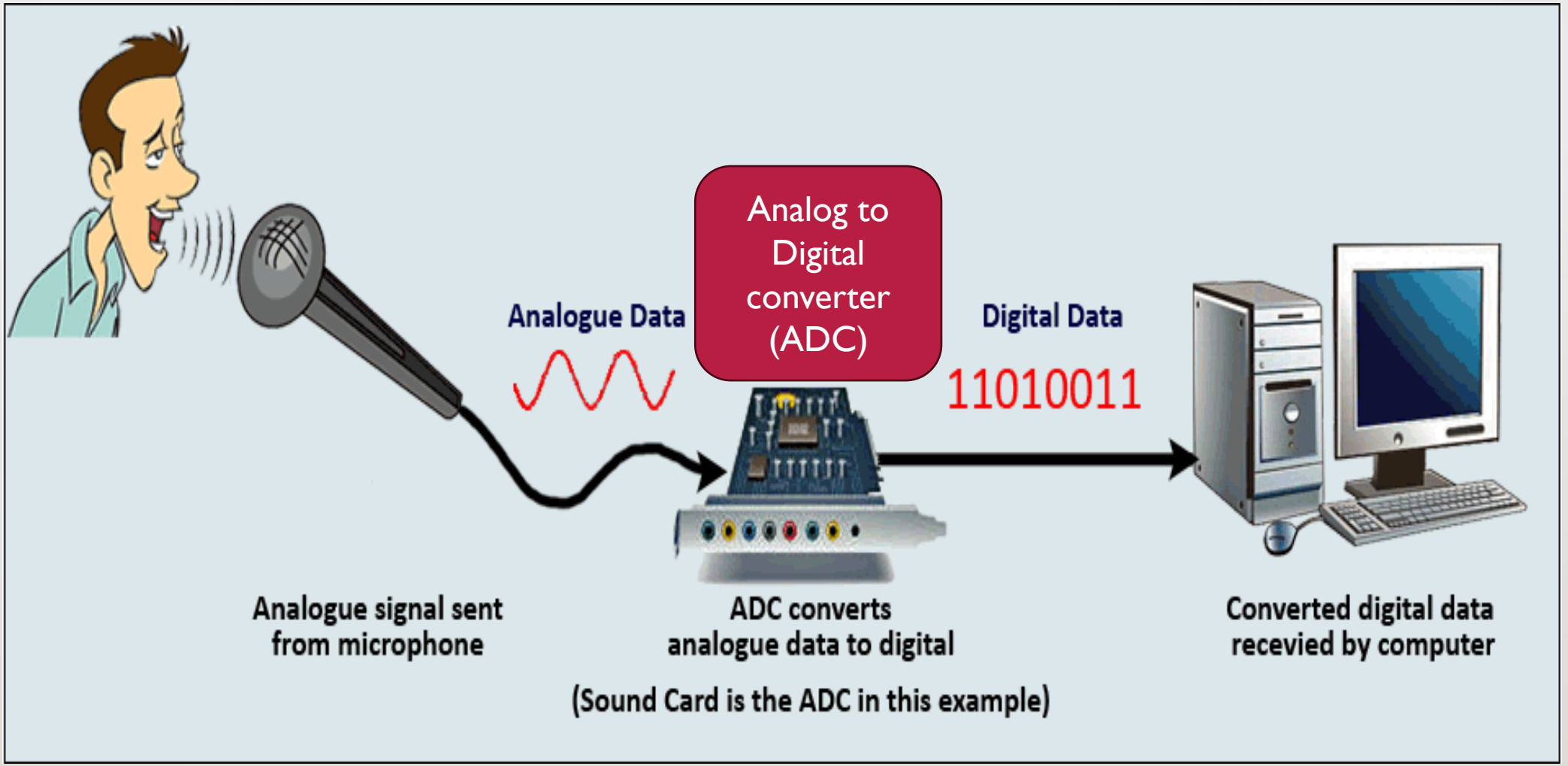




