

ELECTRICAL MATHEMATICS

TEST 1 – TRIAL TEST/ASSIGNMENT

Notes:

- This test covers order of operations, fractions, significant figures, rounding, percentages, calculator usage, scientific/engineering notation, SI units, errors, approximations.
- The final test will be closed book, calculator permitted.
- It is **ESSENTIAL** to show working/steps, where asked, otherwise **no marks** can be given.

1. Calculate the following, **manually**.

$$a. 2 - 4 + 5 \times 6 - 3 = 2 - 4 + 30 - 3 = -2 + 30 - 3 = -2 + 27 = \underline{25}$$

$$b. 15(5-2) + 10/5 - 4 = 15 \times 3 + 2 - 4 = 45 + 2 - 4 = 47 - 4 = \underline{43}$$

$$c. (8/2 - 3 \times 2 + 10)/2 = (4 - 6 + 10)/2 = (-2 + 10)/2 = 8/2 = \underline{4}$$

$$d. 12 - 20/(10 - 5) = 12 - 20/5 = 12 - 4 = \underline{8}$$

$$e. 15 - (4 + 6 - 2) + 2 \times 3 = 15 - (10 - 2) + 2 \times 3 = 15 - 8 + 2 \times 3 = 15 - 8 + 6 = 7 + 6 = \underline{13}$$

2. Calculate the following, **manually, showing all steps**.

$$a. \frac{5}{4} - \frac{5}{8} = \frac{5 \times 2}{4 \times 2} - \frac{5}{8} = \frac{10}{8} - \frac{5}{8} = \frac{10-5}{8} = \underline{\frac{5}{8}}$$

$$b. \frac{3}{7} \times \frac{5}{8} = \frac{3 \times 5}{7 \times 8} = \underline{\frac{15}{56}}$$

$$c. \frac{\frac{1}{4} + \frac{2}{3}}{\frac{1}{5}} = \frac{\frac{1 \times 3}{4 \times 3} + \frac{2 \times 4}{3 \times 4}}{\frac{1}{5}} = \frac{\frac{3}{12} + \frac{8}{12}}{\frac{1}{5}} = \frac{\frac{11}{12}}{\frac{1}{5}} = \frac{11}{12} \div \frac{1}{5} = \frac{11}{12} \times \frac{5}{1} = \underline{\frac{55}{12}}$$

$$d. 3\frac{2}{5} \times 2\frac{5}{8} = \frac{17}{5} \times \frac{21}{8} = \frac{17 \times 21}{5 \times 8} = \frac{357}{40} = \underline{8\frac{37}{40}}$$

$$e. 3\frac{2}{5} + 2\frac{5}{8} = (3+2) + \frac{2}{5} + \frac{5}{8} = 5 + \frac{16}{40} + \frac{25}{40} = 5 + \frac{41}{40} = 5 + 1\frac{1}{40} = \underline{6\frac{1}{40}}$$

$$f. \sqrt{\frac{9}{16}} = \frac{\sqrt{9}}{\sqrt{16}} = \frac{3}{4}$$

$$g. \sqrt{5\frac{4}{9}} = \sqrt{\frac{49}{9}} = \frac{\sqrt{49}}{\sqrt{9}} = \frac{7}{3} = 2\frac{1}{3}$$

$$h. \frac{4}{5} \div 3 = \frac{4}{5} \times \frac{1}{3} = \frac{4}{15}$$

$$i. \sqrt{60+4} = \sqrt{64} = 8$$

$$j. \frac{3}{4} \div \frac{5}{7} = \frac{3}{4} \times \frac{7}{5} = \frac{21}{20} = 1\frac{1}{20}$$

3. Complete the following table by filling in the blanks:

	Usual Decimal	Scientific Notation	Engineering Notation
a.	510.0	5.1×10^2	510.0
b.	75 000	7.5×10^4	75×10^3
c.	22 000 000	2.2×10^7	22×10^6
d.	0.000022	2.2×10^{-6}	2.2×10^{-6}

