FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA
SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHATRONICS ENGINEERING
FIRST SEMESTER 2018/2019 B.Eng. DEGREE MID-SEMESTER EXAMINATION
COURSE: MCE 315: INSTRUMENTATION AND MEASUREMENTS
INSTRUCTION: Attempt ALL Questions in Section A and only Three (3) Questions in Section B
TIME ALLOWED: 3 Hours

Section A: Kindly Attempt ALL Questions in this section [55 Points]

Question One {Introduction to Instrumentation and Measurement**}** **[5 Points]**

a. How would you explain "instrumentation and measurement" in a job interview scenario when you graduate as a mechatronics engineer? **[3 Points]**
b. Justify the need for standard system of Units. **[2 Points]**

Question Two {Analog to Digital Converters**}** **[30 Points]**

a. Justify the need for a sensor in a typical Mechatronics System **[2.5 Points]**
b. Discuss and explain Sensors classification using the following criteria: (i) Power Supply requirement, (ii) Nature of Signal output (iii) Measurement and Operation Modes **[2.5Points]**
c. Distinguish between analog, discrete time signal and digital signals using appropriate figures and equations. **[2.5 Points]**

d) Given that the summing amplifier in Figure 1, Calculate the output voltage and output current in the op-amp circuit. (2.5marks)

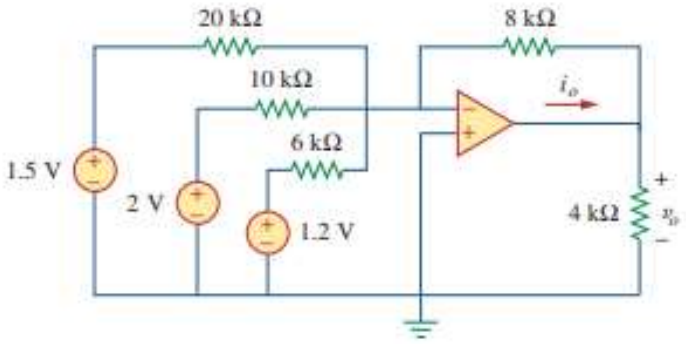

Figure 1: OP Amp

e.) Enumerate five basic features of instrumentation Amplifier (2.5marks)

f) Find the analogue output voltage in figure 1. If the input signal (D3 D2 D1 D0) is given by 1011 for a simple digital-to-analogue conversion circuit where ('1' signal indicates the **ON** position and '0' indicates the **OFF** position(5marks).

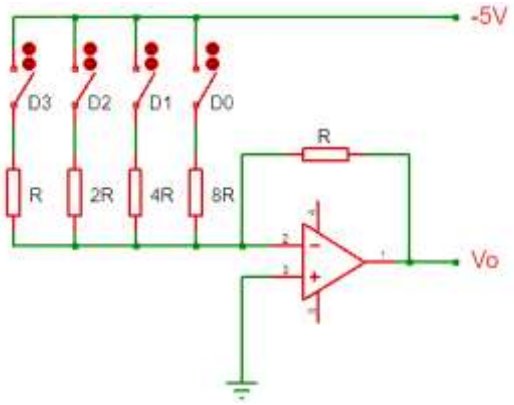

Figure 1: ADC

Question Five {Multi-channel data acquisition**}** **[10 Points]**

Potholes and bumps are responsible for large number of accidents and loss of lives and properties on Nigerian roads. Developing proactive and early detection measures will be an effective approach for reducing accidents, and a source of information for ensuring timely road maintenance activities. Consequently, you are expected to design a cost-effective road defect detection using: Ultrasonic sensor, a global positioning system (GPS) and GPRS system, Microcontroller and an alert system. Block diagram, Flow chart, pseudo code and explanation of detailed procedures will be required for full points.

Question Seven {*Signal conditioning for electronics instruments, Motion Dimensional Motion* **}**

[25 Points]

a. As a Mechatronics Engineering student, list and discuss at least five different conditions that may necessitate signal conditioning while executing a project?
b. Frequently performed types of signals conditioning includes but not limited to: Filtering, Signal-Level Change and Signal Conversion, Linearization etc, give detailed description how these could be successfully achieved in a typical Mechatronics system.

c. The following set of measurement was recorded in the laboratory. Calculate the precision of the fourth measurement

No. meas	1	2	3	4	5	6
Meas. Value	99	103	100	97	100	106

d. List and discuss the four main condition that may warrant the use of potentiometer (Variable Resistor)
e. List and discuss five basic features of instrumentation Amplifier ()

Kindly set 2 questions and let each be 15 Points each.

==========END OF EXAMINATIONS==========