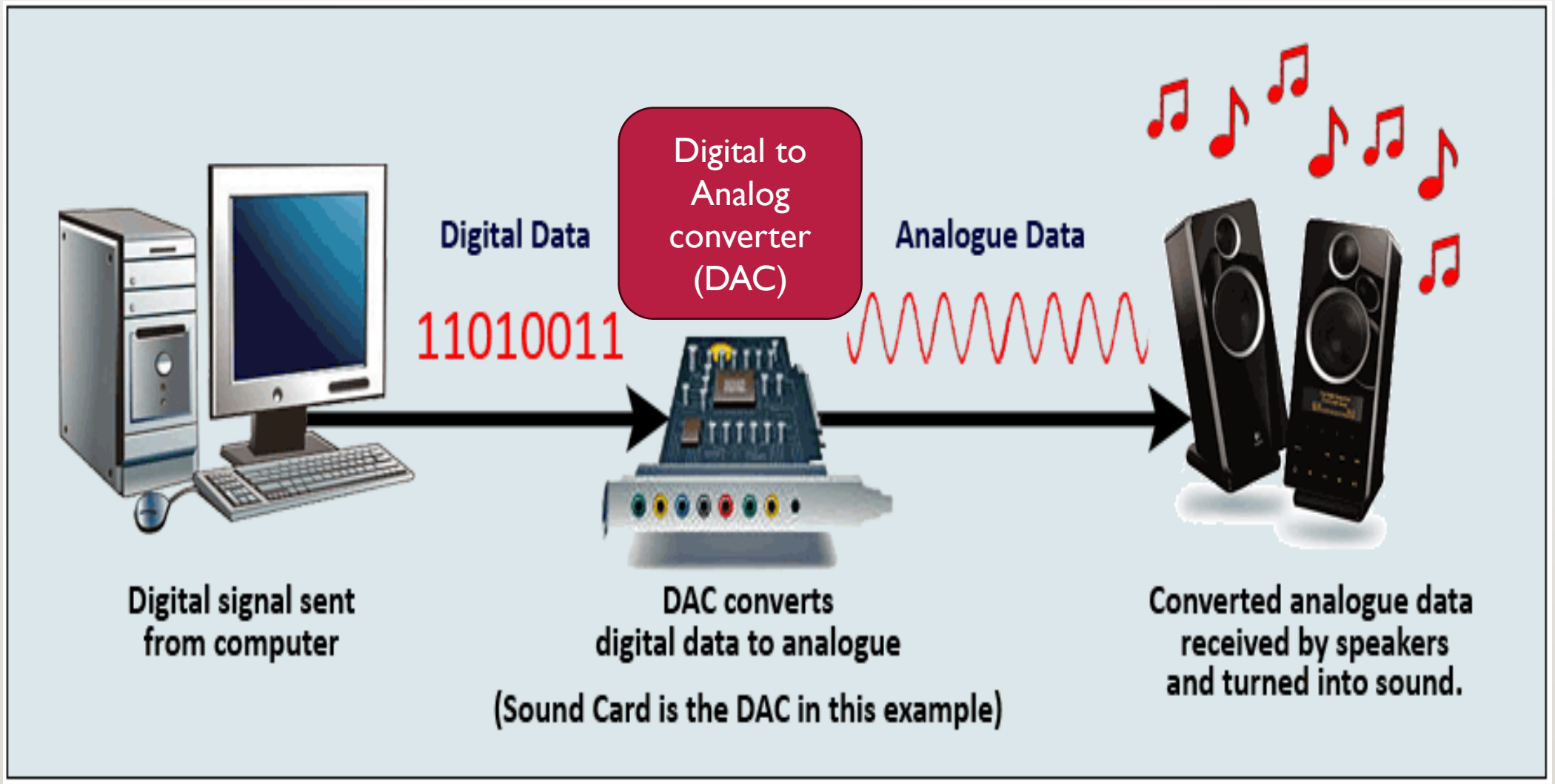
ANALOG Vs DIGTIAL (Cont…)

