AKTU Festival Offer

GATEWAY CLASSES

B.Tech II-Year EC & EC Allied

DSD : Digital System Design

Unit-1 Lec-1



Avinash Sir

Today's target

- Introduction to Number System
- Basic of Number System Conversion
- PYQ
- DPP

Gateway Classes

AKTU : *DIGITAL SYSTEM DESIGN (BEC-302)* Syllabus

UNIT-1 : Logic simplification and combinational logic design

- Number Systems
- Binary arithmetic
- Signed magnitude representation
- Binary codes, code conversion
- Review of Boolean algebra and Demorgans theorem
- SOP & POS forms
- Canonical forms
- Karnaugh maps up to 5 variables
- Tabulation method.

Gateway Classes

A K T U

Gateway Classes

GATEWAY CLASSES

B.Tech

Gateway Udaan Batch

{ Sem-III + Sem-IV }

EC & EC Allied)



COMBO of 11 Subjects

inc-Math-4



Helpline No-7819 0058 53

Gateway Classes

HAPPY INDEPENDENCE DAY OFFER

GATEWAY CLASSES

Coupon Code-INDEPENDENCE DAY

Get Rs.511 OFF on All COMBO

Valid - till 17 Aug

B.Tech I, II, III Year



Number system : A number system is a way to represent and express numbers using a set of symbols (digits). The most commonly used number systems in digital technology are

(1) Binary → Base-2 (0,1)

(2) Decimal

(3) Octal

(4) Hexadecimal

Base or radix:

The number of symbols used in a number system is called base or radix of the number system.

Eg: In decimal number system – Base is 10

In Binary number system – Base is 2

In Hexadecimal number system – Base is 16 etc

Gateway Classes

Number System	Base / Radix	Digits Used	Example
Binary	2	0, 1	$(101111)_2$
Octal	8	0, 1, 2, 3, 4, 5, 6, 7 (0-7)	$(47525)_8$
Decimal	10	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	$(316875)_{10}$
Hexadecimal	16	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F	$(9B21A)_{16}$

NOTE : A = 10, B = 11, C = 12, D = 13, E = 14, F = 15

Gateway Classes

Common Terminology in Digital Electronics

2 Nibble = 8 bit = 1 Byte

1 word = 2Byte = 16 bit = 4 Nib

1 D.W = 2word = 4 Byte = 32 bit

Bit: A binary digit is called a bit. Example: 0 or 1

Nibble: A group of four bits is called a Nibble. Example: 0110, 1110 etc.

Byte: A group of eight bits is called a byte. Example: 01101101, 11010011 etc.

MSB LSB

Word:- A group of two bytes (16 bits) is called a Word.

Double word:- A group of two words (4 bytes or 32 bits) is called a double Word.

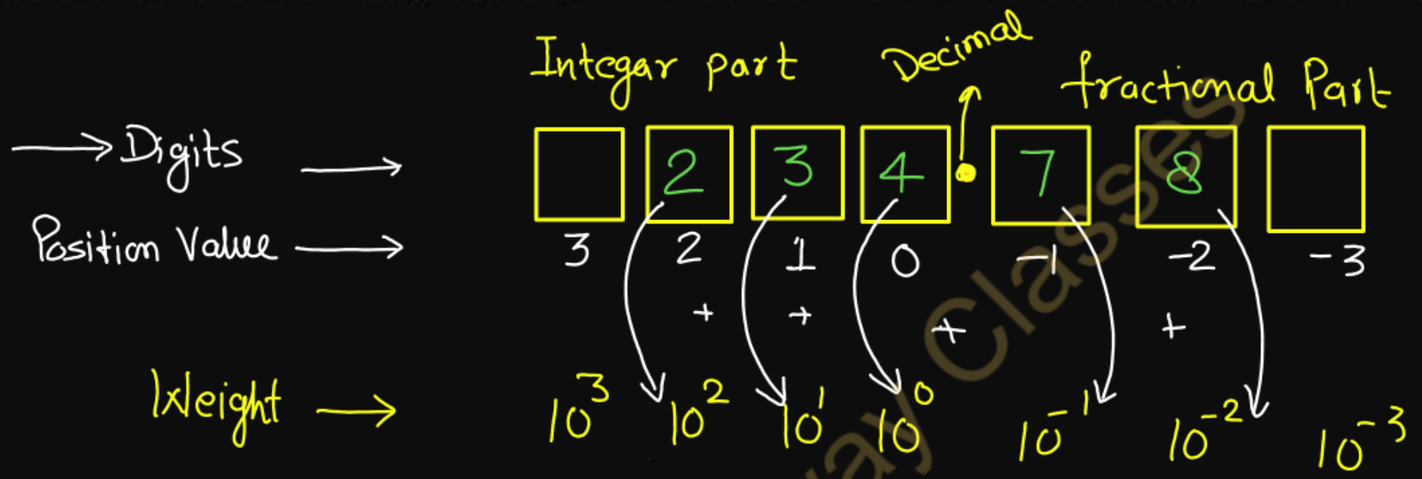
Most significant bit (MSB): The left most bit of a binary number which has the highest place value is called most significant bit.

