

Decimal to Binary Conversion-

① 53_{10}

$$\begin{array}{r} 2 \overline{) 53} \\ 2 \overline{) 26} - 1 \\ 2 \overline{) 13} - 0 \\ 2 \overline{) 6} - 1 \\ 2 \overline{) 3} - 0 \\ 1 - 1 \end{array}$$

$\therefore 53_{10} = (110101)_2$ *Ans*
 MSB $\rightarrow$ LSB

② $(37)_{10}$

$$\begin{array}{r} 2 \overline{) 37} \\ 2 \overline{) 18} - 1 \\ 2 \overline{) 9} - 0 \\ 2 \overline{) 4} - 1 \\ 2 \overline{) 2} - 0 \\ 1 - 0 \end{array}$$

$\therefore 37_{10} = (100101)_2$ *Ans*

③ $(53.625)_{10}$

$$\begin{array}{r} 2 \overline{) 53} \\ 2 \overline{) 26} - 1 \\ 2 \overline{) 13} - 0 \\ 2 \overline{) 6} - 1 \\ 2 \overline{) 3} - 0 \\ 1 - 1 \end{array}$$

~~0.625~~
 $0.625 \times 2 = 1.25 \Rightarrow 1$
 $0.25 \times 2 = 0.50 \Rightarrow 0$
 $0.5 \times 2 = 1.00 \Rightarrow 1$

$\therefore (53.625)_{10} = (110101.101)_2$ *Ans*

④ 167_{10}

$$\begin{array}{r} 2 \overline{) 167} \\ 2 \overline{) 83} - 1 \\ 2 \overline{) 41} - 1 \\ 2 \overline{) 20} - 1 \\ 2 \overline{) 10} - 0 \\ 2 \overline{) 5} - 0 \\ 2 \overline{) 2} - 1 \\ 1 - 0 \end{array}$$

$\therefore 167_{10} = (10100111)_2$

⑤ $(72.45)_{10}$

$$\begin{array}{r} 2 \overline{) 72} \\ 2 \overline{) 36} - 0 \\ 2 \overline{) 18} - 0 \\ 2 \overline{) 9} - 0 \\ 2 \overline{) 4} - 1 \\ 2 \overline{) 2} - 0 \\ 1 - 0 \end{array}$$

$0.45 \times 2 = 0.9 \Rightarrow 0$
 $0.9 \times 2 = 1.8 \Rightarrow 1$
 $0.8 \times 2 = 1.6 \Rightarrow 1$
 $0.6 \times 2 = 1.2 \Rightarrow 1$
 $0.2 \times 2 = 0.4 \Rightarrow 0$
 $0.4 \times 2 = 0.8 \Rightarrow 0$

$\therefore (72.45)_{10} = (1001000.01110)_2$ *Ans*

vi) $(0.4475)_{10}$

$$\therefore 0.4475 \times 2 = 0.895 \Rightarrow 0$$

$$0.895 \times 2 = 1.79 \Rightarrow 1$$

$$0.79 \times 2 = 1.58 \Rightarrow 1$$

$$0.58 \times 2 = 1.16 \Rightarrow 1$$

$$0.16 \times 2 = 0.32 \Rightarrow 0$$

$$0.32 \times 2 = 0.64 \Rightarrow 0$$

$$0.64 \times 2 = 1.28 \Rightarrow 1$$

$$\therefore (0.4475)_{10} = (0.111001)_2$$

$$\text{or } (0.0111001)_2$$

Binary to Decimal conversion

i) $(101111)_2$

$$= \begin{matrix} 5 & 4 & 3 & 2 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 & 1 \end{matrix}$$

$$= 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$= 47$$

$$\therefore (101111)_2 = (47)_{10}$$

ii) $(10001101)_2$

$$= \begin{matrix} 7 & 6 & 5 & 4 & 3 & 2 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 \end{matrix}$$

$$= 1 \times 2^7 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^0 \quad [\text{I never use the '0' term}]$$

$$= 141$$

$$\therefore (10001101)_2 = (141)_{10}$$

$$\textcircled{\text{iii}} (10111.1011)_2$$

$$= \overset{4}{1} \overset{3}{0} \overset{2}{1} \overset{1}{1} \overset{0}{1} . \overset{-1}{1} \overset{-2}{0} \overset{-3}{1} \overset{-4}{1}$$

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

$$= 23.6875$$

$$\therefore (10111.1011)_2 = (23.6875)_{10} \quad \checkmark$$

$$\textcircled{\text{iv}} (0.011011)_2$$

$$= \overset{0}{0} . \overset{-1}{0} \overset{-2}{1} \overset{-3}{1} \overset{-4}{0} \overset{-5}{1} \overset{-6}{1}$$

$$= 1 \times 2^{-2} + 1 \times 2^{-3} + 1 \times 2^{-5} + 1 \times 2^{-6}$$

$$= 0.421875$$

$$\therefore (0.011011)_2 = (0.421875)_{10} \quad \checkmark$$