Analog Signals	Digital Signals
Continuous signals	Discrete signals
Represented by sine waves	Represented by square waves
Human voice, natural sound, analog electronic devices are a few examples	Computers, optical drives, and other electronic devices
Continuous range of values	Discontinuous values
Records sound waves as they are	Converts into a binary waveform
Only used in analog devices	Suited for digital electronics like computers, mobiles and more

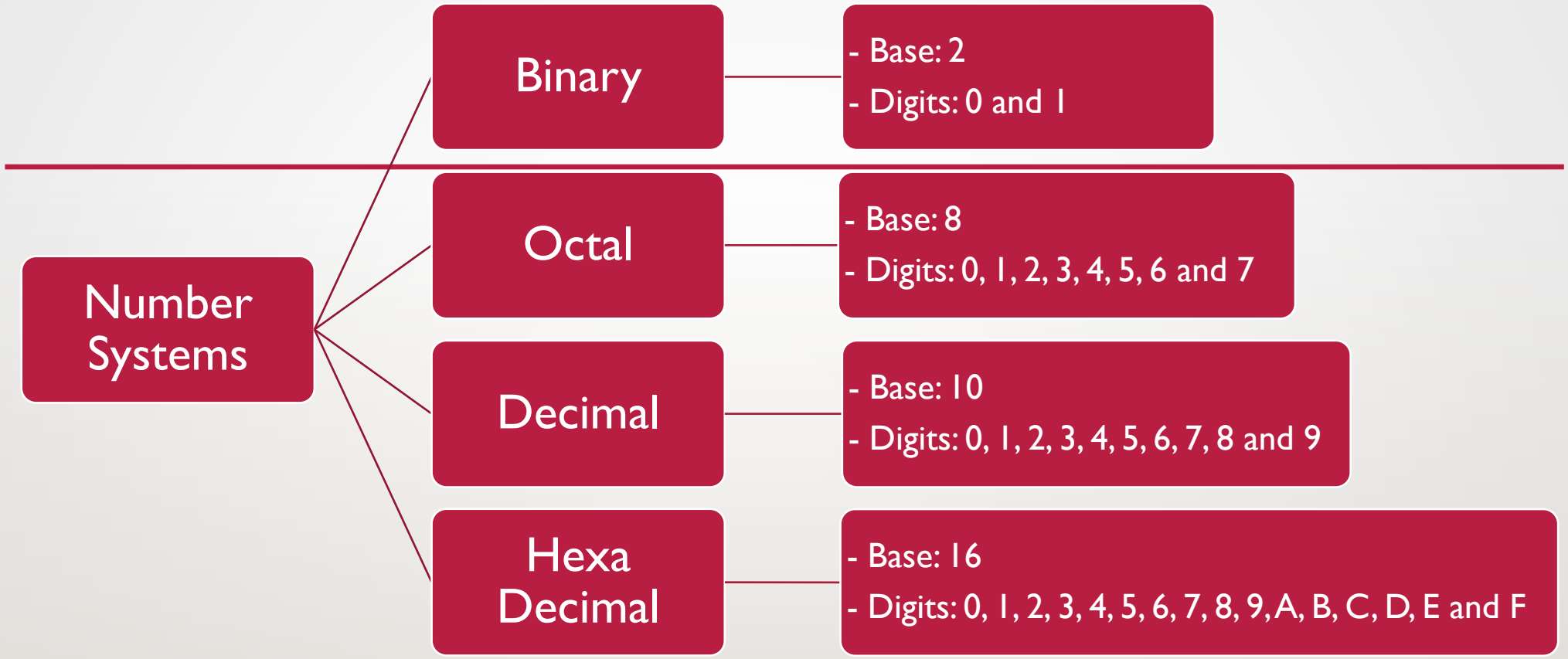
IMPORTANCE OF ANALOG TO DIGTIAL CONVERSION



IMPORTANCE OF DIGITAL TO ANALOG CONVERSION



TYPES OF NUMBER SYSTEMS



Importance of number system in digital system: The modern number system is the basis for digital technology and computing systems. Binary, octal, and hexadecimal number systems, which are widely used in computer science and digital electronics, are derived from the decimal system.

