

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MEDICAL ELECTRONICS

QUESTION BANK



VI SEMESTER - MEDICAL ELECTRONICS

PMD604– ADVANCEMENT IN DIAGNOSTIC AND THERAPEUTIC EQUIPMENT

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SUBJECT : PMD604 ADVANCEMENT IN DIAGNOSTIC AND THERAPEUTIC EQUIPMENT

SEM / YEAR : VI / III

UNIT I – CARDIAC EQUIPMENT

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, ECG machine maintenance and troubleshooting, Cardiac Pacemaker- Internal and External Pacemaker– Batteries, AC and DC Defibrillator- Internal and External, Defibrillator Protection Circuit, Cardiac ablation catheter.

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	Define Electrocardiograph.	CO1	BTL 1	Remembering
2.	What are the components of an ECG machine?	CO1	BTL 1	Remembering
3.	Distinguish between bipolar and unipolar leads.	CO1	BTL 2	Understanding
4.	What is the function of the right leg drive circuit?	CO1	BTL 1	Remembering
5.	List the characteristics of a normal P wave.	CO1	BTL 1	Remembering
6.	Define PR interval.	CO1	BTL 1	Remembering
7.	Differentiate early repolarization from ischemic changes.	CO1	BTL 2	Understanding
8.	Name two abnormalities seen in T waves.	CO1	BTL 1	Remembering
9.	What factors determine abnormal wave formation in ECG?	CO1	BTL 2	Understanding
10.	When is a heart rate monitor used?	CO1	BTL 1	Remembering
11.	Where is a Holter monitor typically used?	CO1	BTL 1	Remembering
12.	List the types of heart rate sensors.	CO1	BTL 1	Remembering
13.	State phonocardiography.	CO1	BTL 1	Remembering
14.	Differentiate between ECG and PCG signals.	CO1	BTL 2	Understanding
15.	Write any two steps in ECG troubleshooting.	CO1	BTL 1	Remembering
16.	Distinguish internal and external pacemakers.	CO1	BTL 2	Understanding
17.	List the commonly used pacemaker batteries.	CO1	BTL 1	Remembering
18.	Define calibration in ECG machines.	CO1	BTL 1	Remembering
19.	Classify pacemakers based on chamber pacing.	CO1	BTL 2	Understanding
20.	Identify the function of a defibrillator protection circuit.	CO1	BTL 2	Understanding
21.	Name the energy source for DC defibrillators.	CO1	BTL 1	Remembering
22.	What is the role of an ablation catheter?	CO1	BTL 1	Remembering
23.	How does RF ablation work?	CO1	BTL 2	Understanding
24.	When is a standard 12-lead ECG used?	CO1	BTL 1	Remembering

PART B				
1.	Construct the block diagram of an ECG Machine and analyze the function of each block. (16)	CO1	BTL 3	Applying
2.	Explain 12 lead electrode system for ECG measurement with necessary Diagrams. (16)	CO1	BTL 4	Analyzing
3.	Sketch the block diagram of an isolation preamplifier commonly used in modern ECG machines and explain it in detail. (16)	CO1	BTL 3	Applying
4.	Sketch the block diagram of a microprocessor based three channel ECG Machine and explain in detail. (16)	CO1	BTL 3	Applying
5.	Explain in detail about normal and abnormal ECG waveform. (16)	CO1	BTL 4	Analyzing
6.	Analyze the operation of a Holter monitor with a neat block diagram and explain the function of each block. (16)	CO1	BTL 4	Analyzing
7.	Analyze the principle of phonocardiography with a neat block diagram. (16)	CO1	BTL 4	Analyzing
8.	Outline the procedures for daily and weekly operational checks of an ECG machine. (16)	CO1	BTL 4	Analyzing
9.	(i) Distinguish between Internal and External pacemaker. (8) (ii) Explain the need of cardiac pacemaker. (8)	CO1	BTL 3	Applying
10.	Describe the following in detail, (i) AC defibrillator (8) (ii) DC defibrillator (8)	CO1	BTL 4	Analyzing
11.	Explain the principle and operations of DC defibrillators. (16)	CO1	BTL 3	Applying
12.	(i) Explain the principle and operations of dual peak DC defibrillators. (8) (ii) Identify the advantages and disadvantages of DC defibrillator. (8)	CO1	BTL 3	Applying
13.	Analyze the operation of a defibrillator protection circuit and examine the mechanisms used to prevent damage to sensitive electronic components during defibrillation. (16)	CO1	BTL 4	Analyzing
14.	Illustrate and explain the cardiac ablation catheter technique with neat diagrams. (16)	CO1	BTL 4	Analyzing
15.	Outline in detail about batteries used in pacemaker. (16)	CO1	BTL 4	Analyzing
16.	Write a brief note on Implantable defibrillator with neat diagrams. (16)	CO1	BTL 3	Applying
17.	Summarize the components, specification and method of stimulation of pacemaker. (16)	CO1	BTL 3	Applying

