Roll No: | | | | | | | | | | | |

PRESIDENCY UNIVERSITY

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi | Approved By BCI
Bengaluru

Mid Term Examinations - October 2026

Date: 07/10/2026 **Time:** 09:30 AM - 11:00 AM

Course Code: ECE3201 **Course Name:** Biomedical Instrumentation

Semester: Fifth Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2	CO3	CO4
Marks	22	24	22	22

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	A patient's movement is restricted by a long cable to a monitor. Name an approach permitting remote measurement and explain its function.	2	CO1	BT2
2	A thermistor's resistance decreases during a warming test. Identify its type and explain the resistance–temperature trend.	2	CO2	BT2
3	A piezoelectric crystal generates a signal under mechanical stress. Explain this conversion and state what happens when a varying voltage is applied instead.	2	CO2	BT2
4	An ECE student tests an electronic blood-pressure monitor against a standard pressure gauge. The standard gauge reads 150 mmHg, while the monitor displays 144 mmHg. Calculate the percentage error and state whether the monitor overestimates or underestimates the pressure.	2	CO3	BT2
5	A respiratory report lists vital capacity rather than a single lung volume. Explain why VC is a capacity and name its three components.	2	CO4	BT2

PART B : Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
6	A biomedical sensor is represented by a 100 µV differential source, total series source resistance 100 kΩ, and amplifier input resistance 1 MΩ. Separately, the amplifier's differential gain is 1000, and common-mode gain is 0.01. Tasks: Explain the three-op-amp instrumentation-amplifier arrangement [4]; illustrate the actual input voltage and loading loss [3]; calculate CMRR as a ratio and in dB [2]; suggest a change reducing loading [1].	10	CO1	BT2
7	An acoustic biomedical sensor feeds a common-emitter preamplifier. Given: The sinusoidal input is 20 mV peak. Assume linear passband operation and negligible loading. Tasks: Explain transistor, collector resistor, bias resistor and coupling-capacitor functions [4]; illustrate the working by finding DC collector voltage, AC output amplitude and collector-voltage range [3]; explain the output after *C2* [2]; state a filtering function [1].	10	CO1	BT2

PART C: Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT

8	An NTC thermistor has 10 kΩ at 25°C and $\beta=3500$ K. Its temperature becomes 37°C. Use:  Tasks: Explain sensing principle, temperature coefficient and excitation classification [3]; calculate resistance at 37°C [4]; explain why wide-range straight-line calibration can be inadequate [2]; state one useful biomedical feature [1].	10	CO2	BT2
9	A pickup experiences a changing force of amplitude 0.20 N. Its charge sensitivity is 200 pC/N, and effective capacitance is 1.0 nF. Use the ideal charge-generator model and neglect leakage during measurement. Tasks: Explain the sensing principle and equivalent model [3]; calculate charge and voltage [4]; determine charge and voltage when capacitance doubles [2]; classify the sensing element [1].	10	CO2	BT2

PART D: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
10	Two simulated cases require: occasional non-invasive readings, and a continuous pressure trace during rapidly changing conditions. A cuff test gives first/disappearing Korotkoff sounds at 136/88 mmHg. A direct-channel interface produces 4 mV, amplified with gain 250. Tasks: Select an approach for each case [2]; interpret the Korotkoff observations [2]; draw the direct-measurement chain [4]; calculate amplifier output [1] and pulse pressure [1].	10	CO3	BT3
11	In a laboratory exercise, 5 mg of dye gives a first-pass concentration–time area of 60 mg·s/L. A repeat test with the same dye mass gives 75 mg·s/L. Assume complete mixing, constant flow within each test and complete relevant dye passage. Tasks: Draw and explain the arrangement [3]; derive the flow expression [3]; calculate both flows in L/min [3]; state one required dye property [1].	10	CO3	BT3

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	(i) Explain the spectrophotometric basis of oximetry [2]. In a two-species teaching model, $HbO2=14.4$ and $Hb=0.6$, in identical concentration units. Calculate oxygen saturation [3]. (ii) Explain how a water-sealed spirometer produces a spirogram [3]. Given TV = 0.40 L, IRV = 2.10 L, ERV = 1.00 L and separately supplied RV = 1.10 L, and based on respiratory physiology illustrate the lung capacities FRC and TLC [2].	10	CO4	BT2
13	(i) A simulation triggers a systolic-pressure alarm for readings strictly greater than 140 mmHg. Readings are 138, 142, 140 and 146 mmHg. Identify alarming readings and their number [2]. State one benefit of displaying multiple parameters [1]. SpO_2 falls from 98% to 94% in 8 minutes; calculate the average decrease in percentage points/minute [2]. (ii) One respiratory recording comes from a nostril thermistor and another from a water-sealed spirometer. Explain how each recording is generated [4], and identify which represents respiratory volume [1].	10	CO4	BT2