DIGITAL DATA REPRESENTATION

Decimal Digit	Binary	Octal	Hexa Decimal
00	0000	00	0
01	0001	01	1
02	0010	02	2
03	0011	03	3
04	0100	04	4
05	0101	05	5
06	0110	06	6
07	0111	07	7
08	1000	10	8
09	1001	11	9

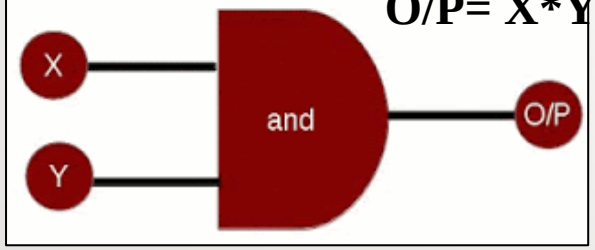
Decimal Digit	Binary	Octal	Hexa Decimal
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F
16	10000	20	10
17	10001	21	11
18	10010	22	12
19	10011	23	13
20	10100	24	14

LOGIC GATES

AND Gate

X	Y	O/P
0	0	0
0	1	0
1	0	0
1	1	1

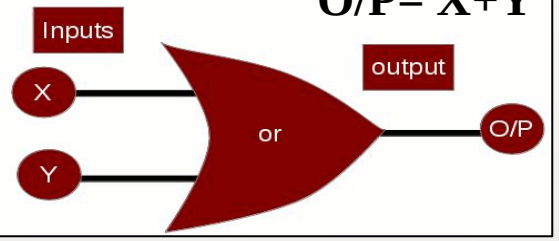
$O/P = X*Y$



OR Gate

X	Y	O/P
0	0	0
0	1	1
1	0	1
1	1	1

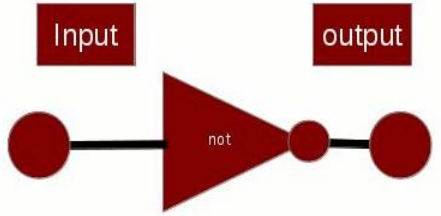
$O/P = X+Y$



NOT Gate

X	O/P
0	1
1	0

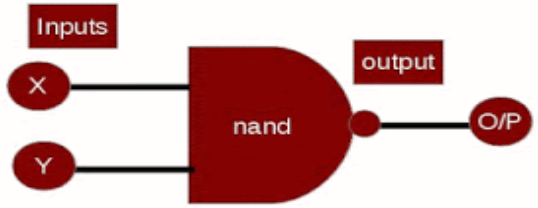
$O/P = \overline{X}$



NAND Gate

X	Y	O/P
0	0	1
0	1	1
1	0	1
1	1	0