UNIT II – NEUROLOGICAL EQUIPMENT

Clinical significance of EEG, Multi-channel EEG recording system, Epilepsy, Evoked Potential–Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph). EEG Bio Feedback Instrumentation. EEG system maintenance and troubleshooting.

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	Define EEG.	CO2	BTL 1	Remembering
2.	What is the clinical significance of EEG?	CO2	BTL 1	Remembering
3.	List the types of EEG electrodes.	CO2	BTL 1	Remembering
4.	Where is a multi-channel EEG recording system used?	CO2	BTL 1	Remembering
5.	State the purpose of EEG biofeedback instrumentation.	CO2	BTL 1	Remembering
6.	Name the major components of an EEG system.	CO2	BTL 1	Remembering
7.	When is an evoked potential recorded?	CO2	BTL 1	Remembering
8.	Identify the energy source used in EEG machines.	CO2	BTL 1	Remembering
9.	Write any two steps in EEG system maintenance.	CO2	BTL 1	Remembering
10.	Define epilepsy.	CO2	BTL 1	Remembering
11.	List two advantages of multi-channel EEG over single-channel EEG.	CO2	BTL 1	Remembering
12.	State the role of MEG in brain research.	CO2	BTL 1	Remembering
13.	Differentiate EEG and MEG.	CO2	BTL 2	Understanding
14.	Distinguish visual, auditory, and somatosensory evoked potentials.	CO2	BTL 2	Understanding
15.	Classify EEG rhythms based on frequency.	CO2	BTL 2	Understanding
16.	Outline the steps in multi-channel EEG recording.	CO2	BTL 2	Understanding
17.	How is EEG biofeedback used in therapy?	CO2	BTL 2	Understanding
18.	Identify common artifacts in EEG recordings.	CO2	BTL 2	Understanding
19.	Compare scalp EEG and intracranial EEG.	CO2	BTL 2	Understanding
20.	Differentiate standard EEG and evoked potential recording.	CO2	BTL 2	Understanding
21.	Distinguish between monopolar and bipolar EEG montages.	CO2	BTL 2	Understanding
22.	Classify evoked potentials based on stimulus type.	CO2	BTL 2	Understanding
23.	Outline the troubleshooting steps in EEG system.	CO2	BTL 2	Understanding
24.	List the clinical importance of evoked potentials.	CO2	BTL 2	Understanding

PART B				
1.	Describe the clinical significance of EEG and identify its role in the diagnosis of neurological disorders. (16)	CO2	BTL 3	Applying
2.	Illustrate and explain the block diagram of a multi-channel EEG recording system and apply it for brain activity monitoring. (16)	CO2	BTL 3	Applying
3.	Explain the EEG features of epilepsy and identify characteristic epileptic waveforms. (16)	CO2	BTL 3	Applying
4.	Outline the functional building blocks of an EEG machine and explain the operation of each block. (16)	CO2	BTL 3	Applying
5.	Identify the common problems and potential hazards encountered during EEG recording. (16)	CO2	BTL 3	Applying
6.	Describe the recording method of somatosensory evoked potentials and apply them in assessing sensory nerve pathways. (16)	CO2	BTL 3	Applying
7.	Explain the different sleep patterns observed in EEG with neat diagrams. (16)	CO2	BTL 3	Applying
8.	Describe the different types of EEG artifacts and outline methods to troubleshoot EEG recording issues. (16)	CO2	BTL 3	Applying
9.	Design the system that would provide Non-visual feedback to a subject who wished to maximize the amplitude of his EEG alpha waves. Explain its operation. (16)	CO2	BTL 3	Applying
10.	Explain 10-20 electrode placement system used in EEG. (16)	CO2	BTL 4	Analyzing
11.	Analyze and demonstrate the design and operation of a multi-channel EEG recording system with a neat block diagram. (16)	CO2	BTL 4	Analyzing
12.	Interpret the different normal EEG waves with sketches, examine the replacement of alpha rhythm by asynchronous discharge on eye opening, and compare abnormal EEG waveforms in epilepsy. (16)	CO2	BTL 4	Analyzing
13.	Analyze visual, auditory, and somatosensory evoked potentials and compare their diagnostic significance in neurological assessment. (16)	CO2	BTL 4	Analyzing
14.	Examine in detail the principles of Magneto Encephalogram (16)	CO2	BTL 4	Analyzing
15.	Analyze EEG biofeedback instrumentation and discuss its effectiveness in therapeutic and clinical applications. (16)	CO2	BTL 4	Analyzing
16.	Illustrate and explain in detail the different types of abnormal EEG waves. (16)	CO2	BTL 4	Analyzing
17.	Explain in detail about the volume conductor problem in EEG. (16)	CO2	BTL 4	Analyzing

