	FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGERIA **SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY** **DEPARTMENT OF MECHATRONICS ENGINEERING** **FIRST SEMESTER 2019/2020 ACADEMIC SESSION**
	MCE 531: Electronic Instrumentation and Design
	TIME ALLOWED: 2 HOURS **CREDIT UNIT:** 2 **LEVEL:** 500
Instruction: Attempt all Questions	

Question 1 (25marks)

a) Explain in details what you understand by: Noise, Noise flow, and characterization. In your explanation do not forget to discuss the usefulness of Noise in mechatronics system design.

b) A SMT2047 Op-amp was used in the design of an audio system for Mechatronics lecture hall, the noise spectrum of the op-amp is 2.5nV/$\sqrt{Hz}$ and was used over an audio frequency range of 30Hz to 50kHz, with a gain of 60dB, the output voltage was measured to be 0dBv, Calculate the Signal to Noise ratio of the design.

c) With the aid of a well labelled graph, explain what you understand by Noise Corner Frequency.

Question 2 (25marks)

(a.) Establish a signal Conditioning system using whetstone bridge to convert the change in resistance to change in voltage and derive the condition for unbalance system to show its output voltage.

(b.) A platinum resistance temperature sensor has a resistance of 100 ohm at 0^{o}C is placed in one arm of a Wheatstone bridge with each of the other arms also being 100ohm. If the resistance temperature coefficient of the platinum is 0.003/K. Determine output voltage from the bridge per degree change in temperature. If the load across the output can be assumed to be infinite with supply voltage of 6v.

(c.) Differentiate between Accuracy and Precision in relation to Wheatstone bridge design.

Question 3 (25marks)

(a.) Define the term Signal conditioning

(b.) The difference in voltage between the emfs of the two junctions of the thermocouple is designed to amplified the output signal. If a temperature difference between the thermocouple junctions 10°C produces an emf difference of 530 microvolts.

i. Draw a circuit to suit the amplification process

ii. Determine the values of the resistor R_1 and R_2 assuming the circuit gives out 10mv at the output.

(c.) If an RC low pass filter with a resistor of 1Kohm and a capacitor 47nF has been designed by a student form the Department of Mechatronics Engineering for laboratory use. Draw a likely circuit diagram for such a design and determine its cutoff frequency.

Question 4 (25marks)

(a.) Define the term Data Acquisition system and mention the primary function of Analogue to Digital Cs Converter (ADC) as a parameter in a typical data acquisition system (DAQ)

(b.) A simple DAQ system block consists of a switching network (multiplexer), an instrumentation amplifier and an analog-to-digital converter (ADC). Draw the circuit or block diagram to implement it.

(c.) Enumerate 3(three) ways in which data acquisition system differs from other measuring instrument like voltmeter.