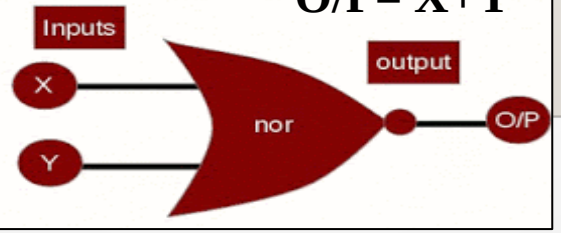
$O/P = \overline{X*Y}$



NOR Gate

X	Y	O/P
0	0	1
0	1	0
1	0	0
1	1	0

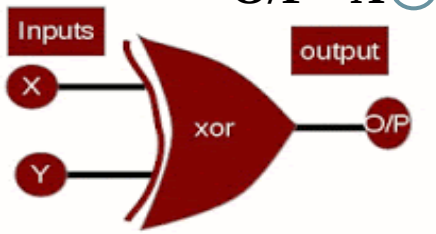
$O/P = \overline{X+Y}$



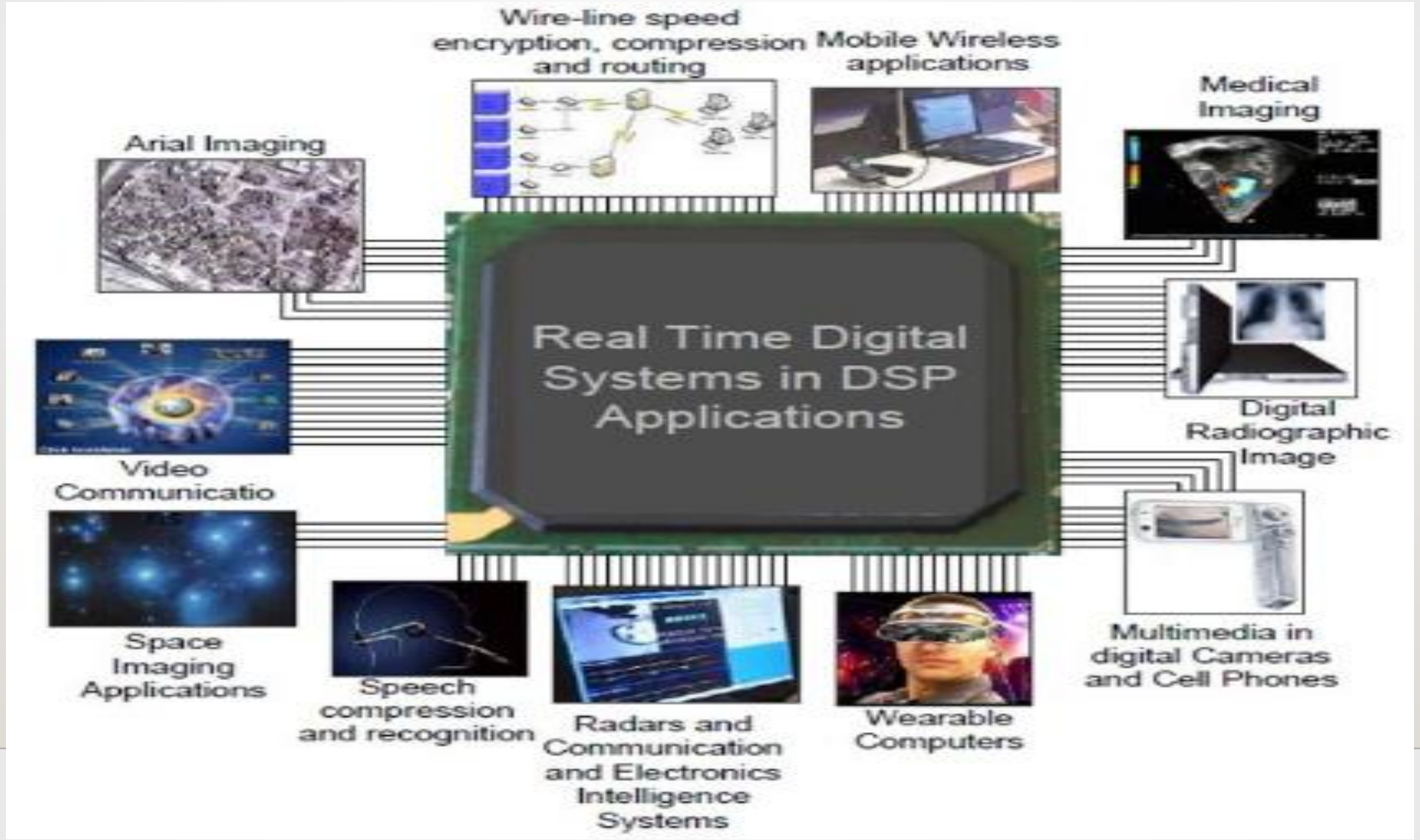
XOR Gate

X	Y	O/P
0	0	0
0	1	1
1	0	1
1	1	0

$O/P = X \oplus Y$



APPLICATIONS OF DIGITAL SYSTEMS



TERMINAL QUESTIONS

1. Explain the basic operations of the AND, OR, and NOT gates in Boolean algebra.

2. List the number system representations for decimal numbers 0 to15

REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Computer System Architecture by M. Moris Mano
2. Fundamentals of Digital Logic with Verilog HDL by Stephen Brown and Zvonko Vranesic

THANK YOU

(DEEMED TO BE UNIVERSITY)

Team – Digital Design & Computer Architecture