UNIT III – MUSCULAR AND BIOMECHANICAL EQUIPMENT

Recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation. Static Measurement – Load Cell, Pedobarograph. Dynamic Measurement – Velocity, Acceleration, GAIT, Limb position.

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	Define Electromyography (EMG).	CO3	BTL 1	Remembering
2.	What are the main components of an EMG recording system?	CO3	BTL 1	Remembering
3.	List the types of EMG electrodes.	CO3	BTL 1	Remembering
4.	When is EMG commonly used in clinical practice?	CO3	BTL 1	Remembering
5.	State the meaning of muscle fatigue in EMG.	CO3	BTL 1	Remembering
6.	Identify two types of muscle stimulators.	CO3	BTL 1	Remembering
7.	What is a nerve stimulator?	CO3	BTL 1	Remembering
8.	Name the units used to measure Nerve Conduction Velocity (NCV).	CO3	BTL 1	Remembering
9.	Write any two steps in EMG system troubleshooting.	CO3	BTL 1	Remembering
10.	Define a load cell.	CO3	BTL 1	Remembering
11.	Mention two parameters measured in a pedobarograph.	CO3	BTL 1	Remembering
12.	State the importance of measuring limb position in biomechanics.	CO3	BTL 1	Remembering
13.	Differentiate surface EMG from needle EMG.	CO3	BTL 2	Understanding
14.	Distinguish between static and dynamic measurements in biomechanics.	CO3	BTL 2	Understanding
15.	Classify muscle stimulators based on waveform type.	CO3	BTL 2	Understanding
16.	Outline the procedure for measuring nerve conduction velocity.	CO3	BTL 2	Understanding
17.	Compare visual biofeedback and auditory biofeedback in EMG systems.	CO3	BTL 2	Understanding
18.	Justify how fatigue characteristics are analyzed in EMG waveforms.	CO3	BTL 2	Understanding
19.	Identify the purpose of multi-channel EMG recording.	CO3	BTL 2	Understanding
20.	Differentiate between velocity and acceleration measurements.	CO3	BTL 2	Understanding
21.	Distinguish GAIT analysis from general limb motion measurement.	CO3	BTL 2	Understanding
22.	List the advantages of EMG biofeedback instrumentation.	CO3	BTL 2	Understanding
23.	Identify how pedobarograph data helps in clinical gait analysis.	CO3	BTL 2	Understanding
24.	Compare nerve conduction measurement using surface vs needle electrodes.	CO3	BTL 2	Understanding