Least significant bit (LSB): The right most bit of a binary number which has the least place value is called least significant bit.

Gateway Classes

Decimal Number system

Decimal number system is the commonly used number system. It is known as base (or radix) ten systems because it has ten digits 0 to 9 that can be used to represent any number.



Conversion to Decimal

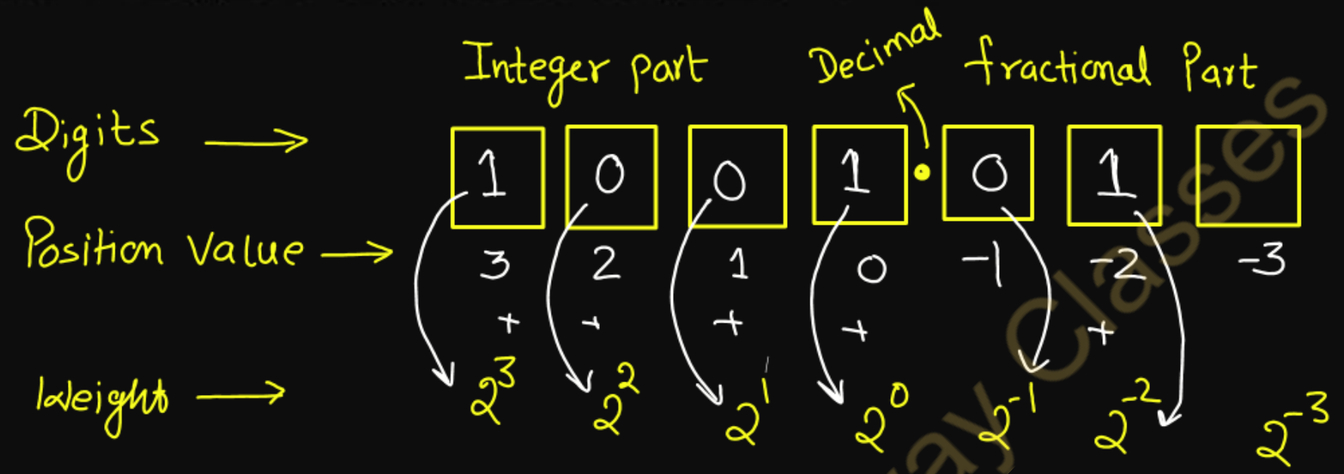
Example :- $234.78 = (2 \times 10^2) + (3 \times 10^1) + (4 \times 10^0) + (7 \times 10^{-1}) + (8 \times 10^{-2})$

$= 200 + 30 + 4 + 0.7 + 0.08$

Gateway Classes

Binary Number system

The binary number has a radix of 2. As r = 2, only two digits are needed, and these are 0 and 1. In binary system weight is expressed as power of 2.

