



COLLEGE OF ENGINEERING SUNY POLYTECHNIC INSTITUTE

ECE 260

Name: _____

Date: _____

Laboratory 0 – Review of Math and Calculator Fundamentals

The following material is meant as a review of the mathematical fundamentals you will need for performing calculations in the laboratory experiments. The following calculations are meant to be performed both with and without a calculator.

A. Powers of 10

You will need to work with very small and very large numbers which will require the use and understanding of powers of 10. If you cannot perform these operations, please find a qualified source to review how to do them.

Perform the following operations by hand. Do not use a calculator.

1. $4,500,000 + 230,000 + 2,000 = \underline{\hspace{2cm}} \times 10^3$

2. $0.03 + 0.006 - 0.2 = \underline{\hspace{2cm}} \times 10^3$

3. $3100 + 0.01 \times 10^2 - 31,000 \times 10^{-4} = \underline{\hspace{2cm}} \times 10^3$

4. $(45,000)(3,000) = \underline{\hspace{2cm}} \times 10^9$

5. $(-2.3 \times 10^{-2})(-5 \times 10^4)(-0.003 \times 10^5) = \underline{\hspace{2cm}} \times 10^0$

6. $0.000072 / 0.0008 = \underline{\hspace{2cm}} \times 10^{-3}$

7. $10000 / (2 \times 10^8) = \underline{\hspace{2cm}} \times 10^{-3}$

8. $(2 \times 10^3)^3 = \underline{\hspace{2cm}} \times 10^9$

9. $(0.00002)^3 = \underline{\hspace{2cm}} \times 10^{-15}$

B. Prefixes

The following list is the prefixes used when expressing numbers in *engineering notation*:

$$10^{12} = \text{tera (T)}$$

$$10^9 = \text{giga (G)}$$

$$10^6 = \text{mega (M)}$$

$$10^3 = \text{kilo (k)}$$

$$10^{-3} = \text{milli (m)}$$

$$10^{-6} = \text{micro } (\mu)$$

$$10^{-9} = \text{nano (n)}$$

$$10^{-12} = \text{pico (p)}$$

For engineering notation, the value of the coefficient must be between 1 and 999 and the power of the base 10 must be a multiple of 3 (it can also be 0).

Apply the most appropriate prefix to convert each of the following quantities into engineering notation:

Example: $0.003 = 3 \times 10^{-3}$ and $124580 = 124.58 \times 10^3$

10. $0.000002\text{A} = \underline{\hspace{2cm}}$

11. $1,400 \, \Omega = \underline{\hspace{2cm}}$

12. $4,000 \text{ V} = \underline{\hspace{2cm}}$

13. $0.00000008 \text{ A} = \underline{\hspace{2cm}}$

14. $100 \text{ mA} = \underline{\hspace{2cm}}$

15. $0.00003\text{kV} =$ _____

16. $0.000021\text{kV} =$ _____

17. $7,600,000\ \Omega =$ _____

18. $760,000\ \Omega =$ _____

19. $5000\ \text{pF} =$ _____

20. $0.5\ \text{nF} =$ _____

C. Square and Cube Roots

Use a calculator

21. $\sqrt{8.1} =$ _____

22. $\sqrt[3]{3000} =$ _____

23. $\sqrt{0.000054} =$ _____

D. Exponential Functions

Use a calculator

24. $e^{3.1} =$ _____

25. $e^{0.2} =$ _____

26. $e^{-0.003} =$ _____

27. $1/e^{-4} =$ _____

E. Algebraic Manipulations (show all work)

28. $P = I^2R$, solve for R and I

$R =$ _____

$I =$ _____

29. $40R = 4R + 4$, solve for R

$R =$ _____

$$30. \frac{1}{V_S} = \frac{1}{V_1} + \frac{1}{5V_1}$$

$$V_S = \underline{\hspace{2cm}}$$

$$31. F = \frac{kQ_1Q_2}{r^2}, \text{ solve for } Q_2 \text{ and } r$$

$$Q_2 = \underline{\hspace{2cm}}$$

$$r = \underline{\hspace{2cm}}$$

F. Calculator Fundamentals

Using a calculator, convert to engineering notation

$$32. 0.0000065 = \underline{\hspace{2cm}}$$

$$33. 45000000 = \underline{\hspace{2cm}}$$

34. $0.0009 =$ _____

35. $330 =$ _____

36. $0.000000000002 =$ _____

37. $0.01 =$ _____

38. $1.01 =$ _____

39. $335 =$ _____

40. $0.000045 =$ _____

Use a calculator and express answers in engineering notation

41. $50\text{E}3 - 2.2\text{E}4 + 0.08\text{E}6 =$ _____

42. $\frac{(4 \times 10^{-6})^2}{8 \times 10^3} =$ _____

43. $0.008 \times (6 \times 10^3) + 5200 \times 10^{-3} - 200\text{E}-3 - 3 =$ _____

44. $30,000 \times \sqrt{(3000)^4} =$ _____

45. $e^{\sqrt{8/3}} =$ _____

46. $e^{e^{-3}} =$ _____

$$47. \frac{86E3 \, x \, e^{-2}}{2E4 + e^7} = \underline{\hspace{2cm}}$$

$$48. 20E2 - 2 + \left(\frac{6}{2E2}\right) = \underline{\hspace{2cm}}$$

$$49. \frac{\sqrt[3]{3^2}}{2+3^2} = \underline{\hspace{2cm}}$$

$$50. \frac{1}{(5-1)^2} = \underline{\hspace{2cm}}$$