PART B

1.	Draw the block diagram of a typical EMG recording system and explain the function of each block. (16)	CO3	BTL 3	Applying
2.	Outline the major clinical applications of EMG and explain how EEG is applied in the diagnosis of neurological disorder. (16)	CO3	BTL 3	Applying
3.	Describe in detail about the electrodes used in measuring EMG. (16)	CO3	BTL 3	Applying
4.	Describe how EMG signal-processing concepts are utilized in myoelectric prosthesis with appropriate diagrams. (16)	CO3	BTL 3	Applying
5.	Discuss the nerve action potentials and explain their significance in evaluating sensory nerve function. (16)	CO3	BTL 3	Applying
6.	Sketch the schematic diagram of the electrode configuration used for studying myoelectric signals and explain in detail. (16)	CO3	BTL 3	Applying
7.	Apply the concepts of dynamic measurement to describe how velocity, acceleration, gait, and limb position are measured in biomechanics. (16)	CO3	BTL 3	Applying
8.	Explain the principle, working, and applications of TENS. (16)	CO3	BTL 4	Analyzing
9.	Draw and explain the typical configuration of an EMG system. (16)	CO3	BTL 4	Analyzing
10.	Illustrate the Electromyographic (EMG) technique with a neat diagram and explain the function of each step. (16)	CO3	BTL 4	Analyzing
11.	Outline the different types of electrodes used in EEG measurement with neat diagram. (16)	CO3	BTL 3	Applying
12.	Explain in detail about the muscle voluntary effect. (16)	CO3	BTL 4	Analyzing
13.	Examine the muscle voluntary effect and analyze its influence on EMG signal characteristics. (16)	CO3	BTL 4	Analyzing
14.	Analyze the common problems and hazards encountered in EMG recording. (16)	CO3	BTL 4	Analyzing
15.	Examine the measurement of motor nerve conduction velocity and analyze the physiological and pathological factors that alter NCV in peripheral nerve disorders. (16)	CO3	BTL 4	Analyzing
16.	Explain the principle and working of a load cell and pedobarograph used in static measurements, and illustrate with neat diagrams. (16)	CO3	BTL 4	Analyzing
17.	Analyze the steps for measuring conduction velocity using EMG, illustrate with a diagram, and list its applications. (16)	CO3	BTL 4	Analyzing

UNIT IV – RESPIRATORY MEASUREMENT AND ASSIST SYSTEM

Instrumentation for measuring the mechanics of breathing – Spirometer -Lung Volume and vital capacity, measurements of residual volume, Pneumotachometer – Airway resistance measurement, Whole body Plethysmograph, Intra-Alveolar and Thoracic pressure measurements, Apnoea Monitor. Types of Ventilators – Pressure, Volume, and Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	Define Spirometer.	CO4	BTL 1	Remembering
2.	What is vital capacity?	CO4	BTL 1	Remembering
3.	List the lung volumes measured using a spirometer.	CO4	BTL 1	Remembering
4.	When is a residual volume measurement performed?	CO4	BTL 1	Remembering
5.	State the function of a Pneumotachometer.	CO4	BTL 1	Remembering
6.	Identify the units used for measuring airway resistance.	CO4	BTL 1	Remembering
7.	Name the purpose of a whole body plethysmograph.	CO4	BTL 1	Remembering
8.	Define intra-alveolar pressure.	CO4	BTL 1	Remembering
9.	Write any two steps in spirometer calibration.	CO4	BTL 1	Remembering
10.	Mention two clinical uses of an apnea monitor.	CO4	BTL 1	Remembering
11.	What is a humidifier in ventilator systems?	CO4	BTL 1	Remembering
12.	Define a nebulizer.	CO4	BTL 1	Remembering
13.	Differentiate volume-controlled and pressure-controlled ventilators.	CO4	BTL 2	Understanding
14.	Distinguish between time-cycled and patient-cycled ventilators.	CO4	BTL 2	Understanding
15.	Classify ventilators based on control variables.	CO4	BTL 2	Understanding
16.	Outline the procedure to measure thoracic pressure using Instrumentation.	CO4	BTL 2	Understanding
17.	Compare flow ventilators and volume ventilators.	CO4	BTL 2	Understanding
18.	Explain how airway resistance is measured using a pneumotachometer.	CO4	BTL 2	Understanding
19.	Identify the advantages of whole body plethysmography.	CO4	BTL 2	Understanding
20.	Differentiate static lung volume measurement from dynamic measurement.	CO4	BTL 2	Understanding
21.	List the benefits of using a humidifier with mechanical ventilation.	CO4	BTL 2	Understanding
22.	Distinguish between nebulizers and inhalators.	CO4	BTL 2	Understanding
23.	Explain how apnea monitors detect cessation of breathing.	CO4	BTL 2	Understanding
24.	Compare manual versus automated spirometry techniques.	CO4	BTL 2	Understanding

