

B.E. ELECTRICAL ENGINEERING 4TH YEAR 2ND SEMESTER EXAMINATION, 2018**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
1.	Answer any THREE. Question no. 1 carries 18 marks. Compare between: (a) Ion-pumps and ion-channels (b) Ligand-gated and voltage-gated ion-channels (c) Action Potential in Nodes of Ranvier and Schwann Cells (d) Absolute and Relative Refractory Period (e) Electrical activity of SA node and AV node of heart (f) Goldberger leads and precordial leads	3x6=18
2.	(a) What is transduction? How is a stimulus converted into an electrical signal in living cell? State the names of any two sites of stimuli. (b) Explain with appropriate diagram(s) the process of generation and propagation of Action Potentials within neurons.	2+2+2 10
3.	(a) Show with appropriate diagrams the placement of electrodes on human body to acquire bipolar limb voltages of ECG. (b) What is Einthoven Triangle? Explain with appropriate vector diagram. (c) How is a lead voltage augmented by using potential dividers? Justify with appropriate derivation and diagram.	6 4 6

[Turn over

4.	<p>(a) What are the different types of noises that may contaminate an ECG signal? How do the noises originate and produce effect on the waveform of ECG?</p> <p>(b) What are the basic requirements of bio-potential amplifiers?</p>	10 6
5.	<p>(a) Show with suitable diagram how a Motor Unit Action Potential (MUAPT) is developed within a muscle and collected between two electrodes?</p> <p>(b) Under what conditions will all the MUAPs be same in a MUAPT?</p> <p>(c) Present with justification one mathematical model of MUAPT that is manifested in an observed waveform of EMG.</p>	8 2 6

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No. of Questions	PART-II	Marks																												
Answer any three, 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 are Korotkoff sounds? Explain oscillometric method of blood pressure measurement. Compare between auscultatory and oscillometric methods of blood pressure measurement.	2+6+4																												
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 data set 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>26</td><td>6</td></tr> <tr><td>29</td><td>15</td></tr> <tr><td>56</td><td>8</td></tr> <tr><td>31</td><td>8</td></tr> <tr><td>52</td><td>6</td></tr> <tr><td>55</td><td>9</td></tr> <tr><td>71</td><td>17</td></tr> <tr><td>31</td><td>22</td></tr> <tr><td>54</td><td>18</td></tr> <tr><td>47</td><td>4</td></tr> <tr><td>40</td><td>23</td></tr> <tr><td>66</td><td>9</td></tr> <tr><td>68</td><td>8</td></tr> </tbody> </table>	x	y	26	6	29	15	56	8	31	8	52	6	55	9	71	17	31	22	54	18	47	4	40	23	66	9	68	8	12
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40	23																													
66	9																													
68	8																													
5.	<p>Write short note on <i>any one</i></p> <p>a) Shielding strategies for bio-medical signal acquisition.</p> <p>b) Computed (Axial) Tomography</p>	12																												