

B.E. ELECTRICAL ENGINEERING 4TH YEAR 2ND SEMESTER EXAMINATION, 2023**SUBJECT: - BIOMEDICAL INSTRUMENTATION**

Time: Three hours

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Questions	PART- I	Marks
	<i>Two marks reserved for neat and well-organized answers.</i>	
	Group – A [Answer any ONE] [CO4-K4]	
1.	Mention clearly whether the following statements are true or false. Justify in favour of your comment. (a) “Baseline wander in an ECG signal can be eliminated by using Twin T notch filter.” (b) “Driven-right-leg circuit is used to eliminate power frequency component from a biomedical signal.” (c) “Calcium ion channel has predominant role in the neuronal Action Potential.	4x3=12
2.	(a) What are the basic requirements of amplifiers that are used for processing biomedical signals? (b) What is a negative capacitance amplifier? Explain in brief its operating principle and the purpose of its use.	6+6=12
	Group – B [Answer any ONE] [CO3-K3]	
3.	How does an objectionable level of interference creep in the ECG due to the presence of common mode voltage? Present an estimate with appropriate derivation.	12
4.	Draw a schematic diagram showing the placement of electrode on the surface of patient’s body to capture ECG signal as <i>aVR</i> . Draw its equivalent circuit. Hence show by circuit analysis that its voltage	12

[Turn over

	at any instant is greater by 50% than that of VR.	
	Group – C [Answer any ONE] [CO2-K2]	
5.	Draw the equivalent circuit of a microelectrode inserted within a cell. Justify the presence of each element in the equivalent circuit. How do you simplify the circuit in different range of operating frequencies?	12
6.	Compare: (a) Neuronal and cardiac Action Potential (b) Absolute and relative refractory period (c) Channel based conduction and saltatory conduction	3×4=12
	Group – D [CO1-K1]	
7.	Write short notes on any TWO: a) Equivalent circuit of electrode skin interface b) Patch Clamp Technique c) Evoked Potential	6+6=12

B.E. ELECTRICAL ENGINEERING 4TH YEAR 2ND SEMESTER EXAM 2023**SUBJECT: - BIO-MEDICAL INSTRUMENTATION (HONS.)****Time: Three hours****Full Marks 100
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No. of Questions	PART-II	Marks																						
Answer any four, 2 marks for well organized answers																								
Answer any 4 (12X4=48)																								
1.	What are the different types of noises which play significant roles in biomedical instrumentation? Explain different methods for elimination of such noises.	5+7																						
2.	What is "Plethysmography"? Explain "Impedance Plethysmography" with proper diagram and show the calculations to obtain the blood volume change from the changes in electrical impedance with respect to the basal impedance.	1+5+6																						
3.	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.	2+6+4																						
4.	<p>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 dataset to reduce its dimension. Show the modified data.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr><td>6</td><td>4</td></tr> <tr><td>3</td><td>1</td></tr> <tr><td>5</td><td>3</td></tr> <tr><td>7</td><td>6</td></tr> <tr><td>7</td><td>5</td></tr> <tr><td>9</td><td>7</td></tr> <tr><td>4</td><td>3</td></tr> <tr><td>8</td><td>5</td></tr> <tr><td>6</td><td>4</td></tr> <tr><td>7</td><td>2</td></tr> </tbody> </table>	x	y	6	4	3	1	5	3	7	6	7	5	9	7	4	3	8	5	6	4	7	2	12
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5.	<p>Write short note on the following topics</p> <p>a) Shielding strategies for bio-medical signal acquisition.</p> <p>b) Computed (Axial) Tomography</p> <p>c) Auscultatory and Oscillometric methods of blood pressure measurement</p>	6+6																						