



ELIZADE UNIVERSITY ILARA MOKIN, ONDO  
STATE

FACULTY OF ENGINEERING  
DEPARTMENT OF ELECTRICAL AND  
ELECTRONICS ENGINEERING

COURSE TITLE: MEASUREMENTS AND INSTRUMENTATION

COURSE CODE: EEE 311

EXAMINATION DATE: 6<sup>TH</sup> MARCH, 2019

COURSE LECTURER: DR O. K. OGIDAN

HOD's Signature

TIME ALLOWED: 3 HOURS

#### INSTRUCTIONS

- a. ANSWER ANY FIVE (5) QUESTIONS.
- b. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
- c. YOU ARE NOT ALLOWED TO BORROW ANY WRITING MATERIALS DURING THE EXAMINATION.

### Question 1

a.) Define the following as it relates to the performance of a system

- i.) Accuracy
- ii.) Sensitivity
- iii.) Range
- iv.) Reproducibility

(2 marks)

b.) Define a real-time system and give two examples

(2 marks)

c.) An ammeter has a f.s.d of 100 mA and a resistance of  $50 \Omega$ . The ammeter is used to measure the current in a load of resistance  $500 \Omega$  when the supply voltage is 10 Volts. Calculate:

- i) the ammeter reading expected (neglecting its resistance)
- ii.) the actual current in the circuit
- iii.) the power dissipated in the ammeter and
- iv.) the power dissipated in the load?

(8 marks)

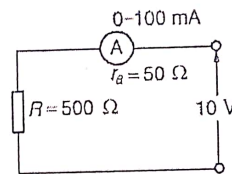


Figure 1

### Question 2

a.) Explain briefly the following terms

(2 marks)

- i.) Transducers and give examples
- ii.) Analogue to digital conversion

b.) What do you understand by instrument loading effect?

(2 marks)

c.) Calculate the power dissipated by the voltmeter and resistor  $R$  in figure 2 when (i)  $R = 250 \Omega$  (ii)  $R = 2 \text{ M}\Omega$ . Assume that the voltmeter sensitivity (figure of merit) is  $10 \text{ K}\Omega / \text{Volt}$ .

(6 marks)

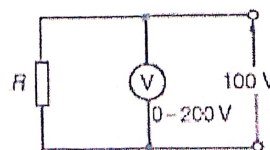


Figure 2

d.) Write briefly on the following instruments

(2 marks)

- i.) Wattmeter
- ii.) Signal generator

### Question 3

a.) What is the main difference between microcontroller and microprocessor? (2 marks)

b.) You are a power system engineer in a developing power distribution company. The power generation available to you is not enough - just one third ( $1/3$ ) of the power required for the city. As a result, there is the need for load-shedding. The city under your control had been grouped into four divisions namely:

- Residential area = pin 3
- Industrial area = pin 4
- Commercial area = pin 7
- University Teaching Hospital = pin 6

i.) Prepare in a tabular form how you will implement a load-shedding activity within a period of twenty four (24) hours. (Hint use 1 second to represent 1 hour) (3 marks)

ii.) Write a program that will implement the load-shedding plan using a modern power distribution controller (5 marks)

iii.) Draw a flowchart of the program you have written to implement the load shedding (2 marks)

### Question 4

a.) What is an oscilloscope? (1 marks)

b.) Distinguish between analogue and digital oscilloscope. (3 marks)

c.) A sinusoidal voltage trace displayed by an oscilloscope is shown in figure 3. If the time on the 'time/cm' switch is on  $500\mu\text{s/cm}$  and the 'Volts/cm' switch is on  $5\text{ V/cm}$ , determine:

- i.) The frequency, ii.) the peak-to-peak voltage, iii.) the amplitude iv.) the r.m.s value

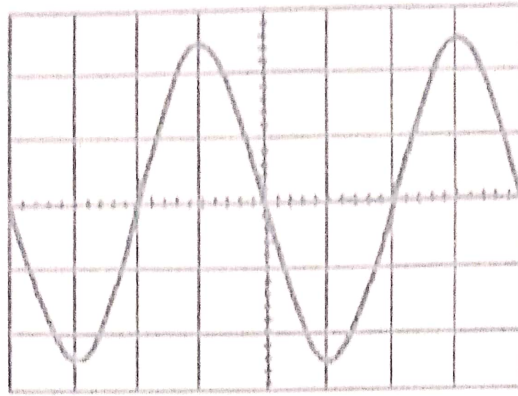


Figure 3

(8 marks)

### Question 5

- Describe briefly the concept of a SCADA system (1 marks)
- Describe three applications of instrumentation systems to everyday life (3 marks)
- Describe briefly the constituent elements of an instrumentation system (3 marks)
- A moving coil instrument having a resistance of 10 ohms gives a f.s.d. when the current is 12mA. What is the value of the multiplier that would be connected in series with the instrument so that it can be used as a voltmeter for measuring up to 120 V. (5 marks)

### Question 6

- With the aid of a suitable diagram, describe the operation of a moving iron coil (attraction type) (2 marks)
- How will you convert a galvanometer to an ammeter? (2 marks)
- How will you convert a galvanometer to a voltmeter? (2 marks)
- A moving coil instrument gives a full scale deflection when the current 80 mA and the resistance is 60 ohms. Calculate the value of the shunt to be connected in parallel with the metre to enable it to be used as an ammeter for measuring up to 120 A. A moving-coil instrument has a f.s.d. of 20 mA and a resistance of 25  $\Omega$ . Calculate the values of resistance required to enable the instrument to be used (2 marks)
  - as a 0 –10 A ammeter, and
  - as a 0 –100 V voltmeter.



### Question 7

- a.) Mention four electrical/electronic measuring instruments and their uses (2 marks)
- b.) Distinguish between analogue and digital measuring instruments. (2 marks)
- c.) What are the advantages of digital measuring instruments over the analogue instruments? (2 marks)
- d.) With the aid of suitable diagram, describe the operation of a digital oscilloscope (4 marks)
- e.) What do you understand by : i.) vertical deflection? ii.) Horizontal deflection? (2 marks)