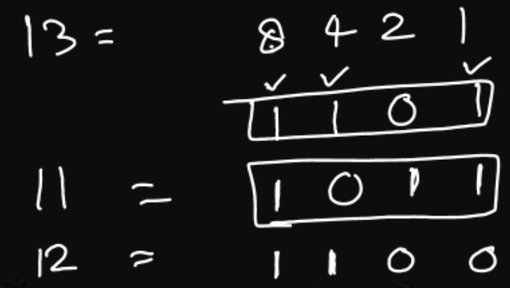


Example :- $(1001.01)_2 = [(1) \times 2^3] + [(0) \times 2^2] + [(0) \times 2^1] + [(1) \times 2^0] + [(0) \times 2^{-1}] + [(1) \times 2^{-2}]$

$(1001.01)_2 = [1 \times 8] + [0 \times 4] + [0 \times 2] + [1 \times 1] + [0 \times 0.5] + [1 \times 0.25]$

$(1001.01)_2 = (9.25)_{10}$

Gateway Classes



Octal Number system

(0-7)

Octal and hexadecimal, are used for representing large binary numbers. Octal systems use a base or radix of 8. It uses first eight digits(0- 7) of decimal number system.

Hexa Decimal Number System

10 6 = 16
(0-9) (A-F)

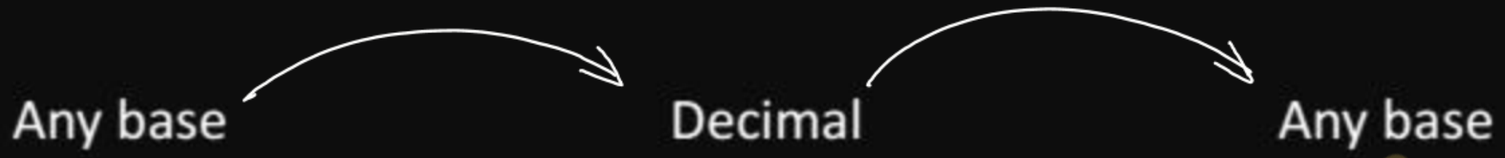
The hexadecimal numbering system has a base of 16. There are 16 symbols. The decimal digits 0 to 9 are used as the first ten digits as in the decimal system, followed by the letters A, B, C, D, E and F, which represent the values 10, 11,12,13,14 and 15 respectively.

Decimal	Binary (2^3 2^2 2^1 2^0 = 8 4 2 1)	octal	Hexadec.
0	0000	0	0
1	0001	1	1
2	0010	2	2
3	0011	3	3
4	0100	4	4
5	0101	5	5
6	0110	6	6
7	0111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

Gateway Classes

Methods of Number system conversion

- Universal Method of Number system conversion



- Easy Method for some Number system conversion

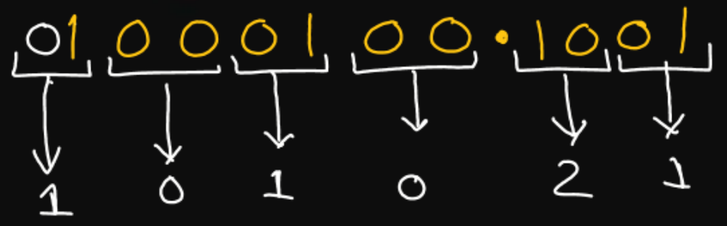
Base	Binary	Base
4, 8, 16	2	4, 8, 16

Base	Group of binary digits
4	2
8	3
16	4

Gateway Classes

(1) Binary to base 4 conversion

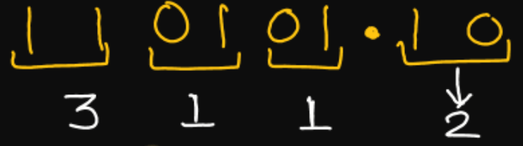
Example : $(1000\ 100\ .\ 1001)_2 = (?)_4$



