AHMEDABAD UNIVERSITY
School of Engineering and Applied Science
2025-2026 Winter

ENR206 Sensors, Instruments and Experimentation
End-Sem Examination
Wednesday 29 April 2026. 8:00 – 9:00

Name:	Roll no.	A	U	2							Marks /30
Section Number:											

Instructions:

1. *Answer all the questions.*
2. *No electronic objects are allowed except calculators.*
3. *Closed book exam. Access to internet is not allowed.*
4. *All acronyms carry their usual meaning.*
5. *Answer the questions in the space provided.*

Answer the questions.

Question 1: [1 Mark]
It is evening time for a cricket match, and there is an appeal for bad light. The two umpires on the ground have commercial light meters L1 and L2, respectively. The standard meter reading is 200 Lux. Both umpires are taking light reading at 10-second intervals, which are as below:
Lux reading of L1: 190.1, 190.3, 189.9, 190.0, 189.6
Lux reading of L2: 196.2, 202.2, 199.0, 201.2, 200.5
Which is the correct statement below?

(a) L1 reading is more accurate than L2 reading
(b) L1 reading is less accurate than L2 reading.

Question 2: [1 Mark]
A device that converts a non-electrical physical quantity into an electrical quantity is called
(a) Actuator
(b) Comparator
(c) Sensor
(d) Amplifier

Question 3: [1 Mark]
Piezoelectric crystal can act as?
(Choose the best option)
(a) Sensor
(b) Actuator
(c) both Sensor and actuator
(d) None of the above

Question 4: [1 Mark]
Which of the following is an example of an actuator?
(a) Thermocouple
(b) Microphone
(c) Speaker
(d) Potentiometer

Question 5: [1 Mark]
A thermocouple acts as a sensor because it converts:
(a) Electrical to non-electrical quantity
(b) Non-electrical (heat) to electrical quantity
(c) Digital to analog signal
(d) Resistance to voltage

Question 6: [1 Mark]
The conformity of a measurement to the true value is specifically defined as:
(a) Precision
(b) Accuracy
(c) Resolution
(d) Linearity

Question 7: [1 Mark]
Which type of error is repeatable and often due to instrument inaccuracies or faulty experimental design?
(a) Random error
(b) Systematic error
(c) Noise
(d) Human error

Question 8: [1 Mark]
The 10-bit ADC in an Arduino maps 5V to which decimal value?
(a) 255
(b) 512
(c) 1000
(d) 1023

Question 9: [1 Mark]
Which function is used to generate a Pulse Width Modulation (PWM) signal?
(a) digitalRead()
(b) analogRead()
(c) analogWrite()

(d) pinMode()

Question 10: [1 Mark]
A PWM duty cycle of 100% corresponds to which integer value in analogWrite()?
(a) 127
(b) 512
(c) 255
(d) 1023

Question 11: [1 Mark]
What happens to the error in a voltage measurement as the meter resistance increases?
(a) The error increases
(b) The error decreases
(c) The error remains constant
(d) The error becomes random

Question 12: [1 Mark]
What is the resolution of ADC in Arduino?
(a) 5/255 Volt
(b) 1/255 Volt
(c) 5/1023 Volt
(d) 5/255 Volt

Question 13: [1 Mark]
What is the bit rate of the ADC used in Arduino?
A. 6 Bit
B. 8 Bit
C. 10 Bit
D. 12 Bit

Question 14: [1 Mark]
The on time of the PWM signal is provided by the PWM pin of the Arduino is 1ms. The total time of the PWM signal is 10 ms. What is the average value provided by the PWM signal if the maximum amplitude of the pulse is 5V?
A. 0.5 V
B. 1 V
C. 1.5 V
D. 2 V

Question 15: [2 Mark]

int x= analogRead(analog pin);
The above line is executed by an arduino. If the value of x obtained is 512 then what is the value of input voltage applied to the analog input pin? Choose the best option.
(a) 1.5 V
(b) 2.5 V
(c) 3.5 V
(d) 4 V

Question 16: [2 Mark]
There is a standard thermometer placed in the playground next to GICT building. It is reading 27 Degree C at 6PM. The football referee has his own temperature meter which gives following reading when taken at interval of 10 seconds: 26.8, 27.5, 28.0, 27.0, 26.5, 26.9 deg
Referee's temperature meter has (select1)
(a) Random error
(b) Systematic error

Question 17: [2 Mark]

A manufacturer provides a best-fit line: $y = 5x + 0.2$ (x in mm, y in Volts).

i) Find y for $x = 4.5$ mm

ii) If $y = 12.7$ V, find x

Question 18: [2 Mark]

You are designing a temperature alarm system. The system uses a Thermocouple to monitor heat and a Heater to maintain temperature.

i. Identify which device is the sensor and which is the actuator based on the signal conversion type.

ii. If the Thermocouple follows the power formula y = kx^m where k=0.5 and m=2, calculate the electrical output y for a temperature input x of 10°C.

Question 19: [2 Mark]

Problem: You are building an analog temperature measuring instrument with a range of 0 to 150°C. You have a sensor with a sensitivity of 12 mV/°C and a voltmeter with a full-scale range of 0 to 10 Volts.

i. Calculate the output of the sensor at 150°C.

ii. Determine the required amplifier gain for full-scale deflection at 150°C.

Question 20: [3 Mark]

List 2 differences and 1 example each of sensors and transducers.

Question 21: [3 Mark]

To reduce random errors, an object is weighed five times. The readings in kg are: 10.2, 9.7, 10.1, 10.0, and 9.8. Calculate the mean, variance and standard deviation in reading values.