MACHAKOS UNIVERSITY

University Examinations for 2019/2020

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL ENGINEERING (TVET)

ELECTRICAL MEASUREMENT

DATE: 14/12/2020 **TIME:2.00-4.00 PM**

INSTRUCTIONS

Answer all questions

1. a) i) State two advantages of SI units (1 Mark)

   ii) Explain what is meant by a measurement (4 marks)

   b) i) Explain the following types of maintenance programs

      I. Breakdown

      II. Preventive

      III. Shut down (6 marks)

   ii) An ammeter reads 38.5 A instead of 38.9A. Calculate

      I. Absolute error

      II. The Percentage Error (3 marks)

   c) Explain, using a diagram, how a deflection type of instrument operates. (6 marks)

2. a) i) Explain how a null instrumentmeasure resistances. (6 Marks)

   ii) In a Wheatstone bridge circuit, calculate the unknown resistor given that R1 = 400Ω, R2 = 200Ω and R3 = 600Ω (7 Marks)

   b) An electrical motor provides an output power of 330kw. The electrical loses are found to be 20kw and the friction and windings loss is 10kw. Calculate the mechanical output to the motor and its overall efficiency. (7 Marks)

3. a) Explain what primary unit's means in measurements. (4 marks)

b) 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. (9 marks)

c) Derive the dimensional equation for capacitance in c.g's. electrostatic units. Take the dimensional equation for charge $[Q] = [\epsilon^{1/2} M^{1/2} L^{3/2} T^{-1}]$ (7 marks)

4. a) Explain, with a diagram, what is a shunt in a circuit (4marks)

b) Explain how a galvanometer can be converted to measure a

i) Current

ii) Voltage (6 marks)

c) A 50Ω galvanometer with a full scale deflection of 100mA is used to measure a current of 10A. Calculate

i) The value of the shunt resistance needed.

ii) If it were to be converted to a voltmeter to measure up to 50V, calculate the required multiplier value needed. (10 marks)

5. a) State four factors that would determine the maintenance of policy to be adopted for a particular system. (6 marks)

b) i) state two effects of the following on the reliability of an equipment i) high temperatures ii) mechanical vibrations and shock (6 marks)

ii) An equipment has a mean time between failures of 800 hours and Mean time to repair of 12 hours. For the equipment determine the

i) maintainability for a time of 7 hours

ii) availability

iii) unavailability (6 marks)