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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 120011

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2024

Third Semester

Biomedical Engineering

U23BM302 – BIOSENSORS AND MEASUREMENT DEVICES

(Regulation 2023)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	What are primary and secondary standards in calibration?	2	K1	CO1
2.	A thermometer shows a reading of 92.45°C, and the static correction from the calibration curve is -0.06°C. Find the true temperature value.	2	K2	CO1
3.	Identify the significance of the temperature coefficient of resistance in RTD materials.	2	K3	CO2
4.	A resistance wire strain gauge uses a platinum wire. The gauge factor is +4.8. Neglecting piezoresistive effects, calculate the Poisson's ratio.	2	K3	CO2
5.	How does a phototransistor differ from a photodiode?	2	K2	CO3
6.	Draw the equivalent circuit of piezoelectric transducer.	2	K1	CO3
7.	State the basic principle of a PMMC instrument.	2	K1	CO4
8.	State the role of a filter in a signal conditioning circuit.	2	K1	CO4
9.	How are biosensors classified?	2	K1	CO5
10.	Describe the working principle of an electronic nose?	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Explain the concept of error propagation in measurement systems when multiple variables are involved. How can the total uncertainty be calculated if several measurements contribute to the final result? Calculate the propagated uncertainty in the power measurement $P=V \times I$. The measured voltage is $V=12 \pm 0.1$ V and a current is measured is $I= 1 \pm 0.05$ A.	13	K3	CO1
(OR)				
b)	Define Mean, Standard Deviation, Variance, and Probability Distribution in the context of measurement errors. Given the temperature measurements: 36.4°C, 36.7°C, 36.6°C, 36.4°C, and 36.8°C, calculate the mean and standard deviation. What do these results indicate about the precision and accuracy of the measurements?	13	K3	CO1
12. a)	List the different types of strain gauges and their applications. Explain the construction and working principle of bonded wire strain gauges, and discuss their advantages and limitations compared to other types of strain gauges.	13	K3	CO2
(OR)				
b)	Explain the construction and working principle of an LVDT for measuring linear displacement. Describe the circuits used, and discuss the advantages, disadvantages, and applications of LVDTs.	13	K3	CO2
13. a)	Explain the working principle of gas-filled radiation detectors and how they detect radiation through gas ionization. Compare the performance and applications of gas-filled detectors, Geiger-Muller counters, and scintillation counters.	13	K3	CO3
(OR)				
b)	Explain the working principle of optical biosensors used for the measurement of blood glucose levels and mention their advantages in medical diagnostics.	13	K3	CO3
14. a)	Derive the expression for the sensitivity of a Wheatstone bridge. Explain how the sensitivity is defined in relation to the change in the unknown resistance and the resulting deflection in the output voltage of the galvanometer.	13	K4	CO4
(OR)				

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| | b) | Explain the operation of ramp type digital voltmeter with necessary diagrams. | 13 | K3 | CO4 |
| 15. | a) | Draw the block diagram of dual channel CRO and explain the function of each block. | 13 | K3 | CO5 |

(OR)

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| | b) | Explain the principle of operation of a magnetic tape recorder. List its components and discuss the function of each component. | 13 | K3 | CO5 |
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PART – C

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO
16. a)	What are the various challenges encountered when measuring low resistances? Explain the principle of operation of Kelvin's Double Bridge and how it eliminates the effects of contact resistance and lead resistance.	15	K3	CO4
	(OR)			
b)	How does signal digitization in a DSO impact measurement accuracy and analysis capabilities compared to the analog processing in a CRO? In what ways do the user interfaces of DSOs and CROs differ, and how do these differences affect usability in practical applications?	15	K4	CO5