ECE 1240 Notes

Scientific Notation

Scientific notation is a shortcut method for writing very small or very large numbers. It takes the format:

$N \times 10^i$ where N is a number $1 \leq |N| < 10$ and i is an integer value that indicates right $(+i)$ or left $(-i)$ shift of the decimal point in N. Zeros are added as placeholders

Examples: $6.5 \times 10^3\ \Omega$

$\Rightarrow N = 6.5,\ i = +3$

$\Rightarrow 6.5 \times 10^3\ \Omega = 6.\underbrace{500}_{1\ 2\ 3}\ \Omega = 6500\ \Omega$

$9 \times 10^{-2}\ A$

$\Rightarrow N = 9,\ i = -2$

$\Rightarrow 9 \times 10^{-2}\ A = \underbrace{0\,9}_{-2\ -1}\ A = 0.09\ A$

To convert a given number to scientific notation, write the number as a value $1 \leq |N| < 10$ and count how far the decimal place must be moved to the right $(+i)$ or left $(-i)$ to obtain original number

Examples: 729,614 V

$\Rightarrow 7.\underbrace{29614}_{1\,2\,3\,4\,5} \times 10^{5}\,V = 7.29614 \times 10^{5}\,V$

$\Rightarrow N = 7.29614,\ i = +5$

0.00461 H

$\Rightarrow \underbrace{004}_{-3\,-2\,-1}.61 \times 10^{-3}\,H = 4.61 \times 10^{-3}\,H$

$\Rightarrow N = 4.61,\ i = -3$

Manual arithmetic operations in scientific notation:

Addition/Subtraction: 1) Convert all numbers to largest exponent of 10
2) Then add/subtract the numbers
3) Re-write the answer with correct form and exponent

Examples: $(6.47 \times 10^{-3}\,A) + (5.1 \times 10^{-2}\,A)$

Step 1 $\Rightarrow (0.647 \times 10^{-2}\,A) + (5.1 \times 10^{-2}\,A)$

Step 2 $\Rightarrow [0.647 + 5.1] \times 10^{-2}\,A$

Step 3 $\Rightarrow 5.747 \times 10^{-2}\,A$

$(8.034 \times 10^5\ W) - (4.36 \times 10^4\ W)$

Step 1 $\Rightarrow (8.034 \times 10^5\ W) - (0.436 \times 10^5\ W)$

Step 2 $\Rightarrow [8.034 - 0.436] \times 10^5\ W$

Step 3 $\Rightarrow 7.598 \times 10^5\ W$

Multiplication/Division: 1) Multiply or divide the numbers

2) Add exponents for multiplication

Subtract exponents for division

3) Re-write the answer with correct form and exponent

Examples: $(5.3 \times 10^{-3}\ A)(2.6 \times 10^{1}\ A)$

Step 1 $\Rightarrow (5.3)(2.6) = 13.78$

Step 2 $\Rightarrow -3+1 = -2$

Step 3 $\Rightarrow 13.78 \times 10^{-2}\ A = 1.378 \times 10^{-1}\ A$

$(6 \times 10^{-6}\ F)/(1.36 \times 10^{-4}\ F)$

Step 1 $\Rightarrow (6)/(1.36) = 4.41$

Step 2 $\Rightarrow -6-(-4) = -2$

Step 3 $\Rightarrow 4.41 \times 10^{-2}\ F$

Although calculators can compute these problems effortlessly, it is important to know the rules governing these operations