



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

**SCHOOL OF ENGINEERING AND TECHNOLOGY
BUILDING AND CIVIL ENGINEERING DEPARTMENT
FIRST YEAR FIRST TERM EXAMINATION FOR
DIPLOMA IN ELECTRICAL ENGINEERING - TVET**

2601/106 - ELECTRICAL MEASUREMENTS

DATE:

TIME:

INSTRUCTIONS: ANSWER ALL THE FIVE QUESTIONS

1.
 - a)
 - i) State two advantages of SI units (2 marks)
 - ii) Explain giving examples explain what is meant by a measurement (5 marks)
 - b)
 - i) Give the names of the following 10^9 , 10^{-12} , 10^{-18} , 10^{-9} (4 marks)
 - ii) Give the values of the following micro, femto, mega, terra (4 marks)
 - iii) Calculate the value of T and give the result in engineering notation
 $T = 0.000003 \times 0.02 \times 0.00007 / 0.06$ (5 marks)
2.
 - a)
 - i) Explain what primary unit's means in measurements. (4 marks)
 - ii) Name the three (3) classified categories of drifts. (3 marks)
 - b) An ammeter reads 38.72 A instead of 38.95 A. Calculate
 - i) static error
 - ii) absolute error

iii) The Percentage Error (6 marks)

c) In the measuring of resistance by substitution method a standard $0.5\text{M}\Omega$ resistor is used. The galvanometer has a resistance of $10\text{K}\Omega$ and gives deflections as follows:

- i) With a standard resistor 41 divisions
- ii) With unknown resistance 51 divisions

Find the unknown resistor (7 marks)

3. a) Explain, giving examples, the meaning of the following terms:

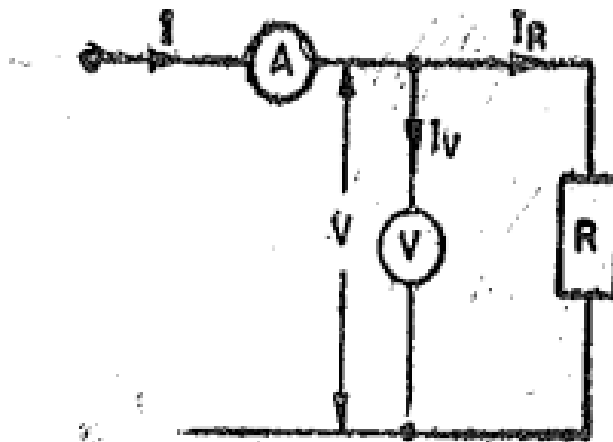
- i) Accuracy
- ii) Span
- iii) Range
- iv) Absolute error

(12 marks)

b) Explain with diagrams the difference between null and deflecting measuring instruments. (8 marks)

c) i) name four methods of measuring resistance

- ii) In the measurement of resistance R , Ammeter-Voltage method is used as shown below. The resistance of the Ammeter is 0.01Ω and that of the voltmeter 2000Ω . In the case of voltmeter the current is 2A and the voltage 180V . Find the percentage error in calculating R as a quotient of the readings and the true value of R . Find also the reading of the voltmeter if the current is 2A .



4. a) The dimensional equation of resistance in the LMTI system of dimensions is $[R] = [ML^2I^{-2}T^{-3}]$. Use this equation to obtain the dimensional equations for the following in the LMTI system of dimensions.
- i) Conductivity
 - ii) Voltage
 - ii) Charge
 - iv) Capacitance (10 marks)
- b) Derive the dimensional equation for capacitance in c. g. s. electrostatic units. Take the dimensional equation for charge $[Q] = [\epsilon^{1/2} M^{1/2} L^{3/2} T^{-1}]$ (10 marks)
5. a) i) Explain how a galvanometer can be converted to measure a
- i) Current
 - ii) Voltage (4 marks)
- ii) A 10Ω galvanometer with a full scale deflection of 10mA is used to measure a current of 10A. Calculate the value of the shunt resistance needed. (6 marks)
- b) i) A moving-coil instrument having a resistance of 10Ω , gives a f.s.d. when the current is 15mA. Calculate the value of the multiplier to be connected in series so that it can be used as a voltmeter for measuring up to 100V. (5 marks)
- ii) In a Wheatstone bridge circuit, calculate the unknown resistor given that $R_1 = 300\Omega$, $R_2 = 150\Omega$ and $R_3 = 250\Omega$ (5 marks)