4. Perform the following calculations, **manually, showing the steps taken:**

$$a. 2.2 \times 10^3 \times 3 \times 10^{-2} = (2.2 \times 3) \times 10^{(3-2)} = 6.6 \times 10^1 = 66$$

$$b. (4.4 \times 10^4) \div (2.2 \times 10^3) = \left(\frac{4.4}{2.2}\right) \times 10^{(4-3)} = 2 \times 10^1 = 20$$

$$c. 2.2 \times 10^4 + 2 \times 10^3 = 22 \times 10^3 + 2 \times 10^3 = (22+2) \times 10^3 = 24 \times 10^3$$

$$d. 6000 / (2 \times 10^4) = (6 \times 10^3) \div (2 \times 10^4) = \left(\frac{6}{2}\right) \times 10^{3-4} = 3 \times 10^{-1} = 0.3$$

5. Complete the following table by filling in the blanks:

	a.	b.	c.	d.	e.
Number Form	$3.3 \times 10^6 \Omega$	$5 \times 10^{-3} A$	0.3 V	200 000 V	9000 V
Engineering Prefix	3.3 MΩ	5 mA	300 mV	200 kV	9 kV

6. What is the symbol of **AND** value for the following prefixes? Eg milli has symbol m and a value of 10^{-3}

- a. Kilo — (k) — 10^3
- b. Pico — (p) — 10^{-12}
- c. Mega — (M) — 10^6
- d. Nano — (n) — 10^{-9}

7. Round off the following numbers to 2 **decimal places**:

- a. 733.3333 = 733.33
- b. 6.5555 = 6.56
- c. 0.2279 = 0.23
- d. 0.00044332 = 0.00
- e. 44.999 = 45.00

8. Round off the numbers in question 7 to 3 (three) **significant figures**:

- a. 733.3333 = 733
- b. 6.5555 = 6.56
- c. 0.2279 = 0.228
- d. 0.00044332 = 0.000443
- e. 44.999 = 45.0

9. Convert the following decimals and fractions to percentages, and vice-versa.

- a. $\frac{1}{4}$ = $\frac{1}{4} \times 100 = 0.25 \times 100 = \underline{25\%}$
- b. 0.45 = $0.45 \times 100 = \underline{45\%}$
- c. 50% = $\frac{50}{100} = \underline{0.5}$
- d. 110% = $\frac{110}{100} = \underline{1.1}$
- e. 10% = $\frac{10}{100} = \underline{0.1}$
- f. $\frac{1}{3}$ = $\frac{1}{3} \times 100 = \underline{33\frac{1}{3}\%}$

10. For the following, express the first quantity as a percentage of the second:

- a. 7 students, 10 students = $\frac{7}{10} \times 100 = 0.7 \times 100 = 70\%$
b. 100 V, 1 kV = $\frac{100}{1000} \times 100 = 0.1 \times 100 = 10\%$
c. 10 mA, 1 A = $\frac{0.01}{1} \times 100 = 1\%$
d. 600 Ω , 50 Ω = $\frac{600}{50} \times 100 = 1200\%$

11. Calculate the lower and upper values for the actual resistance of resistors with the following nominal values and tolerances:

- a. 1000 Ω , $\pm 5\%$ $\frac{5 \times 1000}{100} = 50 \Omega$, \therefore Lower limit = $1000 - 50 = 950 \Omega$
Upper limit = $1000 + 50 = 1050 \Omega = 1.05 k\Omega$
b. 470 k Ω , $\pm 10\%$ $\frac{10 \times 470 \times 10^3}{100} = 47 k\Omega$, Lower limit = $470 - 47 = 423 k\Omega$
Upper limit = $470 + 47 = 517 k\Omega$

12. Where is the evacuation point for the Electrical Mathematics classroom (in case of emergency)?

At the football grounds in front of the building.
*In every test you may find OHS questions.
If you are unsure how to answer them ask your lecturer.

13. Using a calculator, calculate the values of the following expressions **AND** also manually estimate an approximate value for these expressions. **Show how** the estimate was obtained.

- a. $3.2 \times 4.77 + 72.2$

Estimation: $3 \times 5 + 72 = 15 + 72 = 87$

Calculation: 87.464

- b. $\pi 6.9^2$

Estimation: $3 \times 7^2 = 3 \times 49 = 147$

Calculation: 149.57

----- END OF TRIAL TEST/ASSIGNMENT - Check your work! -----