$(1010.21)_4$

(1) Binary to base 4 conversion

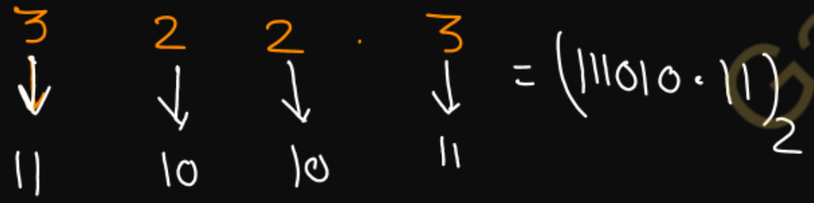
Example : $(110101\ .\ 10)_2 = (?)_4$



$(311.2)_4$

(2) base 4 to binary conversion

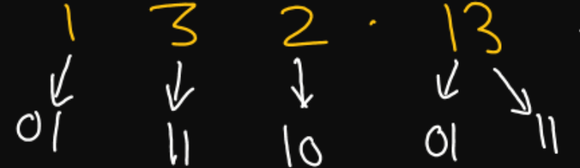
Example : $(322.3)_4 = (?)_2$



$= (111010.11)_2$

(2) base 4 to binary conversion

Example : $(132.13)_4 = (?)_2$



$= (011110.0111)_2$

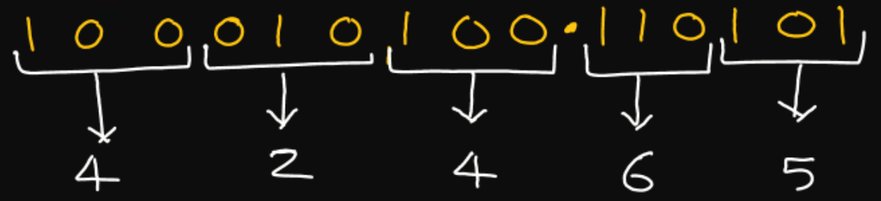
Gateway Classes

$2^3 = 2^n \Rightarrow n = 3$

AKTU-2024-25

(1) Binary to octal conversion

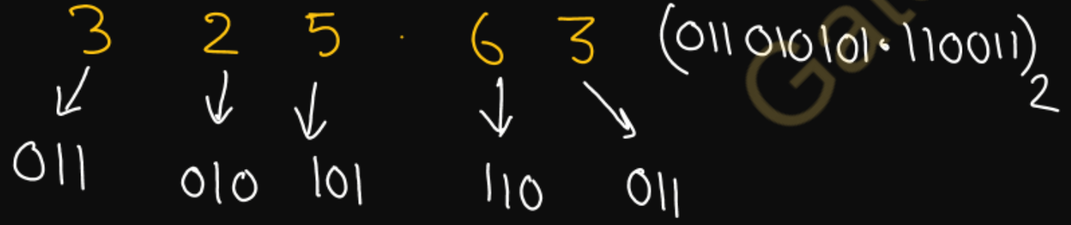
Example : $(1000\ 10100\ .\ 110101)_2 = (?)_8$



$(424.65)_8$

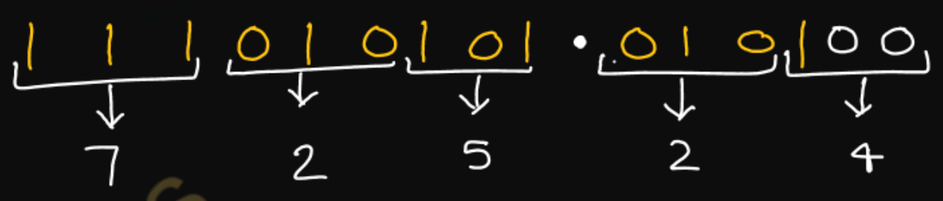
(2) Octal to binary conversion

Example : $(325.63)_8 = (?)_2$



(1) Binary to octal conversion

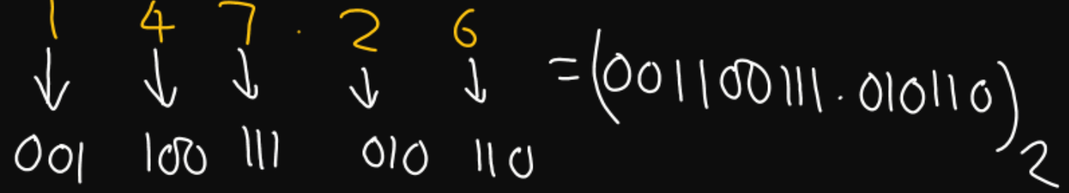
Example : $(1110\ 10101\ .\ 0101)_2 = (?)_8$