PART B

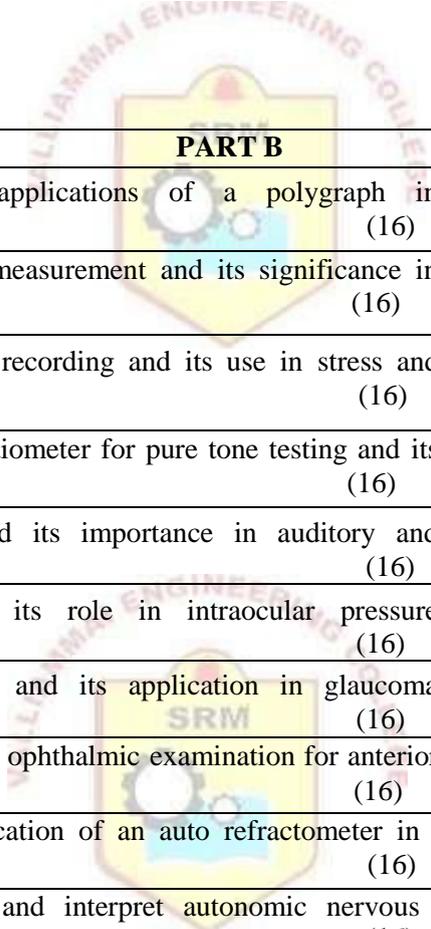
1.	Explain the principle and operation of a spirometer with neat diagram. (16)	CO4	BTL 3	Applying
2.	Explain the physiological basis of breathing and outline the clinical indications for mechanical ventilation. (16)	CO4	BTL 3	Applying
3.	Illustrate the working of a pneumotachograph for measuring airway resistance and airflow patterns. (16)	CO4	BTL 3	Applying
4.	Describe how a whole-body plethysmograph measures thoracic gas volume and lung mechanics. (16)	CO4	BTL 3	Applying
5.	Explain the types of mechanical ventilators and describe the principles of pressure, volume, time and flow-cycled ventilation with suitable waveforms. (16)	CO4	BTL 3	Applying
6.	Describe the function of an apnoea monitoring system and its role in detecting respiratory pauses. (16)	CO4	BTL 3	Applying
7.	Draw a block diagram of microprocessor-controlled ventilator and analyse the importance of each block. (16)	CO4	BTL 3	Applying
8.	Analyze various ventilation modes such as CV, IMV, CMV, SIMV, and CPAP with necessary waveforms. (16)	CO4	BTL 3	Analyzing
9.	Explain the operation of humidifiers, nebulizers, and inhalers in respiratory therapy and drug delivery. (16)	CO4	BTL 3	Applying
10.	Analyze the ventilation parameters, operator controls, and safety alarm mechanisms of a mechanical ventilator (16)	CO4	BTL 4	Analyzing
11.	Categorize the different methods for measuring lung volumes, vital capacity, and residual volume (16)	CO4	BTL 4	Analyzing
12.	Sketch the diagram of the flow tube showing the position of ultrasonic transducers used in a transit-time-based ultrasonic spirogram and explain its working in detail. (16)	CO4	BTL 4	Analyzing
13.	Critically evaluate the design and operation of a whole-body plethysmograph and compare it with conventional lung volume measurement techniques . (16)	CO4	BTL 4	Analyzing
14.	Analyze the common problems and hazards encountered in mechanical ventilators. (16)	CO4	BTL 4	Analyzing
15.	Explain the advanced modes and control strategies of mechanical ventilators—PRVC, MMV, APRV, volume support, high-frequency ventilation, and NAVA—with emphasis on their clinical importance and waveform characteristics. (16)	CO4	BTL 4	Analyzing
16	Draw the block diagram for processing a plethysmographic signal and explain the function of each block. (16)	CO4	BTL 4	Analyzing
17	Analyze the functional block diagram of a mechanical ventilator and explain the role of each block. (16)	CO4	BTL 4	Analyzing

UNIT V – SENSORY DIAGNOSTIC EQUIPMENT

Psychophysiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Speech, Eye Tonometer, Applanation Tonometer, slit lamp, auto refractometer.

