B.E. ELECTRICAL ENGINEERING 4TH YEAR 2ND SEMESTER EXAMINATION, 2022

SUBJECT: - BIOMEDICAL INSTRUMENTATION

Time: **Four hours**

Full Marks 70
(35 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART- I	Marks
	*Answer **question-4** and any **TWO** from rest:*	
1.	Mention clearly whether the following statements are true or false. Justify in favour of your comment. [CO4-K4]	5x2=10
	(a) "Baseline wander in an ECG signal can be eliminated by using an Instrumentation Amplifier."	
	(b) "Frequency spectrum of normal sinus rhythm and sinus tachycardia is same."	
	(c) "Ion channel works on the principle of saltatory conduction."	
	(d) "Calcium ion channel has predominant role in the cardiac Action Potential.	
	(e) The equivalent circuit of electrolyte-electrode has low frequency response.	
2.	[CO3-K3]	
	(a) Design a two op-amp, narrow-band, RC notch filter for removing power line interference from an ECG. The frequency response of the filter has a center notch frequency of 60Hz and a -3dB bandwidth of 0.3Hz. Use 0.1μF capacitors in your design and calculate the expected notch depth in decibels. Write clearly the expressions used without any derivation. Draw the complete circuit.	6
	(b) Draw the circuit of a negative capacitance amplifier. Show that it offers negative capacitance at its terminals. Mention its application.	4
3.	[CO3-K3]	
	(a) In the 10 – 20 system of electrode placement for capturing EEG, draw an appropriate diagram to show the positions of electrodes T6,	4

	Fz, F7, P4 and O1. (b) Draw a schematic diagram showing the placement of electrode on the surface of patient's body to capture ECG signal as ***aVL***. Draw its equivalent circuit. Hence show by circuit analysis that its voltage at any instant is greater by 50% than that of VL.	6
4.	Write short notes on any **ONE** from (a) and (b) and another **ONE** from (c) and (d): a) Equivalent circuit of electrode skin interface [CO1-K1]	7
	b) Patch Clamp Technique [CO1-K1]	7
	c) Generation of Action Potential in neuron [CO2-K2]	8
	d) Effect of interference due to common mode voltage on ECG [CO2-K2]	8

Ref No: Ex/EE/PE/H/T/422C/2022

B.E.E.4TH YEAR 2ND SEMESTER EXAMINATION, 2022

SUBJECT: - BIO-MEDICAL INSTRUMENTATION

Time: Three hours **Full Marks 70**

(35 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART-II	Marks
	Answer any three, 2 marks for well organized answers	
	Answer any 3 (3X11=33, 2 marks for well-organized answers)	
1.	What are the different types of noises which play significant roles in biomedical instrumentation? Explain different methods for elimination of such noises. Explain various shielding strategies in this context.	5+6
2.	What are the importance of pulse oximetry? Explain the basic principle of optical absorption difference based oximetry. Describe a suitable signal amplifier for this application with explanations.	1+6+4
3.	A two dimensional biomedical data is shown in the table given below. Two dimensions are taken as x and y. Physical significance of each dimension is not disclosed. Find and choose a suitable principal component for the data set to reduce its dimension. Show the modified data.	11
4.	Explain oscillometric and auscultatory methods of blood pressure measurement with necessary diagrams.	11
5.	**Write short notes on the following topics**	5.5+5.5=11
a)	Computed (Axial) Tomography	
b)	Impedance plethysmography	

x	y
8	5
4	1
6	3
8	6
8	5
11	8
5	3
9	5
7	4
8	2