$(725.24)_8$

(2) Octal to binary conversion

Example : $(147.26)_8 = (?)_2$



Gateway Classes

AKTU-2024-25

(3) Hexadecimal to binary conversion

Example : $(ABC)_{16} = (?)_2$

A B C

1010 1011 1100

$(101010111100)_2$

Example : $(2F3\blacksquare)_{16} = (?)_2$

AKTU-2023-24

2 F 3

0010 1111 0011

$(001011110011)_{16}$

AKTU-2023-24

Hexadecimal to binary conversion

Example : $(A3B\blacksquare)_{16} = (?)_2$

A 3 B

1010 0011 1011

$(1010001110111)_{16}$

(4) Binary to Hexadecimal conversion

Example : $(1000\ 10100\ .\ 110101)_2 = (?)_{16}$

0001 0001 0100 . 1101 0100

1 1 4 13(D) 4

$(114 \cdot D4)_{16}$

Gateway Classes

(5) Octal to Hexadecimal conversion

Easy Method : Octal → Binary → Hexadecimal

Example : $(642)_8 = (?)_{16}$

6 4 2

110 100 010 ↷ Binary

000 1 | 1010 | 0010 ↷ Hexa

1 A 2

$(1A2)_{16}$

(6) Hexadecimal to octal

Easy Method : Hexadecimal → Binary → Octal

Example : $(1AF.BD)_{16} = (?)_8$

1 A F . B D

0001 1010 1111 1011 1101 ↷ B

001 | 101 | 011 | 110 | 111 | 010

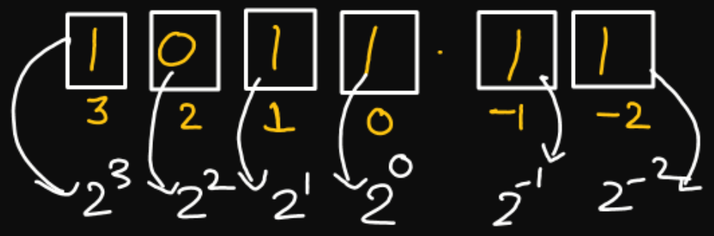
6 5 3 7 5 2

$(653.572)_8$

Gateway Classes

Any base to decimal conversion

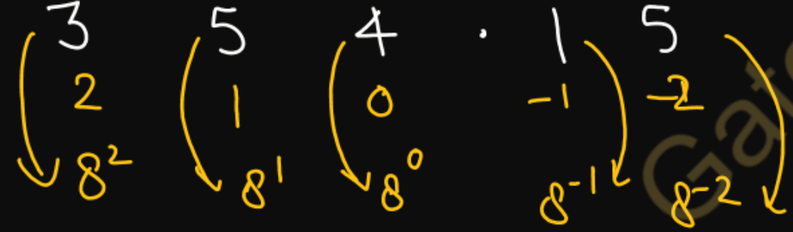
(1) Binary to decimal : Example $(1011.11)_2 = (?)_{10}$



$(1\times2^3)+(0\times2^2)+(1\times2^1)+(1\times2^0)+(1\times2^{-1})+(1\times2^{-2})$

$8 + 0 + 2 + 1 + 0.5 + 0.25 = (11.75)_{10}$ Ans.

(2) Octal to decimal : Example $(354.15)_8 = (?)_{10}$



$(3\times8^2)+(5\times8^1)+(4\times8^0)+(1\times8^{-1})+(5\times8^{-2})$

$= 192 + 40 + 4 + 0.125 + 0.078125$

$= (236.203125)_{10}$

Gateway Classes

(3) Hexadecimal to decimal : Example $(AB2.2C)_{16} = (?)_{10}$

$A_{(10)}$ $B_{(11)}$ 2 . 2 $C_{(12)}$

2 1 0 -1 -2

16^2 16^1 16^0 16^{-1} 16^{-2}

$(10 \times 16^2) + (11 \times 16^1) + (2 \times 16^0) + (2 \times 16^{-1}) + (12 \times 16^{-2})$