PART – A

Q.No	Questions	CO	BT Level	Competence
1.	Define polygraph.	CO5	BTL 1	Remembering
2.	What is basal skin resistance (BSR)?	CO5	BTL 1	Remembering
3.	State the principle of galvanic skin resistance (GSR) measurement.	CO5	BTL 1	Remembering
4.	When is an audiometer used?	CO5	BTL 1	Remembering
5.	List the types of audiometer tests.	CO5	BTL 1	Remembering
6.	Define pure tone audiometry.	CO5	BTL 1	Remembering
7.	What is speech audiometry?	CO5	BTL 1	Remembering
8.	Name the instrument used to measure intraocular pressure.	CO5	BTL 1	Remembering
9.	Define applanation tonometer.	CO5	BTL 1	Remembering
10.	What is the purpose of a slit lamp?	CO5	BTL 1	Remembering
11.	Identify the function of an auto refractometer.	CO5	BTL 1	Remembering
12.	Mention two clinical applications of BSR measurement.	CO5	BTL 1	Remembering
13.	Differentiate between basal skin resistance and galvanic skin resistance.	CO5	BTL 2	Understanding
14.	Distinguish pure tone audiometry from speech audiometry.	CO5	BTL 2	Understanding
15.	Classify audiometers based on type of stimulus.	CO5	BTL 2	Understanding
16.	Outline the procedure for measuring intraocular pressure using a tonometer.	CO5	BTL 2	Understanding
17.	Explain how slit lamp examination is performed.	CO5	BTL 2	Understanding
18.	Identify the advantages of auto refractometers over manual methods.	CO5	BTL 2	Understanding
19.	Compare polygraph and galvanic skin response measurements.	CO5	BTL 2	Understanding
20.	Differentiate between applanation tonometer and non-contact tonometer.	CO5	BTL 2	Understanding
21.	List the steps involved in speech audiometry.	CO5	BTL 2	Understanding
22.	Explain how GSR changes with emotional stimuli.	CO5	BTL 2	Understanding
23.	Compare manual versus automated methods for eye tonometry.	CO5	BTL 2	Understanding
24.	Outline the clinical significance of psychophysiological measurements.	CO5	BTL 2	Understanding



PART B				
1.	Explain the principle and applications of a polygraph in psychophysiological monitoring. (16)	CO5	BTL 3	Applying
2.	Describe basal skin resistance measurement and its significance in autonomic assessment. (16)	CO5	BTL 3	Applying
3.	Explain galvanic skin response recording and its use in stress and emotional evaluation. (16)	CO5	BTL 3	Applying
4.	Describe the operation of an audiometer for pure tone testing and its clinical relevance. (16)	CO5	BTL 3	Applying
5.	Explain speech audiometry and its importance in auditory and communication assessment. (16)	CO5	BTL 3	Applying
6.	Describe eye tonometry and its role in intraocular pressure measurement. (16)	CO5	BTL 3	Applying
7.	Explain applanation tonometry and its application in glaucoma screening. (16)	CO5	BTL 3	Applying
8.	Describe the use of a slit lamp in ophthalmic examination for anterior segment evaluation. (16)	CO5	BTL 3	Applying
9.	Explain the principle and application of an auto refractometer in refractive error assessment. (16)	CO5	BTL 3	Applying
10.	Analyze polygraph recordings and interpret autonomic nervous system responses. (16)	CO5	BTL 4	Analyzing
11.	Examine BSR and GSR measurements and evaluate their effectiveness in psychophysiological studies. (16)	CO5	BTL 4	Analyzing
12.	Analyze pure tone and speech audiometry results and discuss their clinical implications. (16)	CO5	BTL 4	Analyzing
13.	Compare eye tonometry and applanation tonometry techniques and analyze their accuracy in IOP measurement. (16)	CO5	BTL 4	Analyzing
14.	Critically evaluate slit lamp examination findings for anterior eye segment assessment. (16)	CO5	BTL 4	Analyzing
15.	Draw the block diagram for processing a plethysmographic signal and explain the function of each block. (16)	CO5	BTL 4	Analyzing
16.	Examine combined polygraph, BSR, and GSR measurements and analyze their use in stress or lie detection. (16)	CO5	BTL 4	Analyzing
17.	Critically assess sensory response instruments and analyze their application in clinical and research diagnostics. (16)	CO5	BTL 4	Analyzing