

B.E. ELECTRICAL ENGINEERING 5TH YEAR 2ND SEMESTER EXAMINATION, 2019**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
	<p><i>Answer any Five only.</i></p> <p>1. Identify correct option with proper reasons.</p> <p>1.1 With increasing temperature, equilibrium potential across a membrane (A) decreases (B) increases (C) remains same (D) first rises then falls</p> <p>1.2 The energy for the working of ion pump comes from (A) concentration gradient of ion (B) chemo-receptor (C) ATP (D) transmembrane protein</p> <p>1.3 Ionic current contributed by single or multiple ion channel(s) are observed through (A) patch clamp technique (B) implantable electrode (C) floating electrode (D) electrolyte gel</p> <p>1.4 For an ECG, respiratory noise is one of the reasons of (A) high frequency interference (B) power line interference (C) muscle artifact (D) baseline wander</p> <p>1.5 Half cell potential is not affected by (A) electrode metal (B) temperature (C) ion concentration in electrode (D) electrode resistance</p>	5x2
2.	<p>Compare between:</p> <p>(a) Ligand-gated and voltage-gated ion-channels</p>	5x2

	<p>(b) Absolute and Relative Refractory Period</p> <p>(c) Polarizable electrode vs non-polarizable electrode</p> <p>(d) Goldberger leads and precordial leads</p> <p>(e) Internal electrode vs Implantable electrode</p> <p>3. Explain with appropriate schematic diagram the method of collecting EMG with electrodes. In this context, define MAP and MUAP. Explain how MAPs are aggregated to develop MUAP and MUAPT. Hence, present a suitable mathematical model of MUAPT.</p> <p>4. Describe the sequence of generation and propagation of voltage within various parts of the heart and explain its impact on setting the pattern of various segments of ECG waveform. Draw schematic diagram neatly and use in favour of your explanation.</p> <p>5. Draw the connection diagram of electrodes in normal leads of V_L and aV_L. Hence, show that magnitude of aV_L is 50% higher than that of V_L.</p> <p>6. A clinical staff member has attached a patient to an electroencephalograph (EEG machine) for a sleep study. The different types of electrodes for the EEG lead have different source resistances. One has a relatively low resistance of $1,900\Omega$ at EEG frequencies while the other has a higher resistance of $5,200\Omega$. A ground electrode having a resistance of $2,300\Omega$ is also used.</p> <p>The input resistance of each differential input of the EEG machine to ground is $6M\Omega$ and the instrument has a common mode rejection ratio of 100dB. The power line displacement current to the patient is measured as $400nA$. The amplitude of the patient's EEG is $16\mu V$.</p> <p>(i) How much common mode voltage will be seen on this patient and will it significantly interfere with the EEG signal?</p> <p>(ii) How much power line interference will be seen on the patient's</p>	<p>10</p> <p>10</p> <p>10</p> <p>10</p>
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	<p>EEG?</p> <p>7. Write short note on any <i>One</i>.</p> <p>(a) Generation and propagation of action potentials in cells</p> <p>(b) Electrical behaviour of microelectrodes</p> <p>8. What do you mean by</p> <p>(a) Wilson Central Terminal voltage</p> <p>(b) Evoked potential</p> <p>(c) Positioning of electrodes for EEG</p>	<p>10</p> <p>2+3+5</p>
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B.E. (ELECTRICAL ENGG)5TH YEAR 2ND SEMESTER EXAMINATION, 2019**SUBJECT: - BIO-MEDICAL INSTRUMENTATION****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 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" data-bbox="699 1031 951 1371" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr><td>7</td><td>4</td></tr> <tr><td>4</td><td>1</td></tr> <tr><td>6</td><td>3</td></tr> <tr><td>8</td><td>6</td></tr> <tr><td>8</td><td>5</td></tr> <tr><td>10</td><td>7</td></tr> <tr><td>5</td><td>3</td></tr> <tr><td>9</td><td>5</td></tr> <tr><td>7</td><td>4</td></tr> <tr><td>8</td><td>2</td></tr> </tbody> </table>	x	y	7	4	4	1	6	3	8	6	8	5	10	7	5	3	9	5	7	4	8	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>	6+6																						