$(2560) + (176) + 2 + 0.125 + 0.046875$

$= (2738.171875)_{10}$

(4) Other conversion : Example $(213.23)_4 = (?)_{10}$

2 1 3 . 2 3

2 1 0 -1 -2

4^2 4^1 4^0 4^{-1} 4^{-2}

$= (2 \times 4^2) + (1 \times 4^1) + (3 \times 4^0) + (2 \times 4^{-1}) + (3 \times 4^{-2})$

$= 32 + 4 + 3 + 0.5 + 0.1875 = (39.6875)_{10}$

Gateway Classes

(5) Other conversion : Example $(123)_9 = (?)_{10}$

AKTU-2023-24

1	2	3	Digits.
1	1	9	P.V.
9^2	9^1	9^0	weight

$(1 \times 9^2) + (2 \times 9^1) + (3 \times 9^0)$

$81 + 18 + 3$

$(102)_{10}$

Gateway Classes

Decimal to any Base conversion

(1) Decimal to Binary

Example : $(319.6875)_{10} = (?)_2$

I f

Integer part

		Remainder
2	319	
2	159	1
2	79	1
2	39	1
2	19	1
2	9	1
2	4	1
2	2	0
2	1	0
	0	1

Fractional part

$0.6875 \times 2 = 1.375$ → 1

$0.375 \times 2 = 0.75$ → 0

$0.75 \times 2 = 1.50$ → 1

$0.50 \times 2 = 1.00$ → 1

$= (100111111.1011)_2$

Gateway Classes

(2) Decimal to Octal : Example $(378.93)_{10} = (?)_8$

AKTU-2023-24

		R
8	378	
8	47	2
8	5	7
	0	5

(572)

0.93 × 8	= 7.44	7
0.44 × 8	= 3.52	3
0.52 × 8	= 4.16	4
0.16 × 8	= 1.28	1
0.28 × 8	= 2.24	2

(73412)

$= (572.73412)_8$

(3) Decimal to Hexadecimal :

AKTU-2023-24,22-23

Example (i) $(256)_{10} = (?)_{16}$

16	256	
16	16	0
16	1	0
	0	1

$= (100)_H$

		R
16	454	
16	28	6
16	1	12 → C
	0	1

(1C6)

Example (i) $(454.523)_{10} = (?)_{16}$

0.523 × 16	= 8.368	8
0.368 × 16	= 5.888	5
0.888 × 16	= 14.208	14 (E)
0.208 × 16	= 3.328	3

$= (1C6.85E3)_H$

Gateway Classes

(4) Other conversion : Example $(2230)_4 = (?)_3$

2 2 3 0

3 2 1 0

4^3 4^2 4^1 4^0

Decimal.

① 10 → 172 → ③

$(2 \times 4^3) + (2 \times 4^2) + (3 \times 4^1) + (0 \times 4^0)$

$128 + 32 + 12 + 0$

$= (172)_{10}$

		R
3	172	
3	57	1
3	19	0
3	6	1
3	2	0
	0	2

$= (20101)_3$

Gateway Classes

UNIT-1 DPP-1

Q. Convert the following

(i) Binary $(111101110)_2$ to Octal — Ans:- $(756)_8$

(ii) $(5A9.B4)_{16} = (?)_2$ — Ans:- $(10110101001.10110100)_2$

(iii) $(3102.12)_4$ to decimal — Ans:- $(210.375)_{10}$

(iv) Decimal number 37 to binary — Ans:- 100101

(v) Decimal number 24.6 to binary — Ans:- 11000.10011

(vi) Decimal number 35.45 to octal — Ans:- $(43.34631)_8$

Gateway Classes

A K T U

Gateway Classes

GATEWAY CLASSES

B.Tech

Gateway Udaan Batch

{ Sem-III + Sem-IV }

EC & EC Allied)



COMBO of 11 Subjects

inc-Math-4



Helpline No-7819 0058 53

Gateway Classes

Gateway Classes

Empowering Learners, Transforming Futures

GATEWAY CLASSES

Thank You

Gateway Classes

GET IT ON Google Play

Download on the App Store

Helpline No- 7819 0058 53